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1. Introduction to Radiator® AAA Server

This document describes how to install and configure the Radiator® AAA Server (later Radiator) from Open System Consultants.

RADIUS is the de facto standard protocol for authenticating users and recording accounting information. It is commonly used by Wireless Access Points (APs), Terminal Servers, and Network Access Servers (NAS), whenever a user logs on and off network access devices or dial-up Internet service. It is supported and used by most vendors, such as Cisco, Ericsson, Huawei, Juniper, Ruckus, Aruba, Alcatel-Lucent, 3Com, and US Robotics. See RFCs 2865 and 2866 for more details about the RADIUS protocol.

Radiator is a highly configurable and extensible RADIUS, TACACS+, and Diameter server that allows you to easily customise and control how to authenticate users and record accounting information. You can easily integrate Radiator with current and legacy systems and software. Radiator includes special features not found in other servers, such as user name rewriting and vendor-specific RADIUS attributes.

Radiator can authenticate users from passwords held in:

- Remote RADIUS servers (proxying)
- SQL databases, including Oracle, Microsoft SQL Server, PostgreSQL, MySQL, MariaDB, SQLite, Firebird, Sybase, Informix and others
- SQL databases that support ODBC
- LDAP
- Microsoft Active Directory
- RSA Securid
- VASCO Digipass
- YubiKey
- Duo Security
- SIP2, the 3M Standard Interchange Protocol (SIP) 2.0
- RAdmin, the RADIUS User Administration system from Open System Consultants
- Flat files
- DBM files
- Unix password files and similar formats
- iPASS Roaming Network
- RSA Mobile
- Platypus ISP billing system from Boarldtown
- Rodopi ISP billing system
- Emerald ISP billing system from IEA
- BillMax Unix ISP billing system
- Other ISP billing packages
- PAM
- TacacsPlus
- Your own legacy user database
• External programs
• Any external one-time password system
• Most external SOAP-based authentication methods
• OPIE one-time passwords
• Hotel Property Management Systems
• Other methods contributed by Radiator users

Radiator can record user accounting information in:
• Flat files in standard RADIUS detail file format
• Unix wtmp format files
• SQL databases, including Oracle, Microsoft SQL Server, PostgreSQL, MySQL, MariaDB, SQLite, Firebird, Sybase, Informix and others
• SQL databases that support ODBC
• Remote RADIUS servers
• RAdmin, the RADIUS User Administration system from Open System Consultants
• Platypus ISP billing system from Boarldtown
• Rodopi ISP billing system
• Emerald ISP billing system from IEA
• BillMax Unix ISP billing system
• Other ISP billing packages
• Your own legacy usage database
• External programs

Radiator provides external interfaces for the following protocols:
• RADIUS (including WiMAX). A full suite of load balancing modules is included.
• TACACS+
• SNMP
• Telnet
• HTTP
• Diameter
• RadSec

Radiator works with a wide range of EAP (Extensible Authentication Protocol) methods, such as the following:
• TLS
• TTLS
• PEAP
• pwd
• MD5
• MSCHAPV2
2. Installing and upgrading Radiator

Radiator runs on the following platforms:

- Most Unix and Linux hosts
- Windows 7/8/8.1/10
- Windows Server 2008/2012/2016/2019
- macOS

Radiator is written entirely in Perl and is therefore highly portable. Full source code is supplied.

You need to be familiar with system administration to install Radiator. You also need to have a basic understanding of RADIUS and your network's authentication and accounting requirements in order to configure RADIUS.

‘Radiator’ and the Radiator logo are registered trademarks of Open System Consultants Pty. Ltd.

2. Installing and upgrading Radiator

This section provides instructions for installing and upgrading Radiator. Radiator runs on a wide range of platforms and the installation procedure depends on the platform and the type of package selected.

2.1. System requirements

Radiator requires a number prerequisite packages to be installed before you can install it.

2.1.1. Perl

This is the main program that runs Radiator. It must be installed on your Radiator host. Platform-specific methods for installing Perl are discussed below. Radiator requires Perl 5.8.8 or better. Install and test Perl before proceeding further.

Many Unix distributions include Perl as part of the standard installation. Common Windows Perl distributions include ActivePerl and Strawberry Perl.

2.1.2. CPAN

Some of the Radiator features require Perl modules that may not be part of the Perl distribution you are using. For example, there is no prebuilt RPM for Red Hat, or the Windows Strawberry Perl distribution does not include the required module. In this case, you need to install the module from CPAN.

On Windows with ActivePerl or Strawberry Perl, review Windows installation on page 9 before continuing. You can use the tools these Perl distributions provide.
CPAN stands for **Comprehensive Perl Archive Network**. CPAN is a repository of Perl modules including the core Perl itself. You can use CPAN to search and download Perl modules, view their documentation, source code and change logs.

You can search CPAN for Perl modules with several methods, for example:

- **CPAN website** [http://www.cpan.org]
- **MetaCPAN website** [https://metacpan.org]

Perl comes with tools for downloading and building Perl modules automatically. For more information, see [How to install CPAN modules](http://www.cpan.org/modules/INSTALL.html). *cpan* and *cpanm* are the common tools, they are run from command line:

```bash
cpan Digest::MD5
cpanm Digest::MD5
```

If you do not have network access, the general procedure for installing a Perl module is:

1. Unpack the downloaded module in a work area.

   ```bash
tar zxvf Digest-MD5-2.55.tar.gz
```

2. Move to the module directory. See README, INSTALL, and similar files for additional information.

   ```bash
cd Digest-MD5-2.55
```

3. Create the makefile.

   ```bash
perl Makefile.PL
```

4. Build the module.

   ```bash
make
```

5. Run the tests.

   ```bash
make test
```

6. Install the module.

   ```bash
make install
```

### 2.1.3. Digest::MD5

Radiator requires the Digest::MD5 Perl library package (version 2.02 or later). Most modern versions of Perl already include the Digest::MD5 library.

If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it.

### 2.1.4. Digest::SHA

Radiator requires the Digest::SHA Perl library package (version 5 or later). Most modern versions of Perl already include the Digest::SHA library.

If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it.
2.1.5. Digest::MD4

If MSCHAP or MSCHAPV2 support is required, Radiator needs the Digest::MD4 Perl library package.

If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it.

2.1.6. Digest::HMAC

Radiator requires Digest::HMAC Perl library package when TLS-based EAP methods or Stream classes, such as RadSec, are configured.

If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it.

2.1.7. Net::SSLeay and OpenSSL

If support for EAP-TLS, PEAP, EAP-TTLS, EAP-FAST, or any other modules requiring TLS is required, Radiator needs the Net::SSLeay Perl library package. The Perl distributions typically include Net::SSLeay as a prepackaged module.

**CAUTION**

Net::SSLeay 1.83 or later is required if you use Radiator with SSL/TLS library that has TLSv1.3 enabled. Radiator has not been tested with TLS 1.3 yet.

On Windows with ActivePerl and Strawberry Perl, see Section 2.6. Installing and upgrading on Windows on page 9 for more about installing Net::SSLeay on Windows.

If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it.

Many TLS-based configurations also require message digest modules. See Section 2.1.5. Digest::MD4 on page 5 and Section 2.1.6. Digest::HMAC on page 5.

2.1.8. SQL

To use Radiator's modules that utilise SQL for authenticating, recording, accounting, and other purposes, install the DBI Perl library, the DBD Perl library for your particular SQL database. Radiator does not include an SQL database server. Operating system vendors and Windows Perl distributions typically include DBI and DBD libraries for the common SQL databases as prepackaged modules.

To use SQL:

1. Install and test your chosen SQL database server.
2. Install and test DBI.
3. Install and test the DBD Perl module for the installed database server

On Windows with ActivePerl and Strawberry Perl, you can use the PPM command to install the appropriate DBD support for your SQL server.

2.1.9. Memory requirements

The Radiator installation requires approximately 32Mb of disk space. RAM requirements depend strongly on your Radiator configuration and the types of authentication methods being used.
If EAP authentication is not used, Radiator typically starts running at about 20Mb and may grow to around 50Mb and plateau as RADIUS requests are received.

If EAP authentication types, such as TLS, TTLS or PEAP, are used, more memory is needed. This is because Radiator must cache per-user TLS session information in its process memory. If you are handling large numbers of TLS authentications, you also need more memory.

### 2.1.10. SCTP

Stream Control Transmission Protocol (SCTP) support depends on operating system Radiator runs on. When the OS supports SCTP, you can configure Radiator to use one-to-one style sockets.

If you install Radiator’s Radius::UtilXS package for SCTP extended API support, SCTP multihoming is automatically enabled for Stream based clauses, such as AuthBy RADSEC and ServerDIAMETER. Multiple addresses configured with parameters BindAddress on page 366, LocalAddress on page 275 and SCTPPeer on page 330 are used with the extended API to bind and connect to all addresses with one call.

Radiator’s Radius::UtilXS package is available from the same location where you can download Radiator from. Availability of SCTP extended API is logged during \textit{radiusd} startup when logging level is set to debug (Trace 4 or higher number).

### 2.2. Updating from demo or locked version to full version

If your locked version was installed from Linux el7 RPM, Linux deb or Windows MSI package, update as follows:

**Linux el7 RPM:** \texttt{radiator-locked-4.xx-nnn.el7.noarch.rpm}  
update by installing \texttt{radiator-4.xx-nnn.el7.noarch.rpm}

**Linux deb:** \texttt{radiator-locked_4.xx-nnn_all.deb}  
update by installing \texttt{radiator_4.xx-nnn_all.deb}

**Windows MSI:** \texttt{Radiator-Locked-4.xx.nn.msi}  
update by installing \texttt{Radiator-4.xx.nn.msi}

If your locked version is a Linux generic RPM \texttt{Radiator-Locked-x.yy-z.noarch.rpm} and your system supports el7 RPMs, update by installing full el7 RPM. See installation instructions for Red Hat Enterprise Linux 7 and CentOS 7 on page 6. Otherwise make a copy of your configuration file, remove \texttt{Radiator-Locked-x.yy-z.noarch.rpm} and install \texttt{Radiator-x.yy-z.noarch.rpm}.

If you have installed Radiator from .zip or .tgz source code package, update by doing source code installation using a full version source code package.

### 2.3. Installing and upgrading on Linux: Red Hat Enterprise Linux 7 and CentOS 7

These packages have been tested on Red Hat Enterprise Linux 7 and CentOS 7.

To install Radiator:

1. Install the package. Make sure the package name ends with \texttt{el7.noarch.rpm}.
   
   \texttt{sudo yum install radiator-4.22-nnn.el7.noarch.rpm}

2. Start the server.

   \texttt{sudo systemctl start radiator}

3. Test authentication. You should see OK printed to the screen 3 times.
2. Installing and upgrading Radiator

4. Edit `/etc/radiator/radiator.conf` to suit your site and needs. This reference manual describes the options and parameters.

The package will arrange for Radiator service to start automatically each time you reboot your Linux host. The package creates the following system user, system group and an empty home directory for Radiator service:

- `radiator`
- `radiator`
- `/var/lib/radiator`

By default, it creates the following directories for configuration, logs, Radiator itself, its utilities and other files. See `/opt/radiator/radiator/goodies/` for configuration samples:

- `/etc/radiator/`
- `/var/log/radiator/`
- `/opt/radiator/`
- `/usr/share/doc/radiator`

Default log rotate configuration is installed as

- `/etc/logrotate.d/radiator`

You can find documentation, additional dictionaries, and the goodies collection in `/opt/radiator/radiator/` directory.

**Upgrading from a generic, non-el7 RPM**

To upgrade from generic non-el7 RPM packaged Radiator Radiator-Locked-x.yy-z.noarch.rpm, you need to do the following:

1. Stop the old Radiator instance.

   ```
   sudo /etc/init.d/radiator stop
   ```

2. Install the new el7 RPM. The installer removes non-el7 RPM and notes that old Radiator files are removed. Configuration files installed by the old package will be saved as `dictionary.rpmsave`, `radius.cfg.rpmsave` and `users.rpmsave`. Only files that were locally changed are saved as .rpmsave files.

   ```
   sudo yum install radiator-4.22-nnn.el7.noarch.rpm
   ```

3. Copy `radius.cfg.rpmsave` to `radiator.conf`. This is the configuration file used by new RPMs. See if the possible other .rpmsave files need to be addressed.

4. Start the server.

   ```
   sudo systemctl start radiator
   ```

**Upgrading from an el7 RPM**

Upgrades between el7.noarch.rpm packages do not require any special commands. Use 'yum install' or any other commands that you typically use to upgrade packages. Note: remember to restart radiator after each upgrade.
2.4. Installing and upgrading on Linux: Ubuntu 16.04 and Ubuntu 18.04

These packages have been tested on Ubuntu 16.04 and Ubuntu 18.04.

To install Radiator:

1. Install the package.

```
sudo apt install ./radiator_4.22-nnn_all.deb
```

2. Start the server.

```
sudo systemctl start radiator
```

3. Test authentication. You should see OK printed to the screen 3 times.

```
/opt/radiator/radiator/radpwstst
```

4. Edit `/etc/radiator/radiator.conf` to suit your site and needs. This reference manual describes the options and parameters.

The package will arrange for Radiator service to start automatically each time you reboot your Linux host. The package creates the following system user, system group and an empty home directory for Radiator service:

- `radiator`
- `radiator`
- `/var/lib/radiator`

By default, it creates the following directories for configuration, logs, Radiator itself, its utilities and other files. See `/opt/radiator/radiator/goodies/` for configuration samples:

- `/etc/radiator/
- `/var/log/radiator/
- `/opt/radiator/
- `/usr/share/doc/radiator`

Default log rotate configuration is installed as

```
/etc/logrotate.d/radiator
```

You can find documentation, additional dictionaries, and the goodies collection in `/opt/radiator/` directory.

**Upgrading from a deb**

Upgrades between deb packages do not require any special commands. Use `apt install` or any other commands that you typically use to upgrade packages. Note: remember to restart radiator after each upgrade.

2.5. Installing and upgrading on Linux: generic RPM package

This RPM should only be used only on systems that do not have their specific packages. Prerequisite is Perl 5.8.8 or better and Digest-MD5 version 2.02 or better, which are both installed by default in most recent Linux versions.
To install Radiator:

1. Log in as root.

2. Install the package. Make sure you have the correct package: the package name starts with Radiator and ends with noarch.rpm. The name starts with an upper case R and it must not have any distribution part, such as el7.

   ```bash
   rpm -Uvh Radiator-x.yy-z.noarch.rpm
   ```

3. Start the server.

   ```bash
   /etc/init.d/radiator start
   ```

4. Test authentication. You should see OK printed to the screen 3 times.

   ```bash
   radpwtst
   ```

5. Edit `/etc/radiator/radius.cfg` to suit your site and needs. This reference manual describes the options and parameters.

The RPM package will arrange for Radiator to start automatically each time you reboot your Linux host. Systemd users may want to see `goodies/radiator.service` for an alternative startup method. By default, it creates the following directories:

- `/etc/radiator/`
- `/usr/lib/perl5/site_perl/Radius/`
- `/var/log/radius/`
- `/usr/share/doc/packages/Radiator-x.yy/`

You can find documentation, additional dictionaries, and the goodies collection in `/usr/share/doc/packages/Radiator-x.yy`.

### Upgrading generic RPM package

To upgrade, use RPM and restart radiusd:

```bash
rpm -Uvh Radiator-x.yy-z.noarch.rpm
/etc/init.d/radiator restart
```

Check Radiator log file after installation for any errors or other log messages that may require further action.

### 2.6. Installing and upgrading on Windows

Radiator works on Windows 7/8/8.1/10 and Server 2008/2012/2016/2019. It also needs a suitably configured Perl available. Make sure you have system administrator rights.

You can install Radiator with MSI package that bundles Radiator and Strawberry Perl, or with a source code package using a process that is similar to full source distribution installation. For more information, see Section 2.7. Installing and upgrading with full source distribution on page 14.
If you’d like to use Radiator source code package, we recommend using ActiveState’s Perl distribution ActivePerl or Strawberry Perl. For installation packages and support, see their websites ActiveState website [https://www.activestate.com], and Strawberry Perl website [http://strawberryperl.com]. ActivePerl installs quickly and easily, and almost all the optional modules are readily available and easy to install. Strawberry Perl has different packaging and support options and is also quick and easy to install with a large number of optional modules.

Radiator comes with precompiled Perl modules required for <AuthBy LSA> authentication. <AuthBy ACE> and Digipass authentication require a separate binary module. If you require one of these authentication methods, it limits your choice of Perl version to install.

If you require RSA <AuthBy ACE> support, download Authen-ACE4 from CPAN and compile it for your chosen Perl distribution. For more information, see Section 2.1.2. CPAN on page 3. In case you need help with Authen-ACE4 setup, contact OSC.

If you require Digipass module for your chosen Perl distribution, contact OSC.

Radiator currently comes with precompiled modules for Win32-LSA that have been tested with ActivePerl and Strawberry Perl.

2.6.1. Tips for Radiator on Windows

This section lists some useful notes for installing and using Radiator in Windows environment:

• Daemon mode is not supported on Windows platforms. However, radiusd can be installed as a Windows Service. See Section 10.5. System Service on Windows on page 465 for more information.

• Perl on Windows automatically maps Unix style file names to DOS style (for example, changes / to \), so when you specify file names in the Radiator configuration file on Windows, you can use either Unix or DOS style. To avoid conflicts, choose one and use it consistently.

• Some ODBC drivers (notably Oracle) intercept the SIGINT handler, which makes it hard to kill radiusd with Control-C from within an Command Prompt window. To avoid this, create a shortcut to run radiusd, then you can always shut the window to kill radiusd.

• Some DBM file formats produced by AnyDBM_File on a PC and used by <AuthBy DBM> are not compatible with DBM files formats produced by Unix. If you create them with builddbm on one host, they may not be readable by Radiator on a different host. If in doubt, build the DBM file in the similar environment as the target host.

• radpwst in -gui mode does not work properly on Windows, due to a bug in Tk.

2.6.2. Installing and upgrading on Windows with MSI package

Radiator MSI package includes Strawberry Perl for convenience, so that separate installation of Perl is no longer needed. However, if your environment already has a Perl installation, Strawberry Perl in the package does not disturb it. Supported Windows versions are Windows Server 2012 or newer, but older Windows Server versions can also be used provided they have at least PowerShell 3.0 installed.

To install Radiator, double click the MSI file, approve licence screens, and the installation is done. It is not possible to select where Radiator is installed, it will automatically install to the drive with most space available under \Radiator\Radiator. The package will arrange for Radiator service to start automatically as a Windows service each time you reboot your host.

Radiator MSI package also supports silent operations, so it is possible to start the installation, upgrade, or uninstallation from command line without any UIs.
2. Installing and upgrading Radiator

NOTICE

The MSI package is not signed.

By default, the installer creates the following directories for configuration, logs, Radiator itself, its utilities and other files. See \Radiator\Radiator\goodies\ for configuration samples:

- \Program Files\Radiator\n
- \Radiator\Radiator\n
- \Radiator\Strawberry Perl\n
You can find documentation, additional dictionaries, and the goodies collection in \Radiator\Radiator\ directory. For quick access to the above locations, Radiator Software is added to Start menu.

Upgrading and uninstalling the Windows MSI Package

Upgrading works similar way, double clicking the MSI file on the target machine will launch the upgrade functionality. Upgrade will not remove anything from \Program Files\Radiator\, and Radiator Windows Service will be available as it was after the upgrade.

Uninstalling can be done either from double clicking the MSI file used to install the software or from Control Panel - Add/Remove Programs. When uninstalling via MSI file, the only option available is Remove. Repair or Change is not available. All Radiator Software specific items are cleared out during the uninstall, except the \Program Files\Radiator\ folder. This is to ensure your configurations are not lost.

2.6.3. Installing and upgrading on Windows using ActiveState ActivePerl

To install ActiveState ActivePerl and Radiator:

1. Download and install ActivePerl from ActivePerl website [https://www.activestate.com/activeperl/]

   During installation, we recommend installing it in C:\Perl64. This is typically the default for the MSI package.

2. Download the required Perl modules from ActiveState using PPM.

3. Open a Command Prompt window. Install the required Perl modules.

   cd \
   ppm install Win32::Daemon
   ppm install Digest::HMAC
   ppm install Digest::MD4

4. If you are going to use SQL authentication, find the database specific DBD modules:

   ppm search DBD

   For example to install DBD::ODBC, type ppm install DBD::ODBC

5. If you are going to use LDAP for authentication and/or accounting, obtain and install Net::LDAP:

   ppm install Net::LDAP

6. If you are going to use EAP TLS, TTLS, or PEAP for 802.1x authentication obtain and install Net::SSLeay:
2. Installing and upgrading Radiator

7. Download Radiator Zip file from [Radiator downloads](https://www.open.com.au/radiator/downloads.html). Unpack it to the default location, C:\Radiator. When using the default location, Radiator distribution is in C:\Radiator\Radiator-x.yy where x.yy is the version number.

8. Open a Command Prompt window with administrator access and move to the distribution directory.

9. Check that your distribution is complete:

   perl Makefile.PL

10. Run the regression tests:

    perl test.pl

    You see lots of lines like ok xx, and none saying not ok xx.

11. Install Radiator:

    perl Makefile.PL install

    This installs the Radiator programs and libraries in the standard places. It also creates a basic Radiator configuration file in C:\Program Files\Radiator\radius.cfg and a sample users file in C:\Program Files\Radiator\users.

12. Run Radiator to test the sample configuration:

    perl c:\perl64\bin\radiusd

    You see some messages, followed by NOTICE: Server started:. Radiator is now waiting for RADIUS requests.

13. In another Command Prompt window, run the test client program:

    perl c:\perl64\bin\radpwtst -user mikem -password fred

    You see OK for all requests. This proves that Radiator has correctly authenticated the user mikem, whose login details are in the users file in C:\Program Files\Radiator\users.

14. Rerun radpwtst, this time with the wrong password for mikem:

    perl c:\perl64\bin\radpwtst -user mikem -password wrong

    You see Rejected: for Access-Request.

15. If you configure a test NAS to use this server, you are to log in as the user mikem with password fred.

### Upgrading Radiator

To upgrade Radiator, repeat the installation using a new Radiator distribution package file. The files in the new distribution will overwrite any files in the old distribution.

2.6.4. Installing and upgrading on Windows using Strawberry Perl

To install Strawberry Perl and Radiator:

1. Download and install Strawberry Perl from [StrawberryPerl website](http://strawberryperl.com/)

   During installation, we recommend installing it in C:\Strawberry. This is the default for the MSI package.
2. Connect your computer to the Internet so you are able to download any required Perl modules from CPAN. For more information, see Section 2.1.2. CPAN on page 3.

3. Open a Command Prompt window. Install the prerequisite Perl modules.

   ```
cd \ncpan Win32::Daemonncpan Digest::HMACncpan Digest::MD4
   ```

4. If you are going to use SQL authentication, find the database specific DBD module(s) from CPAN. For example, to install DBD::ODBC:

   ```
cpan DBD::ODBC
   ```

5. If you are going to use LDAP for authentication and accounting, obtain and install Net::LDAP:

   ```
cpan Net::LDAP
   ```

6. If you are going to use EAP TLS, TTLS or PEAP for 802.1x authentication obtain and install Net::SSLeay:

   ```
cpan Net::SSLeay
   ```

7. Download Radiator Zip file from Radiator downloads [https://www.open.com.au/radiator/downloads.html]. Unpack it to the default location, C:\Radiator. When using the default location, Radiator distribution is in C:\Radiator\Radiator-x.yy where x.yy is the version number.

8. Open a Command Prompt window with administrator access and move to the distribution directory.

9. Check that your distribution is complete:

   ```
   perl Makefile.PL
   ```

10. Run the regression tests

    ```
    perl test.pl
    ```

    You see lots of lines like `ok xx`, and none saying `not ok xx`.

11. Install Radiator:

    ```
    perl Makefile.PL install
    ```

    This installs the Radiator programs and libraries in the standard places. It also creates a basic Radiator configuration file in C:\Program Files\Radiator\radius.cfg and a sample users file in C:\Program Files\Radiator\users.

12. Run Radiator to test the sample configuration:

    ```
    perl c:\strawberry\perl\bin\radiusd
    ```

    You see some messages, followed by `NOTICE: Server started:`. Radiator is now waiting for RADIUS requests.

13. In another Command Prompt window run the test client program:

    ```
    perl c:\strawberry\perl\bin\radpwtst -user mikem -password fred
    ```

    You see `OK` for all requests. This proves that Radiator has correctly authenticated the user mikem, whose login details are in the users file in C:\Program Files\Radiator\users.
14. Rerun radpwtst, this time with the wrong password for mikem:

```
perl c:\strawberry\perl\bin\radpwtst -user mikem -password wrong
```

You see Rejected: for Access-Request.

15. If you configure a test NAS to use this server, you are to log in as the user mikem with password fred.

### Upgrading Radiator

To upgrade Radiator, repeat the installation using the a Radiator distribution package file. The files in the new distribution will overwrite any files in the old distribution.

#### 2.6.5. Troubleshooting Windows service

**Windows service does not start**

When Windows service does not start at all, the problem can be caused by a missing Perl module. The exact error can be usually found from the Radiator log file, search a line with ERR information or line specifying missing Perl module, for example Can’t locate Win32/NetAdmin.pm in @INC (you may need to install the Win32::NetAdmin module).

**Windows service does not stay up**

When Windows service does start but stops after a while, the problem might also be a missing Perl module. In this case the module is loaded only when it is tried to be used instead of loading the module during startup. Radiator log file can contain information why the service stopped, but this situation can also be troubleshooted with command line.

- Stop the Windows service if it is running.
- Start Radiator manually from command line window. Use the shortcut for elevated command line window \Program Files\Radiator\Perl command line Elevated to get Perl environment and have Radiator log file permissions. Radiator log file permissions are needed because debug information is both logged to file and printed to command line window.
- To start `radiusd` type for example: `perl C:\Radiator\Radiator\radiusd -log_stdout -foreground -trace 4 -config "C:\Program Files\Radiator\radiusd.conf"` The default configuration from the command can be changed to suit the troubleshooting needs.

This will start `radiusd` and print all the debug information to the command line window and to Radiator log file. Once the request that caused Radiator Windows service to stop is sent to the server again, it is likely that the command line window will show the exact problem.

**SE_TCB_PRIVILEGE errors when using command line**

When Radiator is run from command line in Windows and LSA is used, following error might appear: ERR: Could not AdjustPrivilege SE_TCB_PRIVILEGE: A required privilege is not held by the client, on the command line. This means that Radiator must be run on Windows as a user that has the ‘Act as part of the operating system's security policy’ (SE_TCB_PRIVILEGE) enabled. The local system account that the Radiator Windows service runs as has this privilege by default. If all the other errors have been cleared by troubleshooting with command line and only this error is left, Radiator Windows service will work.

### 2.7. Installing and upgrading with full source distribution

Also known as the tar or zip package, this is the general and widely portable procedure for installing Radiator. However, a number of platform-specific installation methods are also available.
This installation method requires ExtUtils-MakeMaker, which is part of Perl. Some recent Linux distributions, such as RHEL 6, do not have ExtUtils-MakeMaker installed by default. Install it with the following command:

```
yum install perl-ExtUtils-MakeMaker
```

The minimum prerequisite is Perl Digest-SHA module, which is part of core Perl since Perl 5.10.0. On RHEL 6 and 7, it is packaged separately and can be installed with yum. On RHEL 5, you have to install it from CPAN. For more information, see Section 2.1.2. CPAN on page 3.

The Radiator full source distribution is supplied as a gzipped, tarred distribution file. The standard distribution file name is Radiator-x.yy.tgz, where "x.yy" is the revision number. Radiator zip distribution is named similarly with file name ending as zip instead of tgz. Save the distribution archive somewhere suitable, such as `/usr/local/src/`, and unpack it as follows:

```
zcat Radiator-x.yy.tgz | tar xvf -
```

In this case, zcat is the GNU zcat command. If your path does not include the GNU zcat:

```
cat Radiator-x.yy.tgz | gunzip -c | tar xvf -
```

To unpack a zip distribution, use a GUI tool or command line:

```
unzip Radiator-x.yy.zip
```

In either case, this creates a directory `Radiator-x.yy` into the current directory:

```
cd Radiator-x.yy
perl Makefile.PL
make test
```

This runs a fairly exhaustive test suite on your RADIUS server. It can take few minutes.

```
make install
```

This optional command installs the RADIUS modules that Radiator requires in your site-Perl directory (for example `/usr/local/lib/perl5/site_perl/`). It installs the RADIUS daemon (`radiusd`, the command line password test program `radpwdtest`, the DBM file builder `builddbm`, and the SQL database builder `buildsql` in your default directory for local executables, which is typically `/usr/local/bin/`.

You can omit `make install` command and run your Radiator directly in the distribution directory.

**Upgrading**

To upgrade Radiator with zip or tgz package, repeat the installation using the new distribution package file. The files in the new distribution will overwrite any files in the old distribution.

### 2.8. Installing and upgrading on Solaris

On Solaris, we recommend install and upgrade from the tar or zip distribution as described above. Previous Radiator versions were packaged for Solaris, but required Perl from Sunfreeware [http://www.sunfreeware.com] to find the correct installation locations. We now recommend to install Perl from your preferred source and then use the Radiator tar package for Radiator installation.

### 2.9. Installing and upgrading on macOS

On macOS, we recommend install and upgrade from the tar or zip distribution as described above. We recommend installing Xcode and Perl installation management tool, such as Perlbrew, which can be used to install, for example, `cpanm` to obtain modules from CPAN. For more information, see Section 2.1.2. CPAN on
3. Configuring Radiator

This allows you to start working with Radiator without modifying the Perl installation that comes with macOS.

Perl that comes with macOS works with Radiator, but may not have all the modules your configuration might require.

2.10. Troubleshooting

If you have trouble installing or running Radiator, see the Radiator log file for hints. For more information about getting help, see Section 21. Getting help on page 491.

3. Configuring Radiator

This section describes the Radiator configuration file and the statements that control the behaviour of the Radiator server, \texttt{radiusd}.

When \texttt{radiusd} starts, it reads the configuration file. The default file name and path for the configuration file depends on the operating system and how Radiator is installed.

- \texttt{Unix and macOS: /etc/radiator/radius.cfg or radiator.conf}
- \texttt{Windows: C:\Program Files\Radiator\radius.cfg or radiator.conf}

Radiator deb, RPM and Windows MSI packages use startup configuration that uses \texttt{radiator.conf} to be consistent with log directory, package name and other names.

You can specify an alternate configuration file with \texttt{radiusd's \textasciitilde config\_file} command line parameter. There is a test configuration file (\texttt{radius.cfg}) in the Radiator distribution that shows most of parameters and clauses that you can use in a configuration file, and examples of how to use them. There is also a very simple example (\texttt{simple.cfg}) in the goodies/ directory in the Radiator distribution. It is a good starting point for your own configuration file.

In general terms, the configuration file allows you control the following things:

- Behaviour of the server in general, including logging
- Which RADIUS clients the server responds to
- Which RADIUS realms the server works with
- Handlers for specifying special ways to handle requests
- For each realm, what methods are used for authenticating users and storing accounting information
- For each authentication method for each realm, the configuration of the authentication module
- Custom Perl hooks that are run during the processing of each request. For more information, see Section 14. Execution sequence and hook processing on page 470

The configuration file is an ASCII text file, it can be edited by any text editor. Leading white space in each line is ignored, so you can use indentation to make your configuration file easier to read. Case is important in all parameter names and clauses.

\textbf{Tip}

An alternative to editing the configuration file directly is to use the ServerHTTP clause (for more information, see Section 3.122. <ServerHTTP> on page 387 and Section 5. Configuring Radiator with GUI on page 405) which allows you to connect to Radiator with standard web browser and examine, change and test the configuration with an easy to use point and click web interface.
The configuration file consist of the following things:

- **Comment line**
  
The comment line starts with a # as the first character. Anything including and after the # is ignored. Blank lines are also ignored. Here is an example:

  ```
  # This is a comment
  ```

- **Parameter setting**
  
The first word is the name of the parameter to set, all the following words and digits are the value to be used for the parameter. All the parameters you can set in the configuration file are described in this document. Here is an example:

  ```
  Trace 4
  ```

- **Parameter setting from file**
  
Parameter values can be retrieved from an external file. The line consist of the parameter name and filename, here is the format:

  ```
  parameter file:"filename"
  ```

This is a useful feature for putting long parameters, such as a hook, in an external file. Here is an example that loads the code for `PreAuthHook` from the external file `hook.pl`:

  ```
  PreAuthHook file:"hook.pl"
  ```

- **Parameter setting from SQL database query.**

Parameter values can be retrieved from an SQL database. The line consist of the parameter name, SQL identifier, and SQL query, here is the format:

  ```
  ParameterName sql:identifier:query
  ```

It looks for a previously defined `<AuthBy SQL>` clause with an Identifier and runs the given SQL query. The first row in the result is used to set the parameter. The SQL database lookup is only done once at startup time. Here is an example of using the SQL query:

  ```
  <AuthBy SQL>
  Identifier        myidentifier
  DBSource          dbi:mysql:radius
  DBUsername        mikem
  DBAuth            fred
  </AuthBy>
  Trace sql:myidentifier:select value from configuration where
  name = 'Trace'
  ```
3. Configuring Radiator

- Start or end of clause

A clause is a collection of parameter settings related to a single feature in the server. The first line in a clause is surrounded by angle brackets, for example `<Client fred>`, which marks the beginning of the configuration for client with the DNS name "fred". Subsequent lines are interpreted as parameter settings for the feature, until the end of the clause is seen. The end of the clause is surrounded by angle brackets with a slash. Here is a usage example:

```
<Client DEFAULT>
  # Configuration parameters for the Client go here
  ....
</Client>
```

3.1. Tips for using Radiator configuration files

This section discusses some practical tips for using Radiator configuration files.

Security

The configuration file usually contains the shared secrets that allow your RADIUS clients to communicate with the Radiator RADIUS server. It can also contain passwords for access to databases and such. This means that for security reasons, keep the configuration file as secure as possible. On Unix, make sure that it is readable only by the user that `radiusd` runs as.

Enabling and disabling flags

Parameters that are on/off flags, such as `LogSuccess` or `LogFailure`, can be enabled or disabled in a number of ways. Values of 0, no, or false (case insensitive) turn the flag off, whereas any other value, including the empty string, turn the flag on.

These turn the flag parameter off:

```
IgnoreAcctSignature 0
IgnoreAcctSignature no
IgnoreAcctSignature NO
IgnoreAcctSignature false
IgnoreAcctSignature FALSE
```

These turn the flag parameter on:

```
IgnoreAcctSignature
IgnoreAcctSignature 1
IgnoreAcctSignature yes
IgnoreAcctSignature anythingatall
DefineGlobalVar myspecialflag yes
IgnoreAcctSignature %{GlobalVar:myspecialflag}
```

Splitting lines

Long lines in your configuration file can be split over multiple lines by using the \ character at the end of each line except the last:

```
AuthSelect select s.password, g.session_timeout \
  s.check_items s.reply_items \
  from subscribers s, groups g \
  where username=? and s.group \```
3. Configuring Radiator

- g.name

**Escaped octal characters**

Parameter values can contain escaped octal characters. Here is an example how to specify an `AcctLogFileFormat` with newline (octal 012) separated lines:

```
AcctLogFileFormat %{Timestamp}\012%{Acct-Session-Id}\012%{User-Name}\012
```

**Clause order**

The order of clauses in the Radiator configuration file is significant. All the clauses are parsed and internal data structures constructed during the initial parse of the configuration file. They are constructed in the order they appear in the configuration file. For example, if a `<Log xxxxxx>` clause is encountered, that logger is created immediately and used to log all subsequent parsing and startup errors. This means that if a `<Log xxxxxx>` clause is encountered in the configuration file, only errors in clauses that appear after the Log clause is logged using that method.

### 3.2. Including parts of configuration from external files

The include directive in the Radiator configuration file is followed by a file name. That external file is opened and read to the end as a configuration file before processing of the current configuration file continues. Special filename characters are permitted (for more information, see Section 3.3. Special formatters on page 19).

Files can be recursively included to any depth. The include keyword is case insensitive, here are examples, which are both correct:

```
include %D/clients.cfg
Include %D/realms.cfg
```

Filename can include csh(1) style wildcards and expansions such as *, ?, [...], {...}, ~, and so on. Files whose first character is a ‘.’ are ignored unless explicitly matched. Wildcard files are included in lexicographic order of their filename. Here are examples of using wildcards:

```
# Reads all files with a .cfg extension:
include %D/*.cfg
# Matches radiator1.cfg, radiator2.cfg etc:
include /etc/radiator/radiator[0123456].cfg
```

You can also use the include mechanism to capture the output of a script. A program name followed by a vertical bar runs the named program and includes its output into the configuration file. This is a useful way for generating some or all of your Radiator configuration programmatically. For example, you can write a script to generate all your `<Client>` clauses by processing some external description of all your NASs. Here is an example of running a program:

```
include %D/myClientScript.pl|
```

### 3.3. Special formatters

Wherever you can specify a file name in the Radiator configuration file, you can use some special formatters in the path name. These special formatters can also be used in a number of other configuration file parameters. These special formatters will be replaced at startup or run time, so you can dynamically change file paths and the like so they depend on such things as the date, realm, user name, and so on.

Special formatters are introduced by a `%`, followed by a single character or a format name in curly brackets.
The following formatters are available:

**Table 1. Special characters, which are replaced from the current time according to the Radiator host**

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>%l</td>
<td>Current time in long format, for example, Thu Jul 1 08:38:21 1999</td>
</tr>
<tr>
<td>%B</td>
<td>Current time in common SQL date time format, for example, Sep 12, 2003 15:48</td>
</tr>
<tr>
<td>%G</td>
<td>Current time in extended SQL date format including seconds, for example, Sep 12, 2003 15:48:59</td>
</tr>
<tr>
<td>%t</td>
<td>Current time in seconds since Jan 1, 1970</td>
</tr>
<tr>
<td>%S</td>
<td>Current second (00-59)</td>
</tr>
<tr>
<td>%M</td>
<td>Current minute (00-59)</td>
</tr>
<tr>
<td>%H</td>
<td>Current hour (00-23)</td>
</tr>
<tr>
<td>%d</td>
<td>Current day of the month (2 digits)</td>
</tr>
<tr>
<td>%m</td>
<td>Current month number (2 digits, 01-12)</td>
</tr>
<tr>
<td>%Y</td>
<td>Current year (4 digits)</td>
</tr>
<tr>
<td>%y</td>
<td>Last 2 digits of the current year (2 digits)</td>
</tr>
<tr>
<td>%q</td>
<td>Day of the week, abbreviated (for example, Sun, Mon, Tue)</td>
</tr>
<tr>
<td>%Q</td>
<td>Day of the week (for example, Sunday, Monday, Tuesday)</td>
</tr>
<tr>
<td>%v</td>
<td>Month of the year, abbreviated (for example, Jan, Feb, Mar)</td>
</tr>
<tr>
<td>%V</td>
<td>Month of the year (for example, January, February, March)</td>
</tr>
<tr>
<td>%s</td>
<td>Microseconds in the current second</td>
</tr>
</tbody>
</table>

**Note**

Timestamp is only available with Accounting-Request messages. For more about Timestamp, see Section 3.40.10. AcctColumnDef on page 176.

**Table 2. Special characters, which are replaced from the Timestamp of the current Accounting-Request packet**

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>%o</td>
<td>Timestamp in long format, for example, Thu Jul 1 08:38:21 1999</td>
</tr>
<tr>
<td>%A</td>
<td>Timestamp in common SQL date time format, for example, Sep 12, 2003 15:48</td>
</tr>
<tr>
<td>%J</td>
<td>Timestamp in another common SQL date time format, for example, 2003-09-12 15:48:00</td>
</tr>
<tr>
<td>%F</td>
<td>Timestamp in extended SQL date format including seconds, for example, Sep 12, 2003 15:48:59</td>
</tr>
<tr>
<td>%b</td>
<td>Timestamp in seconds since Jan 1 1970</td>
</tr>
<tr>
<td>%p</td>
<td>Timestamp second (0-59)</td>
</tr>
<tr>
<td>%k</td>
<td>Timestamp minute (0-59)</td>
</tr>
</tbody>
</table>
### Specifier | Replacement
---|---
%j | Timestamp hour (0-23)
%i | Timestamp day of the month (2 digits)
%g | Timestamp month number (2 digits)
%f | Timestamp year (4 digits)
%e | Last 2 digits of the Timestamp year (2 digits)
%E | The elapsed time in seconds since the packet was received. Can be used, for example, to log processing time for proxied packets.

Table 3. Special characters, which are replaced with other information of the current request

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
</table>
%c | IP address of the client who sent the current request, if any |
%C | Client name of the client who sent the current request, if any. |

**Note**
This does a reverse name lookup on the address and depending on your environment, this may take a number of seconds to resolve.

%R | The realm of the user name in the current request, if any, after any `RewriteUsername` is applied. This is everything following the first `@` sign in the `User-Name`
%K | The trailing realm of the user name named in the current request, if any, after any `RewriteUsername` is applied. This is everything following the last `@` sign in the `User-Name`
%N | NAS-IP-Address in the current request, if any
%n | Full `User-Name`, including the realm, currently being authenticated, after any `RewriteUsername` is applied
%U | `User-Name` currently being authenticated with the realm, if any, stripped off, after any `RewriteUsername` is applied
%u | Full original `User-Name` that was received, before any `RewriteUsername` is applied
%w | User name part of the full original user name before any `RewriteUsername` rules were applied
%W | Realm part of the full original user name before any `RewriteUsername` rules were applied
%P | Decrypted `User-Password` from the current request
%T | Request type of the current request, if any. This may be, for example, `Access-Request` or `Accounting-Request`
%z | `User-Name` in the current packet, hashed with MD5.
%I | NAS identifier as an integer instead of dotted decimal character string, useful for speeding up SQL queries
%X | EAP identity of the EAP request, with any trailing `@realm` stripped off
### Specifier | Replacement
---|---
%\(x\) | EAP identity of the EAP request
%\(Z\) | The RADIUS Identifier of the incoming request
%\{attr\} | The value of the named attribute in the current packet (if any). For example, \%{User-Name} is the same as \%\(n\)

**Table 4. Miscellaneous special characters and format names**

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>%%</td>
<td>Percent character</td>
</tr>
<tr>
<td>%r</td>
<td>Literal newline character</td>
</tr>
<tr>
<td>%D</td>
<td>Value of <code>DbDir</code> as configured in your Radiator configuration file</td>
</tr>
<tr>
<td>%L</td>
<td>Value of <code>LogDir</code> as configured in your Radiator configuration file</td>
</tr>
<tr>
<td>%h</td>
<td>Hostname this server is running on</td>
</tr>
<tr>
<td>%O</td>
<td>The server instance number, when FarmSize is used to specify a server farm. 0 is the main (supervising) server.</td>
</tr>
<tr>
<td>%{Special:X}</td>
<td>Same as %(x), where X is any of the single special characters listed above. For example, %{Special:a} will produce the same result as just %a</td>
</tr>
<tr>
<td>%{GlobalVar:name}</td>
<td>The value of the global variable called name. Global variables can be set with <code>name=value</code> on the command line, or with defineFormattedGlobalVar name value in the configuration file. If the variable “name” has not been defined, replaced with an empty string.</td>
</tr>
<tr>
<td>%a</td>
<td>Framed-IP-Address in the reply message being created, if any</td>
</tr>
<tr>
<td>%{Request:name}</td>
<td>Value of the named attribute in the current request, if any. This is the same as just %{name}, but may be used instead for clarity.</td>
</tr>
<tr>
<td>%{OuterRequest:name}</td>
<td>Value of the named attribute in the outer request, of the current request, if any. May be used where the request has been tunnelled using PEAP or TTLS.</td>
</tr>
<tr>
<td>%{Reply:name}</td>
<td>Value of the named attribute in the reply currently being created, if any. For example, %{Reply:Framed-IP-Address} is the same as %a. If there is no current reply, or the attribute is not present in the reply, replaced with an empty string</td>
</tr>
<tr>
<td>%{RequestAttrs:name}</td>
<td>All values of the named attribute in the current request, separated by commas</td>
</tr>
<tr>
<td>%{OuterRequestAttrs:name}</td>
<td>All values of the named attribute in the outer request of the current request, separated by commas</td>
</tr>
<tr>
<td>%{ReplyAttrs:name}</td>
<td>All values of the named attribute in the current reply, separated by commas</td>
</tr>
<tr>
<td>%{Client:name}</td>
<td>Value of the named parameter from the Client clause that accepted the current packet, if any.</td>
</tr>
<tr>
<td>%{Handler:name}</td>
<td>Value of the named parameter from the Handler clause that is handling the current packet, if any.</td>
</tr>
</tbody>
</table>
### Specifier | Replacement
--- | ---
%{AuthBy:name} | Value of the named parameter from the AuthBy clause that is handling the current packet, if any.
%{Server:name} | Value of the named parameter from the global server configuration, for example, %{Server:Trace} is replaced by the current value of the global Trace parameter.
%{RequestVar:name} | Value of the current request object similar to Client, Handler, and AuthBy specials above.
%{ReplyVar:name} | Value of the current reply object similar to Client, Handler, and AuthBy specials above.
%{IntegerVal:name} | Value of the named attribute in the current packet, if any, expressed as an integer, instead of as a value name from the dictionary, for example, %{IntegerVal:Tunnel-Type} is replaced by 3 if the Tunnel-Type is L2TP.
%{TimestampVal:number} | Value of the current Unix time stamp + the number. Number can be a positive or negative integer, request attribute name, or a special character. For example, %{TimestampVal:3000}, %{TimestampVal:Session-Timeout} or %{TimestampVal:%{Reply:Session-Timeout}}. This is useful for replacing hooks with formatters for calculating time stamps.
%{HexAddress:name} | Replaced by the named IPv4 attribute in the current packet, if any, expressed as a hexadecimal string. For example, %{HexAddress:NAS-IP-Address} is replaced by CB3F9A01 if the NAS-IP-Address in the current request is 203.63.154.1.
%{Quote:somestring} | When used with SQL modules, replaced by somestring quoted with the appropriate quoting style for the SQL database in use. For example, when used with a mysql database, %{Quote:somestring} is replaced by somestring.
%{SQL:identifier:query} | Replaced with a value fetched from an SQL database. Looks for a previously defined AuthBy SQL clause with the Identifier of identifier and runs the SQL query given by query. The first row in the result will be used as the value of the special character. This type of lookup is done whenever the special character is evaluated.
%{EAPTLS:name} | Value of named TLS session parameter for the current TLS-based EAP authentication. The valid parameter names are: Protocol, Cipher, Session_ID, Start_Time, and Timeout. For more information, see OpenSSL sess_id [https://www.openssl.org/docs/manmaster/apps/sess_id.html].
%0 - %99 | Depending on the context, these may be replaced with context-specific values, which are documented in this reference manual.

Note that some of these specifiers are only valid when a RADIUS message is being processed. In any other context, such a specifier will be replaced by an empty string.

In the following example, the log file will be stored in LogDir, with a name that starts with the current year. If LogDir is /var/log and the current year was 1998, this would result in a log file name of /var/log/1998-logfile.
LogFile %L/%Y-logfile

Special characters of the form %{x:y} may be nested and contain other %{a:b} or %h special forms, such as %{x:%{y:z}}, or %{x:%h} This can be useful in an example, where the resulting Host parameter will be desthostname.com:

```plaintext
DefineFormattedGlobalVar hostname myhostname
DefineFormattedGlobalVar role myrolename
DefineFormattedGlobalVar myhostname_myrolename desthostname.com
....
Host %{GlobalVar:%{GlobalVar:hostname}_%{GlobalVar:role}}
```

### 3.4. Date formatting

When Radiator is required to format a date for use with SQL and other databases it uses a configurable DateFormat on page 179. A DateFormat can include special characters which are interpreted according to the following table. Any other characters will be used verbatim.

**Table 5. DateFormat special characters**

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>%%</td>
<td>Percent character</td>
</tr>
<tr>
<td>%a</td>
<td>Day of the week, abbreviated</td>
</tr>
<tr>
<td>%A</td>
<td>Day of the week</td>
</tr>
<tr>
<td>%b</td>
<td>Month, of the year, abbreviated</td>
</tr>
<tr>
<td>%B</td>
<td>Month of the year</td>
</tr>
<tr>
<td>%c</td>
<td>Ctime format, for example, Sat Nov 19 21:05:57 1994</td>
</tr>
<tr>
<td>%d</td>
<td>Current day of the month (2 digits)</td>
</tr>
<tr>
<td>%e</td>
<td>Numeric day of the month</td>
</tr>
<tr>
<td>%D</td>
<td>MM/DD/YY</td>
</tr>
<tr>
<td>%h</td>
<td>Month of the year, abbreviated</td>
</tr>
<tr>
<td>%H</td>
<td>Current hour (00-23)</td>
</tr>
<tr>
<td>%I</td>
<td>Hour, 12-hour clock, leading 0</td>
</tr>
<tr>
<td>%j</td>
<td>Day of the year</td>
</tr>
<tr>
<td>%k</td>
<td>Hour</td>
</tr>
<tr>
<td>%l</td>
<td>Hour, 12-hour clock</td>
</tr>
<tr>
<td>%m</td>
<td>Current month number (2 digits, 01-12)</td>
</tr>
<tr>
<td>%M</td>
<td>Current minute (00-59)</td>
</tr>
<tr>
<td>%n</td>
<td>NEWLINE character</td>
</tr>
<tr>
<td>%o</td>
<td>Ornate day of month, for example, 1st, 2nd, 25th</td>
</tr>
<tr>
<td>%p</td>
<td>AM or PM</td>
</tr>
<tr>
<td>%r</td>
<td>Time format: 09:05:57 PM</td>
</tr>
</tbody>
</table>
3. Configuring Radiator

<table>
<thead>
<tr>
<th>Specifier</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>%R</td>
<td>Time format: 21:05</td>
</tr>
<tr>
<td>%S</td>
<td>Current second (00-59)</td>
</tr>
<tr>
<td>%t</td>
<td>TAB character</td>
</tr>
<tr>
<td>%T</td>
<td>Time format: 21:05:57</td>
</tr>
<tr>
<td>%U</td>
<td>Week number, Sunday as first day of week</td>
</tr>
<tr>
<td>%w</td>
<td>Day of the week, numerically, Sunday = 0</td>
</tr>
<tr>
<td>%W</td>
<td>Week number, Monday as first day of week</td>
</tr>
<tr>
<td>%x</td>
<td>Date format: 11/19/94</td>
</tr>
<tr>
<td>%X</td>
<td>Time format: 21:05:57</td>
</tr>
<tr>
<td>%y</td>
<td>Last 2 digits of the current year (2 digits)</td>
</tr>
<tr>
<td>%Y</td>
<td>Current year (4 digits)</td>
</tr>
<tr>
<td>%Z</td>
<td>Timezone in ASCII. eg: PST</td>
</tr>
</tbody>
</table>

For example, DateFormat %b %e, %Y %H:%M would format a date and time like: Sep 3, 1995 13:37.

3.5. Address binding

One of the main functions of Radiator is to listen for UDP packets and TCP connections from other systems according to the Radiator configuration. The various Radiator clauses that can accept packets or connections from other systems all support the BindAddress parameter, which controls which IP addresses Radiator will listen on. IP packets sent to an IP address which is on the Radiator host, but which Radiator has not bound with BindAddress will not be received by Radiator.

The driver for this is that a single host may have multiple IP addresses, and those addresses may be IPv4, IPv6 and/or IPv6-over-IPv4. You may require Radiator to only honour requests directed to one of or a subset of the IP addresses for the host.

With BindAddress you can control which destination IP addresses Radiator will accept. You can specify one or more IPv4 or IPv6 addresses, including wildcard addresses, with the BindAddress parameter. The following forms may be used:

- 0.0.0.0 (the default) Any IPv4 address on the host
- 1.2.3.4 A specific IPv4 address on the host
- :: Any IPv6 address on the host (and this may include any IPv4 address too, depending on how the host is configured)
- 2001:db8:148:100::31 A specific IPv6 address on the host

They may be combined in one BindAddress parameter like so:

```
BindAddress 0.0.0.0
BindAddress 192.87.30.31,2001:db8:148:100::31
BindAddress ::, 0.0.0.0
```

For more information about IPv6 support and IPv6 wildcard addresses, see Section 3.6. IPv6 support on page 26.
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**CAUTION**

Wildcard addresses may require special attention. When a host is multihomed or uses alias IP addresses, the Radius replies from that host typically use the main address of the outgoing interface. In other words, requests sent to a certain address may be replied from a different address. You can work around this by configuring the addresses individually with `BindAddress` instead of using the wildcard address.

---

### 3.6. IPv6 support

Radiator supports IPv6 transport for RADIUS over UDP, RadSec (RFC 6614), DIAMETER, and TACACS+. This means that Radiator can send, receive, and proxy requests over IPv6.

**Note**

Older Perl versions require `Socket6.pm` for IPv6 support. If Radiator cannot find working IPv6 support during the startup, it logs an INFO level message. If there is no working IPv6 support, RADIUS attributes with IPv6 types are available as binary values, and IPv6 sockets are not supported.

**Note**

Radiator 4.13 does not require `ipv6:-prefix` for IPv6 addresses anymore. It is still allowed but should be avoided in new configurations. This prefix can be used to request IPv6 address resolution for names. By default, the names are currently resolved to IPv4 addresses only.

Various modules describe their IPv6 support in more detail. For example, `<AuthBy LDAP2>` can connect to LDAP servers over IPv6 with detailed IPv6 information. For more information, see Section 3.48. `<AuthBy LDAP2>` on page 210. Another example is the Resolver clause for `<AuthBy DNSROAM>`, which can query DNS servers over IPv6 and optionally fetch IPv6 records if configured to do so.

For more information about SNMP support for IPv6, see Section 3.28. `<SNMPAgent>` on page 128.

Supported RADIUS specific IPv6 RFCs include:

- RFC 3162 which defines Framed-IPv6-Prefix and such
- RFC 4818 which defines Delegated-IPv6-Prefix
- RFCs 4669 and 4671 which define IPv6 RADIUS server MIBs
- RFC 6911 which defines Framed-IPv6-Address and uch
- RFC 6930 which defines the 6rd IPv6 deployment mechanism

Many protocols, such as DIAMETER, do not require specifically IPv4 or IPv6. Radiator supports these protocols over both IP versions as long as the underlying operating system and Perl modules offer support for the both protocols.

#### 3.6.1. IPv6 Clients

IPv6 Client clauses support single IPv6 addresses and IPv6 CIDR notation. When IPv6 CIDR client clauses are used, you may want to consider installing `Math::BigInt::GMP` or `Math::BigInt::Pari` Perl modules for more efficient IPv6 network mask calculation.
3.6.2. IPv6 wildcard listen address

If you are using recent Perl or Socket.pm you can configure separate IPv4 and IPv6 wildcard listen sockets by specifying both IPv6 and IPv4 wildcard addresses and turning on IPV6_V6ONLY socket option:

```plaintext
BindAddress ::,0.0.0.0
BindV6Only
```

For more information about this parameter, see Section 3.7.10. BindV6Only on page 31.

---

**Note**

There are differences between operating systems. For example, on Linux IPV6_V6ONLY is off by default. When it is off, the following will BindAddress parameter not work as expected. The bind to IPv6 wildcard address is done first and this does not allow binding to IPv4 wildcard address afterwards:

```plaintext
BindAddress ::, 0.0.0.0
```

If IPV6_V6ONLY is set to 1, the IPv6 bind will not affect the IPv4 bind and the example BindAddress will work as expected. On OS X 10.9 it is possible to bind to IPv4 wildcard address first followed by IPv6 wildcard address. On Windows IPV6_V6ONLY behaviour is the default.

---

**Note**

Linux has a sysctl kernel parameter net.ipv6.bindv6only and special file to control the system wide behaviour: `/proc/sys/net/ipv6/bindv6only`.

3.6.3. IPv4-mapped IPv6 address

When IPv4 packets are received by a system that uses IPv6 wildcard listen sockets, the client addresses may show as IPv4-mapped IPv6 addresses. See Section 3.7.10. BindV6Only on page 31 for more info about this feature and how to control IPv4 mapped IPv6 addresses.

---

**Tip**

Configuring the operating system or Radiator to not use IPv4-mapped IPv6 addresses allows you to keep IPv4 and IPv6 clearly separate.

3.7. Global parameters

These parameters apply to the server as a whole, and do not appear inside a clause. They are used to control the behaviour of the server as a whole.

3.7.1. Foreground

If this parameter is set, it makes the server run in the foreground instead of as a detached daemon. No argument is required. The default behaviour is to run as a daemon. You must run in the foreground if you want to run Radiator in a console window, from inetd or restartWrapper. For more information, see Section 10.3. Using inetd on page 463 and Section 10.1. Using restartWrapper on page 462.

```plaintext
# Run in the foreground
```
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## 3.7.2. LogStdout

If this parameter appears, it makes all logging output appear on STDOUT as well as in the log file. No argument is required. The default behaviour is not to log to STDOUT. You must be running in Foreground mode for this to have an effect.

```
# Log to stdout
LogStdout
```

## 3.7.3. Trace

Sets the priority level of trace messages to be logged in the log file (and printed on stdout if LogStdout is defined). The argument is an integer from 0 to 5, with the following meanings:

- 0 ERR. Error conditions. Serious and unexpected failures
- 1 WARNING. Warning conditions. Unexpected failures
- 2 NOTICE. Normal but significant conditions
- 3 INFO. Informational messages
- 4 DEBUG. Debugging messages
- 5 EXTRA_DEBUG. Incoming raw packet dumps in hexadecimal

A trace level of 4 or more will produce all the possible tracing messages, including dumps of every RADIUS message received and sent: you probably do not want that in a production environment. The default tracing level is 0. You can change the current tracing level while Radiator is running on Unix platforms by signalling it with SIGUSR1 and SIGUSR2. For more information, see Section 4. Running radiusd on page 402.

```
# Show everything up to and including INFO level
Trace 3
```

## 3.7.4. LogTraceId

`LogTraceId` flag parameter allows logging messages related to an authentication exchange and to its subsequent accounting session with a tracing identifier. `LogTraceId` can be configured for global level and Log clause level. `LogTraceId` enables prepending a tracing ID to messages logged to STDOUT, when LogStdout is enabled, and to log file configured with `<Log FILE>` and `<Log SYSLOG>`. For more information, see Section 3.7.2. LogStdout on page 28.

**Tip**

Support for using the same tracing identifier with accounting messages requires enabling parameter in the authenticating Handler clause. For more information, see Section 3.30.37. AutoClass on page 144.

Tracing ID works in conjunction with the Radiator load balancer allowing coordinated log message indexing and lookup between frontend load balancers and backend workers.

```
# Prepend tracing id to log messages
LogTraceId
```
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3.7.5. LogRejectLevel

Log level for rejected authentication attempts. Can be overridden by Handler. Defaults to 3 (INFO).

3.7.6. AuthPort

Specifies which port(s) Radiator will listen on for RADIUS authentication requests. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services/ (or its equivalent on your system). Multiple comma-separated ports may be specified. The default port is 1645. Note that the officially assigned port number for RADIUS authentication has been changed to 1812. AuthPort may contain special formatting characters. A typical use of special formatting characters is with GlobalVar and command line arguments.

```bash
# Listen for authentication requests on port 1812 as per RFC
# 2865
AuthPort 1812
```

**Note**

Actually Radiator will also service accounting requests received on the authentication port without complaint.

**Tip**

You can prevent Radiator from binding to an authentication port by undefining AuthPort:

```bash
# Do not bind to an auth port:
AuthPort
```

**Tip**

You can pass any port number as a command line argument to radiusd with a configuration like this:

```bash
AuthPort %{GlobalVar:authport}
```

and then run radiusd with an argument to set the port number like this:

```bash
radiusd authport=1810 ...
```

**Tip**

You could listen for requests on the 2 most common RADIUS authentication port numbers with

```bash
AuthPort 1645,1812
```
Tip
Radiator will listen for requests on each given AuthPort (default 1645), on each IP address specified by BindAddress (default 0.0.0.0). For more information, see Section 3.5. Address binding on page 25.

3.7.7. AcctPort

Specifies which port Radiator will listen on for RADIUS accounting requests. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services (or equivalent on your system). Multiple comma-separated ports may be specified. The default port is 1646. Note that the officially assigned port number for RADIUS accounting has been changed to 1813. AcctPort may contain special formatting characters. A typical use of special formatting characters is with GlobalVar and command line arguments.

```
# Listen for accounting requests on port 1813 as per RFC 2866
AcctPort 1813
```

Note
Actually Radiator will also service authentication requests received on the accounting port without complaint.

Tip
You can prevent Radiator from binding to an accounting port by undefining Acct-Port:

```
# Do not bind to an accounting port:
AcctPort
```

Tip
You could listen for requests on the 2 most common RADIUS accounting port numbers with

```
AcctPort 1646,1813
```

Tip
Radiator will listen for requests on each given AcctPort (default 1646), on each IP address specified by BindAddress (default 0.0.0.0). For more information, see Section 3.5. Address binding on page 25.
3.7.8. KeepSocketsOnReload

Note
This option was introduced in Radiator 4.13 and is currently considered experimental.

This optional flag controls whether opened RADIUS listen sockets should be left intact on a reload request. When enabled, the changes in BindAddress, AuthPort and AcctPort are ignored during reload. You may consider enabling this option when incoming RADIUS requests should be buffered during the reload instead of ICMP unreachable messages being sent back to the RADIUS clients.

3.7.9. BindAddress

This optional parameter specifies one or more IPv4 and IPv6 addresses to listen for RADIUS requests on. It is only useful if you are running Radiator on a multi-homed host (i.e. a host that has more than one network address). Defaults to 0.0.0.0 (i.e. listens on all IPv4 networks connected to the host). Multiple addresses can be separated with a comma. Radiator will listen for requests on each AuthPort and AcctPort on each BindAddress address.

Using this parameter, you can run multiple instances of Radiator on the one computer, where each Radiator listens to RADIUS requests directed to a different host address. BindAddress can include special formatting characters and multiple IPv4 and IPv6 addresses.

```bash
# Only listen on one network address
BindAddress 203.63.154.1

You can listen for requests on only some of many multi-homed addresses on this host:

BindAddress 200.10.5.4,200.10.7.3,::1

You can listen for requests directed to a particular IPv6 address:

```

For more information, see Section 3.6. IPv6 support on page 26. Also see Section 3.7.10. BindV6Only on page 31 for more about IPv6 wildcard address :: special handling.

3.7.10. BindV6Only

This optional parameter allows you to explicitly set the IPV6_V6ONLY option for the sockets listening to IPv6 wildcard address.

RFC 3493 “Basic Socket Interface Extensions for IPv6” specifies a boolean socket option IPV6_V6ONLY. When this option is turned off, IPv6 wildcard listen socket can receive both IPv6 and IPv4 packets. Received IPv4 packets use special IPv4-mapped address format where the IPv4 address is encoded after the 96-bit prefix 0:0:0:FFFF.

For example, request from IPv4 address 172.16.172.2 is mapped to IPv6 address ::ffff:172.16.172.2. In this case you may need to configure your Client clause as `<Client ::ffff:172.16.172.2>`

IPV6_V6ONLY socket option is by default turned on by some operating systems and off by some others.

Perl 5.16 or later or recent enough Socket.pm module is required for this parameter.

For more information about IPv6 support and address binding, see Section 3.6. IPv6 support on page 26 and Section 3.7.9. BindAddress on page 31.
### 3.7.11. DbDir

Specifies the directory to be used for user database files. Defaults to `/usr/local/etc/raddb` on Unix and Windows. For convenience, the DbDir directory name can be referred to as `%D` in any file name path in this configuration file.

```
# Look in /opt/etc/raddb for username database
DbDir /opt/etc/raddb
```

### 3.7.12. LogDir

Specifies the directory to be used to store log files. Defaults to `/var/log/radius` on Unix and Windows. For convenience, the LogDir directory name can be referred to as `%L` in any file name path in this configuration file.

```
# Put log files in /opt/radius instead
LogDir /opt/radius
```

### 3.7.13. LogFile

This defines the name of the log file. All logging messages are time stamped and written to this file. Each time this file is written to by Radiator, it opens, writes, and then closes the file. This means that you can safely rotate the log file at any time. The file name can include special path name characters. For more information about special characters, see Section 3.3. Special formatters on page 19. The default is `%L/logfile`, i.e. a file named `logfile` in `LogDir`. For more information, see Section 3.7.12. LogDir on page 32.

Here is an example of using LogFile and special characters:

```
# Log file goes in /var/log, with year number
LogFile /var/log/%Y-radius.log
```

You can disable all logging to the log file by setting `LogFile` to be the empty string:

```
# Disable logging to log file completely
LogFile
```

If the file name starts with a vertical bar character `|` then the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output is appended to the named file.

```
# Pipe to my-log-prog
LogFile |/usr/local/bin/my-log-prog
```

**Note**

If `LogFile` is defined in your configuration file, `<Log FILE>` is invisibly created to handle it. For more information, see Section 3.24. `<Log FILE>` on page 118. You can customise the logging format, and also log microseconds by using `<Log FILE>` and its parameters instead of `LogFile`.

### 3.7.14. LogMicroseconds

For all configured loggers and the LogStdout logger, enables microseconds in the time stamp. LogMicroseconds requires Time::HiRes Perl module. If this module is not installed, the microseconds part in the time stamp will be all zeroes '000000'. Time::HiRes is typically part of the Perl default installation or packaged separately on some systems such as Red Hat and CentOS where the RPM is called `perl-Time-HiRes`
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### Tip
LogMicroseconds can also be enabled separately for specific loggers using the LogMicroseconds parameter in the respective Log clause.

#### 3.7.15. PidFile

The name of the file where `radiusd` will write its process ID (PID) at start-up. Defaults to `%L/radiusd.pid` on Unix and Windows. The file name can include special path name characters as defined in Section 3.3. Special formatters on page 19. If the directory containing the file does not exist, it will attempt to create the directory first.

```bash
# So we do not conflict with another radiusd
PidFile /tmp/radiusd2.pid
```

#### 3.7.16. DictionaryFile

The name of the RADIUS dictionary file. The dictionary file defines the names to be used for RADIUS attributes and their values. Its format is described in Section 9.1. Dictionary file on page 455. The file name can include special path name characters as defined in Section 3.3. Special formatters on page 19. It can also include multiple comma-separated file names. The default is `%D/dictionary`, i.e. a file called “dictionary” in DbDir. A dictionary file called “dictionary” that will work with most NASs and Terminal Servers is included in the Radiator distribution.

```bash
# Dictionary file is in the current directory
DictionaryFile ./dictionary
```

### Tip
You can load the normal dictionary and the old fashioned Ascend attributes dictionary with something like this:

```bash
# need the old Ascend non-vendor-specific attributes too
DictionaryFile %D/dictionary,%D/dictionary.ascend
```

#### 3.7.17. ProxyUnknownAttributes

If this optional parameter is set, Radiator will forward attributes that are not present in the dictionary. Unknown attributes are not proxied by default.

#### 3.7.18. DiameterDictionaryFile

This optional parameter specifies additional Diameter dictionary entries. The entries in `DiameterDictionaryFile` can replace or override any of the default entries hardwired into `DiaDict.pm`. Unlike `DictionaryFile`, only one dictionary file name can be specified. The Diameter dictionary is only used if you have a `ServerDIAMETER` clause in your configuration file. The file name can include special path name characters as defined in Section 3.3. Special formatters on page 19. The default is to use only the hardwired dictionary in `DiaDict.pm`.

```bash
DiameterDictionaryFile %D/my_private_diameter_atrrs.dat
```
3.7.19. DictionaryReloadInterval

DictionaryReloadInterval is an optional parameter that sets an interval in seconds for checking whether the files defined by DictionaryFile on page 33 have changed. If there are changes, all files are reloaded. Not enabled by default and the files are only loaded during server initialisation.

```plaintext
# Check every 30 minutes for dictionary changes
DictionaryReloadInterval 1800
```

3.7.20. Syslog

This parameter is now obsolete, and is replaced by the <Log SYSLOG> clause. For more information, see Section 3.25. <Log SYSLOG> on page 121.

3.7.21. LicenseFile

The name of the file from which radiusd reads its license configuration parameters. There is no default. The file name can include special path name characters as defined in Section 3.3. Special formatters on page 19. If the file does not exist, or Radiator is fully licensed, LicenseFile and its contents are ignored.

License configuration parameters are not needed with fully licensed Radiator. Only certain evaluation or locked configurations need these parameters, as instructed by Radiator sales.

```plaintext
# Read custom parameters for this evaluation license
LicenseFile %D/license.conf
```

3.7.22. SnmpgetProg

Specifies the full path name to the snmpget program. This optional parameter is only used if you are using Simultaneous-Use with a NasType of Livingston or any other NAS type that uses SNMP (see table in Section 3.13.34. NasType on page 97) in one of your Client clauses. Defaults to /usr/bin/snmpget.

Tip
You should use the snmpget from Net-SNMP [http://www.net-snmp.org/]. Do not use the snmpget from CMU: its style of output is not understood by Radiator.

```plaintext
SnmpgetProg /usr/local/bin/snmpget
```

3.7.23. SnmpwalkProg

Specifies the full path name to the snmpwalk program. This optional parameter is only used if you are using Simultaneous-Use with a NasType of Ascend, CiscoVPDN or TigrisOld in one of your Client clauses. Defaults to /usr/bin/snmpwalk.

Tip
You should use the snmpwalk from Net-SNMP [http://www.net-snmp.org/]. Do not use the snmpwalk from CMU: its style of output is not understood by Radiator.

```plaintext
SnmpwalkProg /usr/local/bin/snmpwalk
```
3.7.24. FingerProg

Specifies the full path name to an external finger program. This optional parameter is only used if you are using Simultaneous-Use with a NasType of Portslove, Ascend, Shiva, Computone or any other NAS type that uses finger (see table in Section 3.13.34. NasType on page 97) in any of your Client clauses. Defaults to using the standard Perl Net::Finger client that does not require an external program.

FingerProg /usr/local/bin/finger

3.7.25. PmwhoProg

Specifies the full path name to the pmwho program. This optional parameter is only used if you are using Simultaneous-Use with a NasType of TotalControl or any other NAS type that uses pmwho (see table in Section 3.13.34. NasType on page 97) in one of your Client clauses. Defaults to /usr/local/sbin/pmwho.

PmwhoProg /usr/local/bin/pmwho

3.7.26. LivingstonMIB

This optional parameter specifies the name of the Livingston SNMP MIB. It is only used if you are using Simultaneous-Use with a NasType of Livingston in one of your Client clauses. Defaults to .iso.org.dod.internet.private.enterprises.307

This parameter is deprecated and will not be supported in the future.

3.7.27. LivingstonOffs

Specifies the global default value of where the last S port is before the one or two ports specified in LivingstonHole are skipped (usually 22 for US, 29 for Europe). This optional parameter is only used if you are using Simultaneous-Use with a NasType of Livingston in one of your Client clauses. Defaults to 29. This value can be overridden on a per-Client basis by using LivingstonHole in a Client clause. For more information, see Section 3.13.42. LivingstonOffs on page 102.

3.7.28. LivingstonHole

Specifies the global default value of the size of the hole in the port list (usually 1 for US, 2 for Europe) that occurs at LivingstonOffs. This optional parameter is only used if you are using Simultaneous-Use with a NasType of Livingston in one of your Client clauses. Defaults to 2. This value can be overridden on a per-Client basis by using LivingstonHole in a Client clause. For more information, see Section 3.13.43. LivingstonHole on page 103.

3.7.29. RewriteUsername

This is an optional parameter. It enables you to alter the username in authentication and accounting requests. For more details and examples, see Section 8. Rewriting user names on page 454.

3.7.30. SocketQueueLength

This optional parameter allows you to alter the lengths of the radius socket queues from their default Operating System specific value. You may wish to set the queue lengths to be longer than the default if your Radiator server is handling very large numbers of requests, and is near its performance limits. You should never need to set them to shorter than the default. SocketQueueLength affects the length of both the authentication and the accounting socket queues. SocketQueueLength has no effect on Windows.
Tip
You may need special privileges, or you may need to change your Operating System configuration to permit longer queue lengths than the default. Consult your operating system manuals for details on how to do this.

```bash
# Make a long queue length
SocketQueueLength 1000000
```

### 3.7.31. DefineFormattedGlobalVar

Defines a value for a global variable that can be accessed anywhere special formatting characters are permitted. The syntax is:

```
DefineFormattedGlobalVar variablename value
```

This example defines the global variable called “variablename” to be the string “value”. The value can be accessed where special formatting characters are permitted with `%{GlobalVar:variablename}`.

Within value, special formatting characters are permitted, so you can have one global variable that depends on another global variable.

In the following example, the log file will be called “./detail-server1”:

```
DefineFormattedGlobalVar servername server1
LogFile ./detail-%{GlobalVar:servername}
```

### 3.7.32. DefineGlobalVar

Similar to DefineFormattedGlobalVar, except that special formatting characters in value are not honoured. Deprecated. In the future the functionality of this parameter will become identical to DefineFormattedGlobalVar.

### 3.7.33. StartupHook

This optional parameter allows you to define a Perl function that will be called during server startup and restarts. Only one argument is passed to the hook: `$_[0]` will be set to `undef` during startup and 1 for a restart (usually due to a SIGHUP).

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (`\`) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

StartupHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change or set up environment variables, umasks etc.

```
# Set up a umask to use for the life of this process
StartupHook sub { umask(0222);}
```

### 3.7.34. ShutdownHook

This optional parameter allows you to define a Perl function that will be called just before exiting after receiving a SIGTERM. No arguments are passed.
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The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

ShutdownHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change or set up environment variables, umasks etc.

```perl
# Delete a lock file
ShutdownHook sub { unlink '/tmp/xyzzy.lck';}
```

### 3.7.35. DelayedShutdownTime

DelayedShutdownTime instructs `radiusd` to delay restart or termination for the configured time. When the configured time has passed, restart or termination is done when there are no more requests to serve from the sockets.

The delay has two phases:

1. Wait for the configured amount of seconds before the requested restart or termination action is started.
2. Serve the remaining requests from the incoming sockets.

This allows `radiusd` to process any queued requests before restart or termination.

For more information, see Section 3.7.36. DelayedShutdownHook on page 37.

```perl
# When shutdown is triggered, wait for Radius clients to stop sending
DelayedShutdownTime 5
```

### 3.7.36. DelayedShutdownHook

DelayedShutdownHook is called immediately when `radiusd` is signalled to restart or terminate, and `DelayedShutdownTime` has been set. This hook can, for example, signal upstream proxies about the impending shutdown.

For more information, see Section 3.7.35. DelayedShutdownTime on page 37. `DelayedShutdownHook` is passed the following argument:

- String variable that defines the action. Either `restart` or `termination`

```perl
# Tell NASes to stop sending traffic to us
DelayedShutdownHook file:"%D/delayed-shutdown-hook.pl"
```

### 3.7.37. PreClientHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PreClientHook is called for each request before it passed to a Client clause. A reference to the current request is passed as the only argument.

---

**CAUTION**

At the time this hook is run, integer attributes have not yet been unpacked and decoded, and encrypted attributes have not yet been decrypted. If you need unpacked, decrypted versions of these attributes, consider using a per-client ClientHook instead.
The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

PreClientHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. The current request has its \{Client\} member set to a pointer to the Client clause handling the request.

```perl
# Fake a new attribute into the request
PreClientHook sub { ${$_[0]}->add_attr('test-attr', 'test-value');}
```

### 3.7.38. ClientHook

This hook will be called for each request after the request has been decoded but before any other per-Client processing is done. A reference to the current request is passed as the first argument and the Client object as the second argument.

### 3.7.39. HandlerFindHook

Specifies an optional Perl hook that can be used to avoid linear Handler lookup when there are multiple Handlers. This is advantageous for configurations, such as proxying based on realm, where maximum packet throughput is required. The hook is expected to return the Handler to use or nothing. If nothing is returned, lookup continues as defined by Section 3.30. \<Handler attribute=value,attribute=value, ....>\ on page 132.

The hook is passed the following arguments

- \$_[0] A reference to the current RADIUS request
- \$_[1] Current username without realm part
- \$_[2] Realm part of the username, if any

HandlerFindHook is not set by default. See `goodies/handler-find-hook.cfg` for a configuration sample.

### 3.7.40. USR1Hook

This optional parameter allows you to define a Perl function that will be called when a SIGUSR1 signal is received by Radiator. On Unix, SIGUSR1 normally increases the logging level by 1. If you define a USR1Hook, your hook will be called instead.

### 3.7.41. USR2Hook

This optional parameter allows you to define a Perl function that will be called when a SIGUSR2 signal is received by Radiator. On Unix, SIGUSR2 normally decreases the logging level by 1. If you define a USR2Hook, your hook will be called instead.

### 3.7.42. WINCHHook

This optional parameter allows you to define a Perl function that will be called when a SIGWINCH signal is received by Radiator.

### 3.7.43. MainLoopHook

This optional parameter allows you to define a Perl function that will be called once per second from within the main dispatch loop.
3.7.44. UsernameCharset

This optional parameter checks that every user name consists only of the characters in the specified character set. This can be useful to reject requests that have user names that cannot be valid. The value of the parameter is a Perl character set specification. See your Perl reference manual for details about how to construct Perl character set specifications. Note that the some special characters must be escaped with a backslash. This parameter is not set by default and no character set check is done.

UsernameCharset is available as a global and Handler level parameter. The character set checks are done for both User-Name attribute and EAP identity.

When a request is processed by a Handler, User-Name attribute must pass both global and per Handler UsernameCharset checks. When an EAP-Response/Identity message is handled by an AuthBy, the EAP identity must pass both global and per Handler UsernameCharset checks. The Handler is the last Handler that processed the request before it was passed to the AuthBy.

This example permits only alphanumeric, period, underscore, the @-sign, and dash. Note that a dash at the end of character class needs not to be escaped with a backslash:

UsernameCharset a-zA-Z0-9._@-

3.7.45. User

On Unix, this optional parameter sets both the effective and real user ID (UID) that radiusd runs as, provided radiusd starts as a suitably privileged user, such as root. The value can be a valid Unix user name or an integer UID.

3.7.46. Group

On Unix, this optional parameter sets both the effective and real group ID (GID) and supplementary groups that radiusd runs as, provided radiusd starts as a suitably privileged user, such as root. The value can be a comma-separated list of valid Unix group names or integer GIDs. The first group is set as the effective group ID.

If any of the group names fail to resolve, the call to change the groups is not done.

3.7.47. MaxChildren

Specifies the maximum number of Fork children permitted at any one time. Any attempt by an AuthBy to Fork (if so configured) will fail and the RADIUS request will be ignored if there are already that many Forked children in existence. Defaults to 0, meaning no limit.

3.7.48. SnmpNASErrorTimeout

This optional parameter specifies for how long (in seconds) SNMP simultaneous use checks will be blocked after an SNMP error during communications with a given NAS. Defaults to 60 seconds.

3.7.49. ForkClosesFDs

This optional parameter tells Radiator to forcibly close all the child processes files descriptors after a fork() on Unix. This is only necessary in very unusual circumstances where child processes interfere with the parents connections to an SQL database.
3.7.50. `ResponseTimeThreshold`

`ResponseTimeThreshold` tells Radiator to log a warning when the processing time exceeds configured millisecond threshold. The warning contains the request's User-Name and information about the Client, Handler, and the AuthBy that processes the request.

```bash
# Log if request handling takes more than 0.1 seconds
ResponseTimeThreshold 100
```

3.7.51. `GlobalMessageLog`

This optional parameter defines the Identifier of global MessageLog clause to log all Radius, Diameter, and TACACS+ protocol requests. This parameter is not set by default and no message logging is done.

You can specify multiple `GlobalMessageLog` parameters, typically one for each protocol. The general format is:

```
GlobalMessageLog protocol, identifier[, extras ...]
```

- `protocol` defines the protocol. The possible values are:
  - `radius`
  - `radsec`
  - `diameter`
  - `tacacsplus`

- `identifier` is the Identifier or the `MessageLog` clause that does the logging.

- `extras` is currently unused.

For more information about `MessageLog` clauses, see Section 3.131. `<MessageLog xxxxxx>` on page 395.

Here is an example of using `GlobalMessageLog`:

```bash
# Log all RADIUS and Diameter messages with separate MessageLog clauses
GlobalMessageLog radius,messagelograd
GlobalMessageLog diameter,messagelogdia
```

**Note**

In Radiator 4.20 or later, radius protocol does not include the messages sent and received over RadSec. To log these messages, define the protocol as `radsec`.

3.7.52. `FarmSize`

This optional parameter allows you to specify how many server instances to create in a server farm. A server farm is a set of identical Radiator servers, all monitoring the same RADIUS sockets. Incoming RADIUS requests are distributed among the child servers in the server farm. The main server acts as a supervisor, and restarts children that die or are terminated. Unix only. Defaults to 0, which means no server farm, and only a single instance of Radiator is run.
Tip
This parameter can be used to improve performance in some cases on platforms that support multiple cores and fork().

CAUTION
This parameter, and the use of server farms is not compatible with many EAP protocols, such as EAP-TLS, EAP-TTLS, PEAP etc. This is because such protocols rely in authentication state being held within each server process, and it is necessary for all the requests for such protocols to go to the same Radiator instance.

3.7.53. FarmChildHook
Perl hook that is run in each child when FarmSize is used. The hook is run when the child is started or restarted.

3.7.54. DupCache
This optional parameter defines if duplicate cache is implemented locally within the process, shared between processes with mmapped memory or if a Gossip cluster will provide a global shared cache for detecting duplicate requests. Defaults to 'local'.

For more about Gossip, see Section 3.134, <GossipRedis> on page 400 and the configuration sample goodies/farmsize.cfg.

Possible values are:

- **local**: Local to each process. The duplicate cache is not shared
- **shared**: Shared between processes on the same server. Requires Cache-FastMmap
- **global**: Shared between processes using the Gossip framework

```
# See DupCacheFile for the shared file location
DupCache shared
```

3.7.55. DupCacheFile

DupCacheFile sets the shared memory based cache file name. Special characters are allowed. %0 is replaced by -pid-timestamp-random where the actual values are generated dynamically. Perl module Cache-FastMmap is required.

Defaults to /tmp/radiator-dupcache-sharefile%0 or C:\radiator-dupcache-sharefile%0 on Windows.

CAUTION
DupCacheFile should be readable only by Radiator process. It contains the sent RADIUS reply messages which may include sensitive information.

```
# For example: /var/run/radiator/hashbalance-dupcache-38479-1473082581-9264
DupCacheFile /var/run/radiator/hashbalance-dupcache%
```
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3.7.56. EAP_UseState

EAP_UseState, currently set to off by default, enables or disables the use of State attribute with EAP for the whole server.

If you are using `<AuthBy EAPBALANCE>`, consider changing it to other AuthBy, such as `<AuthBy HASHALANCE>`, to avoid adding second State in the proxied requests. Using other load balancers can cause problems with State when setting up load balancer rules. Radiator does not change the value of State during an EAP message exchange.

Here is an example of using EAP_UseState:

```
# Use State attribute for identifying all EAP authentication conversations
EAP_UseState
```

3.7.57. Identifier

This allows you to assign a symbolic name to a radiusd server instance, similar to Identifier for an AuthBy, Handler, and any other clause. This allows hooks, logging, Gossip framework, and other code to use a name that uniquely identifies a radiusd instance. The global Instance parameter does not have a value by default. Special formatting characters are supported.

```
# Set identifier based on the hostname and server farm instance number
Identifier Radiator-%h-%O
```

**Note**

A 32 hex character long hash is calculated from the formatted Identifier for possible later use. This fixed length value can be accessed from hooks and other custom code.

3.7.58. DisableMTUDiscovery

If this optional parameter is set, it disables MTU discovery on platforms that support that behaviour (currently Linux only). This can be used to prevent discarding of certain large RADIUS packet fragments on supporting operating systems.

3.7.59. PacketDumpOmitAttributes

This optional parameter specifies a comma separated list of RADIUS attribute names which will be omitted from RADIUS packet dumps in logs.

```
PacketDumpOmitAttributes EAP-Message,User-Password
```

3.7.60. StatusServer

Normally, when a Status-Server request is received, Radiator replies with some statistics including the total number of requests handled, the current request rate and so on. You can control Status-Server response by setting StatusServer to one of the following values:

- **off**
  Status-Server requests are ignored.

- **minimal**
  Reply without any attributes.
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• default
  Reply with statistics.

3.7.61. DisabledRuntimeChecks

Radiator tries to check for commonly required but missing modules, some known security vulnerabilities and possible other runtime parameters when it starts up. Any Hooks may also call the runtime check module functions, as required by the Hook authors. Special formatting characters are supported.

Any checks that do not pass are logged but no other action is taken.

The currently recognised built-in checks are:

• CVE-2014-0160 - the OpenSSL vulnerability commonly called Heartbleed
• Digest::MD4 - required by MSCHAP and MSCHAP-v2 and their derivatives

The optional DisabledRuntimeChecks parameter allows you to define the checks that should not be run.

Check for CVE-2014-0160 is done by trying to load Net::SSLeay and using the functions it provides to check for vulnerable OpenSSL versions. Many vendors have patched their OpenSSL for CVE-2014-0160 without changing the OpenSSL version number. For this reason the check may report your OpenSSL as vulnerable. The Net::SSLeay functions for reporting OpenSSL version are only present in recent Net::SSLeay versions. For this reason Radiator may log a message about version check not being able to determine OpenSSL version.

Digest::MD4 is required by MSCHAP, MSCHAP-V2 and their derivatives such as EAP-MSHCHAP-V2. We recommend having Digest::MD4 installed unless you are sure you will never need to support these authentication protocols.

```perl
# Our OpenSSL is patched but still reports vulnerable version
DisabledRuntimeChecks CVE-2014-0160
```

3.7.62. PBKDF2_MinRounds

This is an integer that defines the minimum number of rounds PBKDF2 algorithm. If the stored user password uses less rounds than this parameter specifies, the password check fails. The default value is 100.

3.7.63. PBKDF2_MaxRounds

This is an integer that defines the maximum number of rounds PBKDF2 algorithm. If the stored user password uses more rounds than this parameter specifies, the password check fails. The default value is 200000.

3.8. SQL configuration

SQL clauses use the Perl DBI/DBD interface to connect to your database. You can therefore use SQL clauses with a large number of commercial and free SQL database systems. In order to use SQL, the minimum installation to get your SQL system to work is:

• Database software
• Matching Perl DBD module
• Perl DBI module

The SQL parameters `DBSource`, `DBUsername`, and `DBAuth` are passed to DBI like this:

```perl
DBI->connect(DBSource, DBUsername, DBAuth)
```

`DBSource` is a specification, which usually starts with `dbi:drivername:...`, but the exact meaning of these variables depends on the Perl DBD driver you use. For more information about the syntax of `DBSource`,
DBUsername, and DBAuth for different database vendors, see Section 19. Using SQL with various database vendors on page 485.

You can specify multiple databases by using multiple DBSource, DBUsername, and DBAuth parameters. Whenever Radiator tries to connect to a database, SQL tries to connect to the first DBSource listed, using the first DBUsername and DBAuth parameters. If that connection fails, it tries the second, third and so on, until all the databases are tried, and finally gives up without replying to the NAS. This gives your NAS the opportunity to fall back to another RADIUS server if all your SQL databases are down. You can change this default behaviour with the RoundRobinOnFailure configuration parameter. For more information, see Section 3.8.8. RoundRobinOnFailure on page 47.

SQL clauses are tolerant of database failures. If the database server goes down, Radiator tries to reconnect to a database as described above, starting again at the first database or using round robin, depending on the configuration. Whichever database Radiator connects to, it stays connected to it until that database becomes unreachable, at which time it searches again for a database, starting at the first. If Radiator is not able to connect to any SQL server, it returns an IGNORE, which causes Radiator to ignore the request. This causes most NASs to fall back to a secondary RADIUS server.

Tip
Remember the SQL database needs maintenance. Make sure you have someone who is knowledgeable about installing, configuring, maintaining, and backing up your SQL database.

Tip
In some cases SQL database server use a significant number of CPU cycles and become the performance bottleneck. For example, doing a simple lookup on a user/password database with a simple index on the user name is usually very quick, in the order of milliseconds per lookup, even if the table has millions of rows. However, an insert into a large accounting table with a complicated index can be very slow. Make sure you understand how to design and tune your database tables, otherwise it could have a significant effect on SQL performance.

The following clauses utilise SQL:

- <AcctLog SQL> on page 348
- <AddressAllocator SQL> on page 350
- <AuthBy PRESENCESQL> on page 312
- <AuthBy RADMIN> on page 200
- <AuthBy SQL> on page 170
- <AuthBy SQLAUTHBY> on page 323
- <AuthBy SQLHOTP> on page 319
- <AuthBy SQLRADIUS> on page 235
- <AuthBy SQLTOTP> on page 321
- <AuthBy SQLYUBIKEY> on page 315
- <AuthLog SQL> on page 341
- <ClientList SQL> on page 105
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- <Log SQL> on page 125
- <SessionDatabase SQL> on page 108
- <ServiceDatabase SQL> on page 116
- <StatsLog SQL> on page 393

The following clauses utilise AuthBy SQL and thus support all the common SQL parameters:

- <AuthBy SQLDIGIPASS> on page 259
- <AuthBy EMERALD> on page 202
- <AuthBy EMERALD4> on page 204
- <AuthBy FREERADIUSSQL> on page 294
- <AuthBy PLATYPUS> on page 205
- <AuthBy RADMIN> on page 200
- <AuthBy RODOPI> on page 207
- <AuthBy WIMAX> on page 313

### 3.8.1. SQL bind variables

Most SQL servers support the use of bind variables. Bind variables are used by the SQL server to do a dynamic replacement of variables in an SQL statement. In some SQL servers this can increase query performance by allowing the server to compile and reuse the SQL compiled SQL query many times.

With Radiator SQL clause query parameters that support bind variables, you can specify the query separately from the values for the bind variables. With most SQL servers, the position of each bound variable is marked by a question mark ('?') character. The bound variables will be replaced (after special characters are replaced) at run-time one by one in the order of the question marks in the query, and in the order of the bound variable specifications.

For example, <AuthBy SQL> supports bound variables with the AuthSelect query parameter. In this sample configuration fragment:

```
AuthSelect select PASSWORD from SUBSCRIBERS where USERNAME=? and CLIENT=?
AuthSelectParam %0
AuthSelectParam %N
```

%0 (user name) will be used to replace the first ? (the one for the `USERNAME` column), and %N (NAS id) will be used to replace the second (the one for the `CLIENT` column).

Some SQL queries are cached when configured with bind variables. By default as much as 32 queries can be cached. This can be changed in SqlDb.pm if required.

---

**Note**

Most SQL servers and their Perl DBD modules support bound variables. Check the documentation for your SQL server, and the Perl DBD module for your server.

---

### 3.8.2. DBSource

This parameter is used by Perl DBI to specify the database driver and database system to connect to. It usually begins with `dbi:drivername:`. There is no standard for the text following the driver name, consult the
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details for your DBD (database driver) documentation. You can use any of the special characters described in Section 3.3. Special formatters on page 19. Here are some examples.

```
# Connect to MySQL database called radius. Typically defaults to Unix socket
DBSource dbi:mysql:database=radius

# Or... Use SQLite file called users.db located in the DanDir directory
DBSource dbi:SQLite:%D/users.db

# Or... Connect to the Oracle SID called users
DBSource dbi:Oracle:users

# Or... Connect to PostgreSQL database called radius on localhost, default port
DBSource dbi:Pg:dbname=radius;host=127.0.0.1
```

Tip

For some applications, it is useful to use a `GlobalVar` to specify the name of the SQL database. That way your Radiator can be parameterised from the command line:

```
DBSource dbi:mysql:%{GlobalVar:databasename}
```

```
radiusd --config_file xxxxxx.cfg databasename=radius
```

3.8.3. DBUsername

For most database types, this specifies the user name to log in to the database. For some databases, this has a different meaning. For example, for SQLite user name is meaningless. You can use any of the special characters described in Section 3.3. Special formatters on page 19.

```
# For SQLite, it is ignored
DBUsername ignored

# For Oracle, it is the name of the Oracle user to log in as
DBUsername scott
```

3.8.4. DBAuth

This parameter is usually used by Perl DBI to specify the password for the user specified in `DBUsername`. For some databases, this has a different meaning. For example, for SQLite it is meaningless and can be ignored. You can use any of the special characters described in Section 3.3. Special formatters on page 19.

```
# For SQLite, it is ignored
DBAuth ignored

# For Oracle, it is Oracle password for DBUsername
DBAuth tiger
```

3.8.5. Timeout

This optional parameter specifies a timeout interval in seconds that Radiator waits for when trying to contact the SQL server specified by `DBAuth`. The timeout is also be used for the SQL queries. When a query times out,
it is retried until SQLRetries limit is reached. For more information about SQLRetries, see Section 3.8.7. SQLRetries on page 47.

If the server does not respond within the Timeout period, Radiator considers the SQL server to be failed, and stops trying to contact the SQL server until the FailureBackoffTime is expired. The default value for Timeout is 60 seconds. If you set Timeout to 0, no timeouts are implemented, and Radiator relies on the underlying implementation to timeout any SQL operations.

```ruby
# Set the timeout to two seconds
Timeout 2
```

**Note**

Timeout is not supported on Perl for Windows. On Windows platforms, the timeout usually is determined by the TCP timeouts built in to your Windows TCP stack.

**Note**

When DBD supports defining connection or query timeouts, those driver-specific timeout options must be used in DBSource. In this case, the value of Timeout must be larger than the timeout value in DBSource.

**Tip**

Set Timeout to 0 if you are using Sybase ODBC libraries.

### 3.8.6. FailureBackoffTime

If Radiator detects an SQL server failure, it waits for this number of seconds before trying to contact the SQL server again. The default value is 600 (10 minutes).

```ruby
# Try again after 3 minutes
FailureBackoffTime 180
```

### 3.8.7. SQLRetries

If Radiator detects certain SQL errors while running a query, it will reconnect and retry until it has tried SQLRetries times, then declares an SQL server failure. The default value is 2. Applies to SQL errors other than primary key violations, or Oracle error 'ORA-00001'.

**CAUTION**

If SQLRetries is set to 0, no connection is made and no queries are executed.

### 3.8.8. RoundRobinOnFailure

This optional flag helps with some types of overloaded database that can be connected but then time out when a query is sent. It causes the next database in the DBSource list to be tried next instead of the first one.
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3.8.9. SQLRecoveryFile

**Note**
This feature is known not to work as expected with some types of database. Its use is deprecated: you are strongly discouraged from using this feature. Support for it may be removed in future versions.

This optional parameter specifies the name of a file where any failed SQL do queries are logged, perhaps for later recovery. The default is no logging. The SQLRecoveryFile file is always opened written and closed for each failed SQL do query, so you can safely rotate it at any time.

**Tip**
Make the file name depend on the date. This way, all the missed accounting records per day are located in a single file.

Here is an example of using `SQLRecoveryFile` and logging all failed queries of one day into a one file:

```bash
# Log all failed SQL queries to a log file per day
SQLRecoveryFile %L/sqlfailures-%Y-%m-%d
```

3.8.10. ConnectionHook

This optional parameter specifies a Hook that is run every time this clause connects or reconnects to the SQL database. This is most useful for executing `func()` to configure the database connection in customised ways. The hook is called with 2 arguments. The first is a reference to the clause object that is making the connection. The second argument is the DBH handle to the newly connected database.

In the following example, the hook calls DBI `func()` to configure an Interbase database connection for custom requirements:

```perl
ConnectionHook sub {$_[1]->func(-access_mode => 'read_write',
   -isolation_level => 'read_committed',
   -lock_resolution => 'wait',
   'ib_set_tx_param')}
```

3.8.11. ConnectionAttemptFailedHook

You can run this hook whenever Radiator attempts to connect to an SQL database and fails to connect. The default is to log the failure. The hook is called with 4 arguments: `$object`, `$dbsource`, `$dbusername`, `$dbauth`. $object is the SqlDb object trying to connect. The other parameters are the currently used values for DBSource, DBUsername, and DBAuth.

In the following example the default hook is replaced with a hook that logs unobscured password.

```perl
ConnectionAttemptFailedHook sub { \
    my $self = $_[0]; my $dbsource = $_[1]; \
    my $dbusername = $_[2]; my $dbauth = $_[3]; \
```
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3.8.12. NoConnectionsHook

You can run this hook whenever Radiator fails to connect to any SQL server. The default is to log the failure. The hook is called with 1 argument: $object. $object is the SqlDb object that was trying to connect.

In the following example the default hook is replaced with a hook that logs a very short message.

```perl
NoConnectionsHook sub { 
    my $self = $_[0]; 
    $self->log($main::LOG_ERR, "Could not connect to any SQL database"); }
```

3.8.13. ConnectSQLAtStartup

This optional flag parameter causes radiusd to connect to SQL database immediately when Radiator starts. This flag is not set by default and the connection to SQL is first made when the first SQL query is done.

See AsynchronousSQL on page 49 and goodies/addressallocator.sql for a configuration sample.


This optional flag parameter tells radiusd to use asynchronous SQL queries. This flag is not set by default and the queries are synchronous which means no processing is done before the reply, or timeout, is received from the SQL database. With asynchronous queries, radiusd can do other processing while the query is being processed by the database. When the the database result is ready, radiusd continues from the point where the asynchronous query was started.

Starting with Radiator 4.18, asynchronous queries are supported with MySQL, MariaDB and PostgreSQL. Testing was mainly done with DBD::mysql 4.035 with MariaDB 10.1.13.

**Note**

Asynchronous SQL queries were introduced with Radiator 4.18, and as of Radiator 4.19, are only supported by Address Allocator SQL on page 350 clause.

Here is an example of AsynchronousSQL and the parameters typically used with it:

```xml
# See goodies/addressallocator.cfg for full example
# Run address allocator in asynchronous mode
<AddressAllocator SQL>
    # Other parameters
    AsynchronousSQL
    AsynchronousSQLConnections 10
    ConnectSQLAtStartup
    RoundRobinQueries
</AddressAllocator>
```

3.8.15. AsynchronousSQLConnections

This optional parameter defines the size of connection pool used when AsynchronousSQL on page 49 is enabled. The default value is 1 which means that only a single connection is established with the database.
3. Configuring Radiator

See AsynchronousSQL on page 49 and goodies/addressallocator.sql for a configuration sample.

3.8.16. RoundRobinQueries

This optional flag parameter enables load balancing SQL queries to all defined DBSources on page 45 when AsynchronousSQL on page 49 is enabled. This flag is not set by default and only one of the defined DBSources is used at the time.

See AsynchronousSQL on page 49 and goodies/addressallocator.sql for a configuration sample.

3.9. LDAP configuration

Radiator's LDAP support requires Perl Net::LDAP module version 0.32 or later. Operating system vendors and Windows Perl distributions typically include Net::LDAP. If it is not present in your Perl distribution, see Section 2.1.2. CPAN on page 3 for how to obtain and install it. Net::LDAP works with Microsoft Active Directory, Novell/NetIQ eDirectory, OpenLDAP, and other LDAP servers.

When an LDAP clause needs to fetch information from the LDAP server, it connects to the LDAP server specified by Host. Optionally, you can authenticate Radiator as a valid user of the LDAP server by specifying AuthDN and AuthPassword. This is not the same thing as authenticating a user. It happens before querying the LDAP server, and proves that this radiusd is allowed to talk to the LDAP database.

At present, LDAP clauses do synchronous connections and searches. This can mean significant delays if your LDAP server is reached by a slow network connection, or your LDAP server is slow. If this is the case, consider putting the LDAP server in a sub-server and having your main Radiator forward requests for that realm to the RADIUS sub-server.

The following configuration clauses utilise LDAP:

- <ClientList LDAP> on page 103
- <AuthBy LDAP2> on page 210
- <AuthBy LDAPRADIUS> on page 234
- <AuthBy LDAPDIGIPASS> on page 264
- <AuthBy LDAP_APS> on page 266

SASL Authentication of the LDAP connection

LDAP clauses support SASL authentication of the connection to the LDAP server. If SASL authentication is specified, the LDAP server uses SASL to authenticate the SASL user credentials specified by SASLUser and SASLPassword. You must configure your LDAP server to enable SASL authentication, and to map SASL user names to LDAP server administrator names. For example, when using OpenLDAP see their SASL configuration guide for the details.

3.9.1. BaseDN

This is the base DN relative to which the searches are made.

Special formatting characters are permitted. See the specific LDAP configuration clauses for more information about the clause-specific formatting characters.

Here is an example of using BaseDN:

```
# Start looking here
BaseDN o=University of Michigan, c=US
```
3. Configuring Radiator

3.9.2. SearchFilter

Each Radiator LDAP clause defines a default SearchFilter that sets the conditions an entry in the directory must meet to be returned by the search.

Special formatting characters are permitted. See the specific LDAP configuration clauses for more information about the clause specific formatting characters. For example, the default search filter for <ClientList LDAP> is:

```
SearchFilter {objectclass=oscRadiusClient}
```

3.9.3. Scope

This optional parameter allows you to control the search scope used to find the user. The default value is sub.

The permitted options are:

- base
- one
- sub or subtree
- children Requires Net::LDAP 0.48 or better and LDAPv3 subordinate feature extension

Here is an example of using Scope:

```
# We know where the entry should be
Scope base
```

3.9.4. AuthDN

This is the optional name to use to authenticate this Radiator server to the LDAP server. You only need to specify this if the LDAP server requires authentication from its clients.

Here is an example of using AuthDN:

```
# Log in to LDAP as admin
AuthDN admin
```

3.9.5. AuthPassword

This is the optional password to use to authenticate this Radiator server to the LDAP server. You only need to specify this if the LDAP server requires authentication from its clients, and you specify AuthDN.

Here is an example of using AuthPassword:

```
# log in to LDAP with password adminpassword
AuthPassword adminpassword
```

3.9.6. Host

This specifies the LDAP host names to connect to. The default value is localhost. Special formatting characters are permitted. Multiple space separated host names can be specified and Net::LDAP chooses the first available one. If Host begins with ipv6: the subsequent host names are interpreted as IPv6 addresses where possible, and Net::LDAP uses IPv6 to connect to the LDAP server. IPv6 may require IO::Socket::INET6, Socket6 or other IPv6 specific Perl modules depending on your Perl version.

Here are 2 examples of using Host:
3. Configuring Radiator

# Always connect to UMICH
Host ldap.itd.umich.edu

Or:

# Connect to first available host:
Host ldaphost1 ldaphost2 ldaphost3

3.9.7. Port

This parameter specifies the port to connect to the LDAP host. The default value is 389, the standard port for unencrypted LDAP. If UseSSL is specified, the default value is 636, the standard port for encrypted LDAP. Port can be a numeric port number or a symbolic service name from etc/services or its equivalent on your system. Usually, there is no need to override the defaults. Port can contain special formatting characters. A typical use of special formatting characters is with GlobalVar and command line arguments.

Here is an example of using Port:

# Connect using the SSL encrypted port
Port 636

3.9.8. UseSSL

This optional parameter specifies to use direct SSL or TLS to connect to the LDAP server. For more information about STARTTLS support, see Section 3.9.9. UseTLS on page 53.

Here is an example of using UseSSL:

# Enable direct SSL/TLS instead of using STARTTLS
UseSSL

A full SSL/TLS configuration requires setting the certificate locations and possible other parameters.

# Enable direct SSL/TLS and tell it where to find certificates
UseSSL

# Name of the client certificate file:
SSLCAClientCert %D/certificates/cert-clt.pem
# Name of the file containing the client private key
SSLCAClientKey %D/certificates/cert-clt.pem

# Only need to set one of the following
#SSLCAPath %D/cadirectory
SSLCAFile %D/certificates/demoCA/cacert.pem

Tip
All certificates are required to be in PEM format.

Tip
If both UseSSL and UseTLS are specified, UseSSL is prioritised.
3.9.9. UseTLS

This optional parameter is used in a similar way as UseSSL. For more information, see Section 3.9.8. UseSSL on page 52. UseTLS enables STARTTLS and forces the LDAP connection to use TLS authentication and encryption. UseTLS takes the same parameters as UseSSL, including SSLVerify, SSLCiphers, SSLCAPath, SSLCAFile, SSLCAClientCert, and SSLCAClientKey.

```ruby
# Use STARTTLS with this LDAP server
UseTLS
```

**Tip**

If both UseSSL and UseTLS are specified, UseSSL is prioritised.

**Note**

Net::LDAP 0.57 and earlier had a bug where LDAP + STARTTLS followed by LDAPS failed. This happens when a clause with UseTLS is followed by another clause with UseSSL.

3.9.10. Debug

This parameter enables debugging of the Net::LDAP module. This sets the Net::LDAP debug parameter for the connection, which prints to STDOUT. You can use the following debugging options by adding together the relevant bits. The available values are shown below:

- 1
  - Show outgoing packets (using asn_hexdump)
- 2
  - Show incoming packets (using asn_hexdump)
- 4
  - Show outgoing packets (using asn_dump)
- 8
  - Show incoming packets (using asn_dump)

Here is an example of enabling Debug messages for outgoing and incoming packet using asn_dump:

```
Debug 12
```

3.9.11. Timeout

This optional parameter sets the timeout period in seconds for the connection to the LDAP server. The default value is 10 seconds. If this is set to 0, Radiator waits forever for LDAP connections and transactions.

If the connection times out:

- LDAP authentication request are IGNOREd
- LDAP Client list refresh is not done and Radiator continues to use the current client list

Here is an example of using Timeout:
3. Configuring Radiator

```plaintext
# Make timeout really short, 2 seconds
Timeout 2
```

3.9.12. FailureBackoffTime

This optional parameter sets the period of time that this clause (<AuthBy, <ClientListLDAP>, or other) stops trying to connect to its LDAP server after a connection failure. The default value is 600 seconds (10 minutes). This is intended to give the LDAP server time to recover after a failure. During the failure back-off interval, all authentication requests are IGNOREd.

3.9.13. BindFailedHook

This optional parameter allows you to define a Perl function that is run after the LDAP bind with the AuthDN fails.

`BindFailedHook` has the following arguments:

1. Handle to the current Net::LDAP object
2. Name of the user being authenticated
3. Password of the user being authenticated
4. Error string
5. LDAP server the connection was made to
6. Possible SASL error

The default is to log the error with the password set to obscured. If password debugging is required, redefine the hook or use the `Debug` parameter and see the console output.

3.9.14. HoldServerConnection

By default the LDAP clauses, except `<AuthBy LDAPRADIUS>`, disconnect from the LDAP server after each authentication. This is because not all LDAP servers permit multiple searches from the same LDAP connection. `HoldServerConnection` forces holding the connection to the LDAP server up for as long as possible. It is an optional parameter and available for `<AuthBy LDAP>` and `<AuthBy LDAPDIGIPASS>`.

Most of the LDAP servers support this behaviour and it can significantly improve performance, especially where `UseTLS` or `UseSSL` is enabled. If you enable this parameter and get unwanted behaviour, you are probably using an unsupported LDAP server. In this case, remove this parameter.

Here is an example of using `HoldServerConnection`:

```plaintext
# Our server supports multiple searches
HoldServerConnection
```

**Note**

In some cases, using `HoldServerConnection` with `ServerChecksPassword` of `<AuthBy LDAP2>` may cause failure situations. This is due to some LDAP servers' behaviour when the password check fails but the connection is not closed. A failure situation may also occur when the password check succeeds but the user is not allowed to perform searches in the server. If your users experience unexpected authentication failures, try testing your system without using these 2 parameters together.
3. Configuring Radiator

3.9.15. NoBindBeforeOp

This optional parameter prevents Net::LDAP from binding with the AuthDN and password prior to a search operation.

---

**Note**

This is an advanced parameter. Most installations do not need to use it.

---

3.9.16. SSLVerify

This parameter can be used with the UseSSL or UseTLS parameters to control how the LDAP server’s certificate is verified. The options are:

- **none**
  
  No server certificate is required, and if the server supplies a certificate it is not checked.

- **optional**
  
  Verify if the server offers a certificate.

- **require**
  
  The server must provide a certificate, and it must be valid.

The default value is **require**.

---

**Tip**

**require** is the most secure option.

---

3.9.17. SSLCiphers

This optional parameter specifies which subset of cipher suites are permissible for this connection, using the standard OpenSSL string format. The default value is **DEFAULT:!EXPORT:!LOW**.

Here is an example of using **SSLCiphers**:

```bash
# Exclude cipher suites using RC4 too
SSLCiphers DEFAULT:!EXPORT:!LOW:!RC4
```

3.9.18. SSLCAPath

You can define a directory containing several trusted certificates as separate files as well as an index of the certificates. To use that directory for validation purposes, use this parameter to specify the directory. There is no need to set both **SSLCAPath** and **SSLCAFile**. Special characters are permitted.

Here is an example of using **SSLCAPath**:

```bash
SSLCAPath %D/cadirectory
```
3.9.19. SSLCAFile

Use this option to locate the file containing the certificates of the trusted certificate authorities. Thus, you can verify that the server certificate has been signed by a reputable certificate authority. Special characters are permitted.

Here is an example of using **SSLCAFile**:

```
SSLCAFile %D/certificates/demoCA/cacert.pem
```

3.9.20. SSLCAClientCert

This optional parameter specifies the location of the SSL client certificate that this LDAP connection uses to verify itself with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.

Here is an example of using **SSLCAClientCert**:

```
SSLCAClientCert %D/certificates/cert-clt.pem
```

3.9.21. SSLCAClientKey

This optional parameter specifies the location of the SSL private key that this connection uses to communicate with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.

It is common for the SSL client private key to be in the same file as the client certificate. In that case, both **SSLCAClientCert** and **SSLCAClientKey** refer to the same file.

If **SSLCAClientKey** contains a private key in encrypted format, you need to specify the decryption password in **SSLCAClientKeyPassword**.

Here is an example of using **SSLCAClientKey**:

```
SSLCAClientKey %D/certificates/cert-clt.pem
```

3.9.22. Version

This optional parameter sets the LDAP version number to use. Currently supported values are 2 and 3. The default value is 3.

Here is an example of using **Version**:

```
# Support LDAP protocol version 2 as required by very old servers
Version 2
```

3.9.23. Deref

By default, aliases are dereferenced to locate the base object for the search, but not when searching subordinates of the base object. Change this by specifying **Deref** with one of the following case-sensitive values:

- **never**
  
  Do not dereference aliases in searching or in locating the base object of the search.

- **search**
Dereference aliases in subordinates of the base object in searching, but not in locating the base object of the search.

• **find**
  Dereference aliases in locating the base object of the search, but not when searching subordinates of the base object. This is the default.

• **always**
  Dereference aliases both in searching and in locating the base object of the search.

---

**Note**
Usually, there is no need to use this parameter.

### 3.9.24. UseSASL

This optional parameter tells Radiator to request SASL authentication of the connection to the LDAP server instead of the default simple authentication. *AuthDN* and *AuthPassword* are used as the SASL credentials. Only if *AuthDN* and *AuthPassword* are not defined, *SASLUser* and *SASLPassword* are used.

Using this parameter requires the Authen-SASL-2.09 module or later. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

### 3.9.25. SASLUser

---

**Note**
This parameter is deprecated.

This is a string that defines the user name, which is used for SASL authentication during the connection to the LDAP server. However, if *AuthDN* is defined, it overrides *SASLUser* and is used instead. Only if *AuthDN* is not defined and *SASLUser* is defined, *SASLUser* is used for authentication. For more information, see Section 3.9.4. AuthDN on page 51.

### 3.9.26. SASLPassword

---

**Note**
This parameter is deprecated.

This is a string that defines the password, which is used for SASL authentication during the connection to the LDAP server. However, if *AuthPassword* is defined, it overrides *SASLPassword* and is used instead. Only if *AuthPassword* is not defined and *SASLPassword* is, *SASLPassword* is used for authentication. For more information, see Section 3.9.5. AuthPassword on page 51.
3.9.27. SASLMechanism

If `UseSASL` is enabled, this optional parameter specifies what SASL mechanisms are to be used to authenticate the connection to the LDAP server. `SASLMechanism` is a space-separated list of mechanism names supported by Authen::SASL, such as

- ANONYMOUS
- CRAM-MD5
- DIGEST-MD5
- EXTERNAL
- LOGIN
- PLAIN

The default value is `DIGEST-MD5`. If you change this, it is possible that you need also to change your SASL to LDAP user mapping. See your SASL system documentation for details on what mechanisms are supported.

Here is an example of using `SASLMechanism`:

```
SASLMechanism DIGEST-MD5,PLAIN
```

3.9.28. BindAddress

You can specify the local address for the client side of the LDAP connection with `BindAddress`, in the form `hostname[:port]`.

Use this parameter to set `LocalAddr` parameter of the underlying IO::Socket used as the LDAP client. This is usually useful only on multi-homed hosts, where you need to control the source address of the LDAP connection, perhaps for firewall rules. There is no default and the system chooses the address.

Tip

This parameter is separate from the global `BindAddress`, see Section 3.7.9. BindAddress on page 31.

3.9.29. MultiHomed

This optional flag enables the `MultiHomed` option in Net::LDAP and IO::Socket for this LDAP connection. If this is set then Net::LDAP tries all addresses for a multi-homed LDAP host until one is successful. The default value is true.

3.10. EAP configuration

This section introduces the parameters used for EAP configuration. EAP parameters are available for several AuthBys. For more information about supported EAP methods, see Section 17. Extensible Authentication Protocol (EAP) on page 477.

3.10.1. EAPType

This optional parameter specifies which EAP authentication methods are permitted when EAP authentication is requested by the NAS. See RFCs 3748, 5216, and 2433 for more details. When an EAP identity request is received, Radiator replies with the first EAP type given. If the NAS requests another type, it is permitted only if it appears in `EAPType` list. It is ignored and has no effect unless EAP authentication is requested. The allowed values for `EAPType` are given by the following table.
### Table 6. Allowed values for EAPType

<table>
<thead>
<tr>
<th>EAPType</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MD5, MD5-Challenge</strong></td>
<td>This is the default value. Use <strong>MD5-Challenge</strong> as per RFC 3748. This can be used with any authentication method that provides a plaintext password, such as <code>&lt;AuthBy FILE&gt;</code>, <code>&lt;AuthBy SQL&gt;</code>, and <code>&lt;AuthBy LDAP&gt;</code>. See goodies/eap_md5.cf for example configuration.</td>
</tr>
<tr>
<td><strong>One-Time-Password</strong></td>
<td>Use One-time-password authentication as per RFC 3748. This requires a one-time password authenticator such as <code>&lt;AuthBy OPIE&gt;</code> or <code>&lt;AuthBy OTP&gt;</code>.</td>
</tr>
<tr>
<td><strong>Generic-Token</strong></td>
<td>Use Generic Token authentication as per RFC 3748. This requires a token-based authenticator such as <code>&lt;AuthBy OPIE&gt;</code>, <code>&lt;AuthBy OTP&gt;</code>, <code>&lt;AuthBy ACE&gt;</code>, or <code>&lt;AuthBy RSA MOBILE&gt;</code>.</td>
</tr>
<tr>
<td><strong>TLS</strong></td>
<td>Use Transport Layer Security (TLS). This can be used with any authentication method. TLS checks that the client certificate is valid and has a short enough certificate chain to the root certificate. It requires an SSL certificate for the server and one on each client requiring authentication. See goodies/eap_tls.cfg for example configuration.</td>
</tr>
<tr>
<td><strong>TTLS</strong></td>
<td>Use Tunnelled TLS as required by Funk Odyssey wireless clients. This can be used with any authentication method. TTLS does not usually involve a client certificate, but the client may be configured to check the server's SSL certificate. See goodies/eap_ttls.cfg for example configuration.</td>
</tr>
<tr>
<td><strong>PEAP</strong></td>
<td>Use PEAP tunnel as used by Windows XP and others. This can be used with any authentication method. See goodies/eap_peap.cfg for example configuration.</td>
</tr>
<tr>
<td><strong>LEAP</strong></td>
<td>This is compatible with Cisco LEAP authentication, a proprietary authentication protocol. LEAP requires an authenticator that supplies plaintext passwords, such as <code>&lt;AuthBy FILE&gt;</code>, <code>&lt;AuthBy SQL&gt;</code>, or <code>&lt;AuthBy LDAP&gt;</code>, or <strong>MSCHAPV2</strong>, such as <code>&lt;AuthBy LSA&gt;</code>.</td>
</tr>
<tr>
<td><strong>SIM</strong></td>
<td>Use EAP-SIM which authenticates against SIM cards. This requires the additional EAP-SIM bundle from Open System Consultants.</td>
</tr>
<tr>
<td><strong>AKA</strong></td>
<td>Use EAP-AKA. This requires the additional EAP-SIM bundle from Open System Consultants, which contains support for EAP-AKA.</td>
</tr>
<tr>
<td><strong>AKA-PRIME</strong></td>
<td>Use EAP-AKA'. This requires the additional EAP-SIM bundle from Open System Consultants, which contains support for EAP-AKA'.</td>
</tr>
<tr>
<td><strong>MSCHAP-V2</strong></td>
<td>Use EAP-MSCHAPV2, which is commonly tunneled inside PEAP</td>
</tr>
<tr>
<td><strong>TNC</strong></td>
<td>Support EAP-TNC, a protocol for assessing the security posture of end points.</td>
</tr>
<tr>
<td><strong>FAST</strong></td>
<td>Use EAP-FAST, a rarely-used protocol from Cisco.</td>
</tr>
<tr>
<td><strong>PAX</strong></td>
<td>Use EAP-PAX (Password Authenticated Exchange)</td>
</tr>
<tr>
<td><strong>PSK</strong></td>
<td>Use EAP-PSK (Pre-Shared Key).</td>
</tr>
<tr>
<td><strong>PWD</strong></td>
<td>Use EAP-pwd, a method which uses a shared password for authentication.</td>
</tr>
</tbody>
</table>

This is not set by default, which means that Radiator does not perform EAP authentication by default.
3. Configuring Radiator

3.10.2. EAPContextTimeout

This optional parameter specifies the maximum time period in seconds an EAP context is retained. The default value is 120 seconds. Usually there is no need to change this.

3.10.3. EAPAnonymous

For tunnelling EAP types, such as TTLS and PEAP, this optional parameter specifies the User-Name that is used in the RADIUS request resulting from the EAP inner request. The default value is anonymous. Special characters can be used. %0 is replaced by the EAP identity of the inner EAP request.

This parameter is useful when proxying the inner authentication. If there is a realm in the EAPAnonymous name, it is used to choose a local Realm to handle the inner authentication.

3.10.4. EAPTLS_CAFile

For TLS based EAP types such as TLS, TTLS and PEAP, this parameter specifies the name of a file containing Certificate Authority (CA) root certificates that may be required to validate TLS client certificates. The certificates must be in PEM format. The file can contain several root certificates for one or more CA's. Radiator looks for root certificates first in EAPTLS_CAFile, then in EAPTLS_CAPath, so there usually is no need to set both.

EAPTLS_CAFile is expected to contain a stack of CA one or more CA certificates that will be used to validate client certificates. The list of CA issuers in that is also sent to the client during handshaking to tell the client which certificates Radiator accepts.

Special characters are supported.

3.10.5. EAPTLS_CAPath

For TLS based EAP types such as TLS, TTLS and PEAP, this parameter specifies the name of a directory containing CA root certificates that may be required to validate TLS client certificates. The certificates must be in PEM format, one per file. The files names are looked up by the CA 'Subject Name' hash value. Radiator looks for root certificates first in EAPTLS_CAFile, then in EAPTLS_CAPath, so there usually is no need to set both.

Special characters are supported.

3.10.6. EAPTLS_CertificateFile

For TLS-based EAP types, such as TLS, TTLS and PEAP, this parameter specifies the name of a file containing the RADIUS server certificate. The server certificate is sent to the EAP client and validated by the client during EAP authentication. The certificate file may be in PEM or ASN1 format, depending on the setting of the EAPTLS_CertificateType parameter. The certificate file can also contain the server's TLS private key if the EAPTLS_PrivateKeyFile parameter specifies the same file. If the server certificate is a chain of certificates, use EAPTLS_CertificateChainFile instead.

Special characters are supported.

3.10.7. EAPTLS_CertificateChainFile

For TLS-based EAP types, such as TLS, TTLS and PEAP, this parameter specifies the name of a file containing a certificate chain for the Radius server certificate. The server certificate chain is sent to the EAP client and validated by the client during EAP authentication. The certificate chain must be in PEM format. EAPTLS_CertificateChainFile can be used instead of EAPTLS_CertificateFile for explicitly constructing the server certificate chain which is sent to the client.
Use `EAPTLS_CertificateChainFile` to specify a chain of certificates that the server uses to identify itself to the client. If there is only one server certificate, and not a chain, you can use `EAPTLS_CertificateFile` instead.

Special characters are supported.

### 3.10.8. EAPTLS_CertificateType

For TLS-based EAP types, such as TLS, TTLS and PEAP, this optional parameter specifies the format of the `EAPTLS_CertificateFile`. The options are:

- **PEM**
- **ASN1**

The default value is **ASN1**.

Special characters are supported.

### 3.10.9. EAPTLS_PrivateKeyFile

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter specifies the name of the file containing the server's private key. It can be located in the same file as the server certificate (`EAPTLS_CertificateFile`). If the private key is encrypted, which is usually the case, `EAPTLS_PrivateKeyPassword` is the key to decrypt it.

Special characters are supported.

### 3.10.10. EAPTLS_PrivateKeyPassword

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter specifies the password that is used to decrypt the `EAPTLS_PrivateKeyFile`.

Special characters are supported.

### 3.10.11. EAPTLS_Protocols

This specifies the comma-separated list of TLS protocols that are permissible for TLS-based EAP types. Currently supported protocols are:

- TLSv1
- TLSv1.1
- TLSv1.2
- TLSv1.3

**CAUTION**

TLSv1.3 is not supported with Radiator yet. This option is provided for testing purposes and future use. Net::SSLeay 1.83 or later is required if you use Radiator with SSL/TLS library that has TLSv1.3 enabled.

There is no default value. If this parameter is not set, all protocols, which are supported by the SSL/TLS library within Radiator, are permitted.

The available TLS protocols depend on your system's TLS library. See Radiator debug log for details when the first EAP message is processed by this AuthBy.
3. Configuring Radiator

3.10.12. EAPTLS_Ciphers

This parameter specifies which subset of cipher suites is permissible for TLS-based EAP types. It uses the standard OpenSSL string format. The default is `DEFAULT:!EXPORT:!LOW`.

```plaintext
# Exclude cipher suites using RC4 too
EAPTLS_Ciphers DEFAULT:!EXPORT:!LOW:!RC4
```

3.10.13. EAPTLS_RandomFile

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter specifies the name of a file containing randomness. Usually there is no need to set this parameter.

Special characters are supported.

3.10.14. EAPTLS_DHFile

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter specifies the name of the DH group. Usually there is no need to set this parameter. It is required if you use ephemeral DH keys.

Special characters are supported.

3.10.15. EAPTLS_ECDH_Curve

For TLS-based EAP types, this optional parameter enables ephemeral EC keying by specifying the name of the elliptic curve to use. The default is to not enable ephemeral EC keying.

```plaintext
# Curves often have multiple aliases. Need OpenSSL name here.
# openssl ecparam -list_curves
EAPTLS_ECDH_Curve prime256v1
```

3.10.16. EAPTLS_AllowUnsafeLegacyRenegotiation

This optional parameter enables legacy insecure renegotiation between OpenSSL and unpatched clients or servers. It is used with TLS-based EAP types, such as TLS, TTLS, and PEAP, and with OpenSSL version 0.9.8m or later. OpenSSL 0.9.8m and later always attempts to use secure renegotiation as described in RFC5746. This counters the prefix attack described in CVE-2009-3555 and elsewhere.

3.10.17. EAPTLS_MaxFragmentSize

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter specifies the maximum size in octets permitted for each TLS message fragment. The default value is `2048`, but many EAP clients, routers, and wireless Access Points have limitations that require `EAPTLS_MaxFragmentSize` to be set as low as 1000 or less. Setting this number too small can result in excessive RADIUS request round trips during EAP TLS authentication. This slows down the authentication process. Setting this number too large can result in failure to complete TLS authentication for some types of clients and devices. Many customers find that 1300 is a good compromise.

The EAP packet that is encapsulated inside EAP-Message and all other radius attributes must not exceed one Ethernet frame because EAP does not support fragmentation.

Depending on the number of other RADIUS attributes your switches or WLAN controllers send to the RADIUS servers, you can increase `EAPTLS_MaxFragmentSize`, which may result in fewer RADIUS requests in the
EAP conversation which reduces the authentication time and lowers to load on both the RADIUS client (switch, WLAN controller) and RADIUS server.

If incoming RADIUS requests have Framed-MTU that is less than $EAPTLS_{\text{MaxFragmentSize}}$, then Radiator uses the reported Framed-MTU to limit fragment size when doing TLS, TTLS, PEAP, and PSK.

Special characters are supported.

### 3.10.18. EAPTLS_CRLCheck

This optional flag parameter specifies if Certificate Revocation List must be checked for revoked certificates. It is used with TLS-based EAP types, such as TLS, TTLS, and PEAP, that have been configured to check client certificates.

### 3.10.19. EAPTLS_CRLCheckUseDeltas

This optional flag parameter specifies if Delta Certificate Revocation List must be checked for revoked certificates in addition to base CRL. It is used with TLS-based EAP types, such as TLS, TTLS, and PEAP, that have been configured to check client certificates. Currently delta CRL files are loaded with $EAPTLS_{\text{CRLFile}}$ parameter, similar to base CRL files.

**CAUTION**

$EAPTLS_{\text{CRLCheckUseDeltas}}$ is currently experimental.

Before enabling $EAPTLS_{\text{CRLCheckUseDeltas}}$, note the following requirements and restrictions:

- $EAPTLS_{\text{CRLCheck}}$ must be enabled in Radiator configuration
- Both base and delta CRLs must use CRL v2 format
- Do not use delta CRL files without enabling $EAPTLS_{\text{CRLCheckUseDeltas}}$
- OpenSSL indicates only one delta CRL file can be used
- Review OpenSSL notes about delta CRLs on OpenSSL manual page for X509_VERIFY_PARAM_set_flags. [https://www.openssl.org/docs/manmaster/man3/X509_VERIFY_PARAM_set_flags.html]
- Test that your base and delta CRL work when CRL files are updated or refreshed

Please contact Radiator support about success or possible problems there might be with delta CRLs.

### 3.10.20. EAPTLS_CRLCheckAll

For TLS-based EAP types, this optional flag parameter enables CRL checks for the entire certificate chain. $EAPTLS_{\text{CRLCheckAll}}$ is not enabled by default. The CRL files for the intermediate CAs must be found, otherwise the certificate check fails. See Section 3.10.21. EAPTLS_CRLFile on page 64 for the details.

**Note**

$EAPTLS_{\text{CRLCheck}}$ must be enabled for any certificate checks to happen.
3.10.21. **EAPTLS_CRLFile**

For TLS-based EAP types, such as TLS, TTLS, and PEAP, and where CRL checking has been enabled with EAPTLS_CRLCheck, this optional parameter specifies one or more CRL files that are used to check client certificates for revocation. These files are also used when EAPTLS_CRLCheckAll is enabled.

If a CRL file is not found, or if the CRL says the certificate has been revoked, TLS authentication will fail with an error:

```text
SSL3_GET_CLIENT_CERTIFICATE:no certificate returned
```

One or more CRLs can be named with the EAPTLS_CRLFile parameter. Alternatively, CRLs may follow a file naming convention: the hash of the issuer Subject Name and a suffix that depends on the serial number, for example ab1331b2.r0 or ab1331b2.r1.

You can find out the hash of the issuer name in a CRL with:

```bash
openssl crl -in crl.pem -hash -noout
```

CRLs with this name convention will be searched in EAPTLS_CAPath, else in the openssl certificates directory (typically `/usr/local/openssl/certs/`).

CRLs are expected to be in PEM format. A CRL file can be generated with openssl like this:

```bash
openssl ca -gencrl -revoke cert-clt.pem
openssl ca -gencrl -out crl.pem
```

Use of these flags requires Net_SSLeay-1.30 or later.

---

**Note**

CRL reloading does not currently work as described with the recent OpenSSL libraries. To ensure the CRL files are correctly used, you may need to restart Radiator when the CRL files change.

---

The intended way CRL reloading, see the note above, works is this: Each CRL file named with a EAPTLS_CRLFile will be automatically reloaded and reread at the start of each new EAP TLS, TTLS or PEAP session if the modification date of the named CRL file has changed since the last time it was loaded. If the CRL for a particular issuer changes, it is sufficient to replace the existing CRL file with the newer version and Radiator will reload the new CRL when required.

---

**Tip**

Operating system wildcards are supported, so you can name multiple CRLs with a single wildcard like:

```bash
EAPTLS_CRLFile %D/crls/*/r0
```

---

**Tip**

Do not use the issuer name hash as the CRL file name: it can confuse OpenSSL. Use a text name like:

```bash
EAPTLS_CRLFile revocations.pem
```
Special characters are supported.

### 3.10.22. EAPTLS_SessionResumption

For TLS-based EAP types such as TLS, TTLS, and PEAP, this optional parameter enables or disables support for TLS Session Resumption and PEAP Fast Reconnect. It is enabled by default.

```
# Disable session resumption
EAPTLS_SessionResumption 0
```

Special characters are supported.

### 3.10.23. EAPTLS_SessionResumptionLimit

For TLS-based EAP types such as TLS, TTLS, and PEAP, this optional parameter allows you to limit how long after the initial session that a session can be resumed. The time is given in seconds and the default value is 43200 seconds (12 hours).

Special characters are supported.

### 3.10.24. EAPTLS_SessionContextId

For TLS-based EAP types, such as TLS, TTLS, and PEAP, this optional parameter allows you to set the context within which the TLS session resumption is allowed. The default value is %1:%3:%n, which means that TLS session resumption is allowed if the resumed and the full authentication are processed by the same Handler, EAP Type, and original user name.

Special characters are supported. %0 is replaced by value referring to Client, %1 is replaced by value referring to Handler, %2 is replaced by value referring to AuthBy, and %3 with the current EAP type number.

Here is an example of using `EAPTLS_SessionContextId`:

```
# Allow resumption when using the same Client and Handler
EAPTLS_SessionContextId %0%1
```

### 3.10.25. EAPTLSRewriteCertificateCommonName

For TLS-based EAP types such as TLS, TTLS, and PEAP, this optional parameter allows you to rewrite the Common Name in the client's TLS certificate before using it to find the user name in the Radiator database:

```
EAPTLSRewriteCertificateCommonName s/testUser/mikem/
```

### 3.10.26. EAPTLS_PEAPVersion

For PEAP, this optional parameter allows you to control which version of the draft PEAP protocol to honour. The default value is 0. Set it to 1 for unusual clients.

### 3.10.27. EAPTLS_PEAPBrokenV1Label

This optional parameter makes PEAP Version 1 support compatible with non-standard PEAP V1 clients that use the old TLS encryption labels. These labels appear to be used frequently, due to Microsoft's use of the incorrect label in its V0 client.

### 3.10.28. EAP_PEAP_MSCHAP_Convert

For EAP-PEAP MSCHAPV2 authentication, this optional parameter tells Radiator to convert the inner EAP-MSCHAPV2 request into a conventional RADIUS-MSCHAPV2 request. The new RADIUS-
3. Configuring Radiator

MSCHAPV2 request is re-despatched to the Handlers, where it is detected and handled with `<Handler ConvertedFromEAPMSCHAPV2=1>`.

This is useful when proxying PEAP-MSCHAPV2 inner requests to a remote RADIUS server that can handle ordinary RADIUS-MSCHAPV2, but not EAP authentication. See `goodies/eap_peap_mschap_proxy.cfg` in your distribution for an example of how to configure convert and proxy system.

3.10.29. EAPTLSRequireClientCert

This optional parameter forces TTLS and PEAP to require a valid client certificate to be presented by the client. TLS always requires a valid client certificate, regardless of the setting of this parameter. In this case, valid means that the certificate is within its validity dates and has been signed by a CA for which Radiator has a root certificate.

3.10.30. EAPTLSPolicyOID

For TLS based EAP types such as TLS, TTLS, and PEAP, when the client presents a certificate, this optional parameter enables certificate policy checking. It also specifies one or more policy OIDs that must be present in the certificate path. It sets the 'require explicit policy' flag as defined in RFC3280. Using this requires NetSSLeay 1.37 or later.

```c
# Require just one policy
EAPTLS_PolicyOID 2.5.29.32.0
```

3.10.31. EAP_LEAP_MSMCHAP_Convert

For LEAP authentication, this optional parameter tells Radiator to convert the LEAP request into a conventional RADIUS-MSCHAP request. The new RADIUS-MSCHAP request is re-despatched to the Handlers, where it is detected and handled with `<Handler ConvertedFromLEAP=1>`.

This is useful for proxying LEAP requests to a remote RADIUS server that cannot handle LEAP, but which can handle RADIUS-MSCHAP. See `goodies/eap_leap_proxy.cfg` in your distribution for an example of how to configure such a convert and proxy system.

3.10.32. EAP_GTC_MaxLength

This parameter specifies the maximum length of EAP GTC token that is accepted from the client. The default value is 253, which is compatible with RADIUS protocol.

3.10.33. EAP_GTC_PAP_Convert

For EAP-GTC authentication, this optional parameter tells Radiator to convert the EAP-GTC request into a conventional RADIUS-PAP request. The new RADIUS-PAP request is re-despatched to the Handlers, where it is detected and handled with `<Handler ConvertedFromGTC=1>`.

3.10.34. EAP_MSCHAPv2_UseMultipleAuthBys

Note

Avoid using this parameter. It will probably be deprecated if additional features, such as support for password change, are implemented in EAP MSCHAP-V2. If you need support for multiple user database lookups, use `EAP_PEAP_MSCHAP_Convert` instead. For more information, see Section 3.10.28. `EAP_PEAP_MSCHAP_Convert` on page 65.
This optional parameter is used with EAP MSCHAP-V2 authentication. It allows using multiple AuthBys within one Handler or AuthBy GROUP. If this parameter is not set, using multiple EAP MSCHAP-V2 causes an authentication failure. To avoid this, define $EAP_MSCHAPv2_UseMultipleAuthBys in all AuthBys within Handler or AuthBy GROUP. This flag is not set by default.

Here is an example of using $EAP_MSCHAPv2_UseMultipleAuthBys:

```
<Handler>
  AuthByPolicy ContinueUntilAcceptOrChallenge
  <AuthBy SQL>
    EAPType MSCHAP-V2
    EAP_MSCHAPv2_UseMultipleAuthBys
  </AuthBy>
  <AuthBy SQL>
    EAPType MSCHAP-V2
    EAP_MSCHAPv2_UseMultipleAuthBys
  </AuthBy>
</Handler>
```

### 3.10.35. EAPTLS_NoCheckId

For EAP-TLS authentication, this optional parameter prevents the comparison of the user name with the certificate common name. The certificate acceptance is based only on the validity dates and the verification chain to the root certificate. There is no requirement for the user to be in any Radiator user database. This allows Radiator to mimic the behaviour of some other RADIUS servers.

### 3.10.36. EAPTLS_CertificateVerifyHook

For EAP-TLS authentication, this optional parameter specifies a Perl function that is called after the request user name or identity has been matched with the certificate CN. It passes the certificate and various other details, and returns a different user name which is used to do the user database lookup.

The function is passed the following arguments:

- $$_[0]$: $matchedcn, the CN that matched the user name or identity with or without the domain name. $matchedcn is the CN in the certificate that was matched against either the user name or EAP identity. It is normally used as the user name to do the user database lookup, but you can return a new name from this function.

- $$_[1]$: $x509_store_ctx, the EAP SSLEAY store context (you can pass this to Net::SSLeay::X509_STORE_CTX_get_current_cert)

- $$_[2]$: $cert, the current certificate, result of Net::SSLeay::X509_STORE_CTX_get_current_cert($x509_store_ctx)

- $$_[3]$: $subject_name, the certificates subject name, result of &Net::SSLeay::X509_get_subject_name($cert)

- $$_[4]$: $subject, the certificate subject, result of &Net::SSLeay::X509_NAME_oneline($subject_name)

- $$_[5]$: $p, the current Radius::Radius request

The function is expected to return a new value for $matchedcn, which is used to do the user database lookup. If it returns undef, the certificate verification is deemed to fail with the OpenSSL error X509_V_ERR_APPLICATION_VERIFICATION.
3.10.37. EAPTLS_CertificateVerifyFailedHook

EAPTLS_CertificateVerifyFailedHook specifies a Perl function that is called if the certificate cannot be verified. It is an optional parameter and is used with EAP-TLS authentication. It is passed the certificate (if present), and various other details.

The peer certificate $cert is not always present. An example of such case is a policy OID mismatch.

EAPTLS_CertificateVerifyFailedHook is passed the following arguments:

- `$_[0]`: $verify_error
  This is the EAP SSLEAY store context verification code.
- `$_[1]`: $x509_store_ctx
  This is the EAP SSLEAY store context.
- `$_[2]`: $cert
  This is the current certificate. May be undefined.
- `$_[3]`: $subject_name
  This is the certificate's subject name. Undefined when $cert is undefined.
- `$_[4]`: $subject
  This is the certificate subject. Undefined when $cert is undefined.
- `$_[5]`: $p
  This is the current Radius::Radius request.

EAPTLS_CertificateVerifyFailedHook must return a single value. This value is used as an OpenSSL error code to set the verify result code as follows:

- `> 0`: Non-zero error code
  This is a new verification result code.
- `0`
  This changes verification failure to verification success.
- `< 0`
  The verification process is immediately stopped with "verification failed" state.
- `Undefined`
  This is handled as an OpenSSL error X509_V_ERR_APPLICATION_VERIFICATION.

Here is an example of using EAPTLS_CertificateVerifyFailedHook. This configuration accepts all certificates. Any additional authorisation must be done later.

```perl
EAPTLS_CertificateVerifyFailedHook sub { return 0; }
```

The following example allows expired certificates. 10 is X509_V_ERR_CERT_HAS_EXPIRED.

```perl
EAPTLS_CertificateVerifyFailedHook sub {
    if ($_[0] == 10) { return 0; } else { return $[0]; }
}
```
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Note
This parameter may cause security issues if not used properly. Use it only in special cases.

3.10.38. EAPTLS_CommonNameHook

This optional parameter specifies a Perl hook that is used to choose the authenticated CN from the client certificate during EAP-TLS authentication. Normally, EAP-TLS attempts to match each CN in the client certificate (after EAPTLSRewriteCertificateCommonName is executed) against the User-Name (with and without any trailing @domain) and the EAP identity (with and without any trailing @domain). If a match is found, that is the authenticated CN, and it is the name that is be used to look up the user name in the user database.

If EAPTLS_CommonNameHook is defined, it returns the user name that matches with the CN.

It is called for each CN in the client certificate with the following arguments:

- \$_[0]: the CN
- \$_[1]: the User-Name from the incoming request
- \$_[2]: the EAP Identity of the TLS handshake

It is expected to return the matched CN or undef if no match is found.

3.10.39. EAPTLS_TraceState

For TLS based authentication, such as EAP-TLS, EAP-TTLS, and PEAP, this flag turns on TLS state tracing. This is used mostly for tracing TLS handshake process. This is not set by default.

TLS state tracing is also enabled when:

- Trace is set to 5 (EXTRA_DEBUG).
- PacketTrace is set for the request that initiates the TLS handshake. This allows, for example, enabling TLS state tracing for all authentication attempts from a certain Client.

Here is an example of using EAPTLS_TraceState:

```bash
# Turn on TLS state tracing for this AuthBy
EAPTLS_TraceState
```

3.10.40. EAPTLS_CopyToInnerRequest

This parameter overrides the default list of attributes that is copied from an outer EAP request, such as PEAP, EAP-TTLS, or EAP-FAST, to an inner request. The default list of attributes for PEAP and EAP-FAST is NAS-IP-Address NAS-Identifier NAS-Port Calling-Station-Id. The default list is empty for EAP-TTLS.

Here is an example of using EAPTLS_CopyToInnerRequest:

```bash
EAPTLS_CopyToInnerRequest Calling-Station-Id, Called-Station-Id
```

3.10.41. EAPTLS_CAPartialChain

This is a flag parameter. It is used with TLS-based EAP types, such as TLS, TTLS, and PEAP. When it is enabled, only a partial CA certificate chain is required to validate TLS client certificates. This is not set by default.
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3.10.42. EAPTLS_UseCADefaultLocations

This is a flag parameter. It is used with TLS-based EAP types, such as TLS, TTLS, and PEAP. When set, the default locations are used for loading CA certificates. This is not set by default.

The default CA certificate directory is `certs/` in the default OpenSSL directory. Use `SSL_CERT_DIR` environment variable to override the default location. The default CA certificate file is `cert.pm` in the default OpenSSL directory. Use `SSL_CERT_FILE` environment variable to override the default file name.

3.10.43. EAPTLS_NoClientCert

This is a flag parameter. It is used with TLS-based EAP types, such as TTLS and PEAP. When set, it disables loading of any CA certificates for client certificate verification. This allows you to simplify PEAP and EAP-TTLS configuration when client certificates are not requested with `EAPTLS_RequireClientCert`. Do not set this if EAP-TLS support is needed.

3.10.44. EAPTLS_OCSPCheck

This optional flag parameter is alternative to `EAPTLS_OCSPAsyncCheck`. This defines if Online Certificate Status must be checked for revoked certificates. It is used only with TLS-based EAP types, such as TLS, TTLS, and PEAP, that are configured to check client certificates. Using this parameter requires `LWP::UserAgent` and `HTTP::Request` Perl modules.

Here are the requirements for using OCSP parameters:

- OpenSSL 1.0.0 or later
- Net::SSLeay 1.59 or later. Net::SSLeay 1.82 or later is recommended.
  
  If you use `EAPTLS_OCSPStapling`, Net::SSLeay 1.82 or later is required.

3.10.45. EAPTLS_OCSPAsyncCheck

This optional flag parameter defines if Online Certificate Status must be checked asynchronously for revoked certificates. This is used only with TLS-based EAP types, such as TLS, TTLS, and PEAP, that are configured to check client certificates. Using this parameter requires `HTTP::Async` and `HTTP::Request` Perl modules.

`EAPTLS_OCSPAsyncCheck` is alternative to `EAPTLS_OCSPCheck`, the same requirements apply also with `EAPTLS_OCSPAsyncCheck`. For more information, see Section 3.10.44. EAPTLS_OCSPCheck on page 70.

3.10.46. EAPTLS_OCSPStapling

This optional flag parameter defines if Radiator provides OCSP staple with its server certificate. This is used only with TLS-based EAP types, such as TLS, TTLS, and PEAP. Using this parameter requires `LWP::UserAgent` and `HTTP::Request` Perl modules.

Using `EAPTLS_OCSPStapling` does not require that `EAPTLS_OCSPCheck` or `EAPTLS_OCSPAsyncCheck` is set, but the same requirements apply when you use only `TLS_OCSPStapling`. See the requirements list in Section 3.10.44. EAPTLS_OCSPCheck on page 70.

3.10.47. EAPTLS_OCSPURI

This string defines the OCSP URI that is used for all OCSP queries.

3.10.48. EAPTLS_OCSPFailureBackoffTime

If the OCSP query fails, the query is not sent again to the failed OCSP URI. This integer defines the time for how long the failed OCSP URI is not contacted. The unit is seconds.
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3.10.49. **EAPTLS_OCSPStrict**

This optional flag parameter defines if Online Certificate Status must be checked successfully. This is used only with TLS-based EAP types, such as TLS, TTLS, and PEAP, that are configured to check client certificates.

When `EAPTLS_OCSPStrict` is set, the certificate check must be successful in all phases. Here are some examples when the certificate check fails if `EAPTLS_OCSPStrict` is set:

- `EAPTLS_OCSPURI` is not set and the certificate does not have OCSP URI.
- OCSP responder is not responding.
- OCSP responder cannot be reached.

3.10.50. **EAPTLS_OCSPCacheTime**

This integer defines the time for how long OCSP replies are save in the cache. The unit is seconds. The default value is 1200, that is 20 minutes.

3.10.51. **EAPTLS_OCSPCacheSize**

This integer defines the maximum number of OCSP cache entries. The default value is 1000.

3.10.52. **EAPFAST_PAC_Lifetime**

For EAP-FAST, this parameter specifies the maximum lifetime for each PAC.

3.10.53. **EAPFAST_PAC_Reprovision**

For EAP-FAST, this parameter specifies the time after which a PAC is re-provisioned.

3.10.54. **EAP_TTLS_AllowInRequest**

For EAP-TTLS authentication, this optional parameter tells Radiator to allow only the specified attributes in requests from EAP-TTLS clients. Attributes that are not allowed are ignored and logged on debug level.

By default, the following attributes are allowed in requests.

- `User-Name`
- `User-Password`
- `CHAP-Password`
- `CHAP-Challenge`
- `EAP-Message`
- `MS-CHAP-Response`
- `MS-CHAP-Challenge`
- `MS-CHAP2-Response`

These are the attributes from EAP-TTLS RFC 5281 except of the password change related attributes, which are currently not allowed by default.

Here is an example of using `EAP_TTLS_AllowInRequest`:

```bash
# Also allow our vendor specific attribute in EAP-TTLS requests
EAP_TTLS_AllowInRequest OSC-AVPAIR, User-Name, User-Password, \ 
    CHAP-Password, CHAP-Challenge, EAP-Message, \ 
```
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3.10.55. EAP_TTLS_AllowInReply

For EAP-TTLS authentication, this optional parameter tells Radiator to allow only the specified attributes in replies to EAP-TTLS clients. Attributes that are not allowed are silently ignored.

By default, the following attributes are allowed in requests:

- EAP-Message
- MS-CHAP2-Success

These are the attributes from EAP-TTLS RFC 5281 except of the password change related attributes, which are currently not allowed by default.

Here is an example of using EAP_TTLS_AllowInReply:

```bash
# Also allow our vendor specific attribute in EAP-TTLS replies
EAP_TTLS_AllowInReply OSC-AVPAIR, EAP-Message, MS-CHAP2-Success
```

3.10.56. EAP_Identity_MaxLength

This is an integer that specifies the maximum length of EAP identity. The default value is 253.

3.10.57. EAP_PWD_PrepMethod

This parameter specifies a password preparation method to be used in EAP-pwd authentication. RFC 5931, that defines EAP-pwd, specifies three password pre-processing methods. RFC 8146 specifies additional methods which are not implemented by Radiator yet. Preparation methods are configured with an optional parameter EAP_PWD_PrepMethod. The default value is None. The currently available methods are shown in the table below.

<table>
<thead>
<tr>
<th>Preparation method</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>Password is used as is. No additional preparation is done. The password must be stored in plain text, including rcrypt, format.</td>
</tr>
<tr>
<td>NtHash</td>
<td>Password is processed to produce the output PasswordHashHash, as defined in RFC 2759. The password must be stored in plain text, including rcrypt, or NT hashed format. This requires Digest::MD4 Perl module.</td>
</tr>
<tr>
<td>SASLprep</td>
<td>Password is processed according to RFC 5931 SASLprep specification. The password must be stored in plain text, including rcrypt, format. This requires Authen::SASL::SASLprep version 1.100 or later.</td>
</tr>
</tbody>
</table>

CAUTION

EAP-pwd clients may not support other methods than None. For example, wpa_supplicant 2.6+fixes is needed for the NtHash method to work.

Here is an example of using EAP_PWD_PrepMethod:

```bash
# Our passwords are stored in {nthash} prefixed format
```
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EAP_PWD_PrepMethod NtHash

3.10.58. UsernameCharset

This optional parameter checks that every user name consists only of the characters in the specified character set. This can be useful to reject requests that have user names that cannot be valid. The value of the parameter is a Perl character set specification. See your Perl reference manual for details about how to construct Perl character set specifications. Note that the some special characters must be escaped with a backslash. This parameter is not set by default and no character set check is done.

UsernameCharset is available as a global and Handler level parameter. The character set checks are done for both User-Name attribute and EAP identity.

When a request is processed by a Handler, User-Name attribute must pass both global and per Handler UsernameCharset checks. When an EAP-Response/Identity message is handled by an AuthBy, the EAP identity must pass both global and per Handler UsernameCharset checks. The Handler is the last Handler that processed the request before it was passed to the AuthBy.

This example permits only alphanumeric, period, underscore, the @-sign, and dash. Note that a dash at the end of character class needs not to be escaped with a backslash:

UsernameCharset a-zA-Z0-9._@-

3.10.59. NoEAP

This optional parameter disables EAP authentication in the specific AuthBy. If the AuthBy would otherwise do EAP authentication, this parameter forces it to do conventional authentication. This is useful for performing additional checks besides EAP authentication, for example, when doing MAC Address whitelist checking as well as EAP authentication.

AuthByPolicy ContinueWhileAccept
# Check the MAC address is valid..
<AuthBy FILE>
  NoEAP
  AuthenticateAttribute Calling-Station-Id
  Filename ...
  ...
</AuthBy>
# then check the username and password, perhaps by EAP
<AuthBy LDAP>
  EAPType ....
  ....
</AuthBy>

3.10.60. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- Client clause

  PreHandlerHook is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.

- AuthBy clause

  The functionality depends on the used EAP authentication type:
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- PEAP, EAP-TTLS, EAP-FAST

  `PreHandlerHook` specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.

- LEAP

  If `EAP_LEAP_MSCHAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- EAP-MSCHAPv2

  If `EAP_PEAP_MSCHAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- EAP-GTC

  If `EAP_GTC_PAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- AuthBy DYNAUTH clause

  `PreHandlerHook` is called for each request created by the clause before the request is passed to a Realm or Handler clause.

- ServerRADSEC clause

  `PreHandlerHook` is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

- ServerDIAMETER clause

  `PreHandlerHook` is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

- ServerTACACSPLUS clause

  `PreHandlerHook` is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's `PrehandlerHook` is run before ServerTACASPLUS's `PreHandlerHook`. Global and per-Client user name rewriting and other processing is done before the hooks are run.

A reference to the request is passed as the only argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (`\`) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

`PreHandlerHook` can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using `PreHandlerHook`:

```perl
# Fake a new attribute into the request
PreHandlerHook sub { @{$_[0]}->add_attr('test-attr', 'test-value'); }
```

3.11. TLS configuration

Multiple Radiator configuration clauses are built on top of common server and client stream modules. These modules support TCP and SCTP stream transport protocols and can optionally be configured to use TLS for transport security.
The exact behaviour of many of the configuration parameters, such as the search order between `TLS_CAFile` and `TLS_CAPath`, depends on the TLS library Radiator uses. This is typically OpenSSL but can be LibreSSL or any other TLS library that works with Net::SSLeay Perl module. For more information about Net::SSLeay and OpenSSL, see Section 2.1.7. Net::SSLeay and OpenSSL on page 5.

The default values for the TLS configuration parameters are the same for all configuration clauses unless otherwise stated.

### 3.11.1. TLS_Protocols

`TLS_Protocols` forces SSL or TLS for the configuration clause and specifies a comma-separated list of SSL and TLS protocols that are permissible for SSL and TLS connections. Currently, the supported SSL and TLS protocols are:

- SSLv3
- TLSv1
- TLSv1.1
- TLSv1.2
- TLSv1.3

**CAUTION**

TLSv1.3 is not supported with Radiator yet. This option is provided for testing purposes and future use. Net::SSLeay 1.83 or later is required if you use Radiator with SSL/TLS library that has TLSv1.3 enabled.

When set, `TLS_Protocols` overrides `UseSSL` and `UseTLS`. Otherwise `UseSSL` and `UseTLS` control the allowed protocols, if set. `TLS_Protocols` is not set by default.

Here is an example of using `TLS_Protocols`:

```plaintext
# Allow connections with these TLS versions only
TLS_Protocols TLSv1.1, TLSv1.2
```

**Note**

SSLv3 is obsolete and may not be supported by the TLS library Radiator uses. Use of SSLv3 is strongly discouraged but it is available for communicating with legacy SSLv3 peers.

### 3.11.2. TLS_CAFile

When TLS is enabled, this parameter specifies the name of a file containing Certificate Authority (CA) root certificates that may be required to validate TLS peer certificates. The certificates must be in PEM format. The file can contain several root certificates for one or more Certificate Authorities. Radiator looks for root certificates for RadSec connections in `TLS_CAFile` then in `TLS_CAPath`, so there usually is no need to set both.

### 3.11.3. TLS_CAPath

When TLS is enabled, this parameter specifies the name of a directory containing CA root certificates that may be required to validate TLS peer certificates. There must be one certificate per file and the certificates must be
in PEM format. The files names are looked up by the CA ‘Subject Name’ hash value. Radiator looks for root certificates for RadSec connections in `TLS_CAFile` then in `TLS_CAPath`, so there usually is no need to set both.

### 3.11.4. TLS_CertificateFile

When TLS is enabled, this parameter specifies the name of the file containing the certificate that Radiator uses. This certificate is sent to the TLS peer and validated by the peer during TLS setup. The certificate file must be in PEM or ASN1 format, depending on the setting of the `TLS_CertificateType` parameter. The certificate file can also contain the certificate's private key if the `TLS_PrivateKeyFile` parameter specifies the same file.

**Note**

RadSec clients expect the server certificate to have a common name (CN) the same as the RadSec servers DNS host name or address.

### 3.11.5. TLS_CertificateChainFile

When TLS is enabled, this parameter specifies the name of the file containing Radiator's certificate chain. The certificate chain is sent to the TLS peer and validated by the peer during TLS setup. The certificate chain must be in PEM format. This should be used alternatively or additionally to `TLS_CertificateFile` for explicitly constructing the certificate chain, which is sent to the peer in addition to the Radiator's own certificate.

### 3.11.6. TLS_CertificateType

When TLS is enabled, this optional parameter specifies the format of the `TLS_CertificateFile`. Permitted options are:

- **PEM**
- **ASN1**

The default is **ASN1**.

### 3.11.7. TLS_PrivateKeyFile

When TLS is enabled, this optional parameter specifies the name of the file containing the private key of the certificate configured with `TLS_CertificateFile`. It is sometimes in the same file as the `TLS_CertificateFile`. Usually the private key is encrypted, use `TLS_PrivateKeyPassword` is the key to decrypt it. For more information, see Section 3.11.4. TLS_CertificateFile on page 76 and Section 3.11.8. TLS_PrivateKeyPassword on page 76.

### 3.11.8. TLS_PrivateKeyPassword

When TLS is enabled, this optional parameter specifies the password that is to be used to decrypt the `TLS_PrivateKeyFile`. Special characters are permitted.

### 3.11.9. TLS_Ciphers

`TLS_Ciphers` specifies which subset of cipher suites is permissible for the connection, using the standard OpenSSL string format. The default value is `DEFAULT:!EXPORT:!LOW`.

```bash
# Exclude cipher suites using RC4 too
TLS_Ciphers DEFAULT:!EXPORT:!LOW:!RC4
```
3. Configuring Radiator

3.11.10. TLS_ReqlireClientCert

This is an optional flag, which is available only for servers. It specifies whether the server clause requires each client to present a valid client certificate during TLS handshake or not. If the client certificate is not a valid certificate, the TLS handshake fails and the TCP or SCTP connection is disconnected. Certificate validity is determined by the root certificates that are configured for the server clause with TLS_CAFil or TLS_CAPath, and other TLS configuration parameters, such as TLS_ExpectedPeerName and TLS_SubjectAltNameURI.

Note
For compliance with RFC 6614, TLS_ReqlireClientCert is enabled by default for ServerRADSEC.

3.11.11. TLS_RandomFile

When TLS is enabled, this optional parameter specifies the name of a file containing randomness. Usually there is no need to set this parameter.

3.11.12. TLS_DHFile

When TLS is enabled, this optional parameter specifies the name of the DH group. Usually there is no need to set this parameter, but it may be required if you are using ephemeral DH keys.

3.11.13. TLS_ECDH_Curve

When TLS is enabled, this optional parameter enables ephemeral EC keying by specifying the name of the elliptic curve to use. The default is to not enable ephemeral EC keying.

# Curves often have multiple aliases. Need OpenSSL name here.
# openssl ecparam -list_curves
TLS_ECDH_Curve prime256v1

3.11.14. TLS_CRLCheck

When TLS is enabled and it has been configured to check peer certificates with TLS_ReqlireClientCert, this optional flag parameter specifies that Certificate Revocation List (CRL) must be checked for revoked certificates during validation of the peer certificate.

3.11.15. TLS_CRLCheckUseDeltas

This optional flag parameter specifies if Delta Certificate Revocation List must be checked for revoked certificates in addition to base CRL. Currently delta CRL files are loaded with TLS_CRLFile parameter, similar to base CRL files.

CAUTION

TLS_CRLCheckUseDeltas is currently experimental.

Before enabling TLS_CRLCheckUseDeltas, note the following requirements and restrictions:

• TLS_CRLCheck must be enabled in Radiator configuration
• Both base and delta CRLs must use CRL v2 format
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- Do not use delta CRL files without enabling `TLS_CRLCheckUseDeltas`
- OpenSSL indicates only one delta CRL file can be used
- Review OpenSSL notes about delta CRLs on OpenSSL manual page for X509_VERIFY_PARAM_set_flags. [https://www.openssl.org/docs/manmaster/man3/X509_VERIFY_PARAM_set_flags.html]
- Test that your base and delta CRL work when CRL files are updated or refreshed

Please contact Radiator support about success or possible problems there might be with delta CRLs.

### 3.11.16. TLS_CRLCheckAll

When TLS is enabled, this optional flag parameter enables CRL checks for the entire certificate chain. This is not enabled by default. The CRL files for the intermediate CAs must be found or the certificate check fails. For more information, see `TLS_CRLFile` on page 78.

**Note**

`TLS_CRLCheck` must be enabled for any certificate checks to happen.

### 3.11.17. TLS_CRLFile

This optional parameter specifies one or more CRL files that are used to check peer certificates for revocation when all the following conditions apply:

- TLS is enabled.
- TLS is configured to check peer certificates with `TLS_RequireClientCert`.
- CRL checking is enabled with `TLS_CRLCheck`.

The CRL files are also used when `TLS_CRLCheckAll` is enabled.

If the CRL file is not found or the CRL says the certificate has been revoked, TLS authentication fails with an error:

`SSL3_GET_CLIENT_CERTIFICATE:no certificate returned`

One or more CRLs can be named with multiple `TLS_CRLFile` parameters. Alternatively, CRLs can follow the file-naming convention: the hash of the issuer Subject Name and a suffix that depends on the serial number, such as `ab1331b2.r0`, `ab1331b2.r1`.

Find out the hash of the issuer name in the CRL with the following command:

```
openssl crl -in crl.pem -hash -noout
```

CRLs with this name convention are searched in `TLS_CAPath`, else in the OpenSSL certificates directory (typically `/usr/local/openssl/certs/`).

CRLs are expected to be in PEM format. A CRL file can be generated with OpenSSL like this:

```
openssl ca -gencrl -revoke cert-clt.pem
openssl ca -gencrl -out crl.pem
```

Using these flags requires Net_SSLeay-1.30 or later.

Each CRL file named with a `TLS_CRLFile` is automatically reloaded and reread at the start of each new RadSec session if the modification date of the named CRL file has changed since the last time it was loaded. If
the CRL for a particular issuer changes, it is sufficient to replace the existing CRL file with the newer version and RadSec reloads the new CRL when required.

**Tip**

Operating system wildcards are supported, so you can name multiple CRLs with a single wildcard like:

```
TLS_CRLFile %D/crls/*.r0
```

### 3.11.18. TLS_PolicyOID

When a TLS peer presents a certificate, this optional parameter enables the certificate policy checking and specifies one or more policy OIDs that must be present in the certificate path. It sets the 'require explicit policy' flag as defined in RFC3280. Using this parameter requires Net-SSLeay 1.37 or later. This parameter may be used for additional certificate validity checks, for example, with RadSec.

Here is an example of using `TLS_PolicyOID`:

```
# Require just one policy
TLS_PolicyOID 1.3.6.1.4.1.9048.33.2
```

### 3.11.19. TLS_ExpectedPeerName

When a TLS peer presents a certificate, this optional parameter specifies a regular expression pattern that is required to match the Subject in the peer certificate.

The default value for servers, such as ServerRADSEC, is `.+` which means to accept any Subject.

Different configuration clauses have different defaults for certificate validation. See the documentation of the specific configuration clause, such as `<AuthBy RADSEC>`, for the details.

Here is an example of using `TLS_ExpectedPeerName`:

```
# Accept certificates with CN ending in .xyz.com
TLS_ExpectedPeerName CN=.*\.xyz\.com
```

### 3.11.20. TLS_SubjectAltNameURI

When a TLS peer presents a client certificate, this optional parameter specifies a regular expression pattern that must match against at least one `subjectAltName` of type URI in the peer certificate.

There is no default value and no `subjectAltName` checks are done.

Different configuration clauses have different defaults for certificate validation. See the documentation of the specific configuration clause, such as `<AuthBy RADSEC>`, for the details.

Here is an example of using `TLS_SubjectAltNameURI`:

```
# Accept certificates that have a subjectAltName type URI that
# ends in open.com.au:
TLS_SubjectAltNameURI .*open.com.au
```
3.11.21. TLS_SubjectAltNameDNS

This optional parameter is used only by TLS clients. When a TLS server presents a certificate, this defines an FQDN that matches against a subjectAltNameDNS of type DNS in that certificate. Currently, this is not a regular expression but this is subject to change.

By default, the TLS client checks if the server certificate contains a subjectAltName extension of type IPADDR or DNS that matches the Host name used to connect to the server. When subjectAltNameDNS is configured, type DNS values are checked against the value configured with subjectAltNameDNS. This parameter has no default value.

Here is an example of using TLS_SubjectAltNameDNS:

```
# Host is set to an IP address so we set the expected name here
TLS_SubjectAltNameDNS test.server.open.com.au
```

3.11.22. TLS_CertificateFingerprint

You can require that the peer matches one of a specified set of signatures with TLS_CertificateFingerprint. When a TLS peer presents a certificate, this optional parameter specifies one or more fingerprints, one of which must match the fingerprint of the peer certificate. The format is `algorithm:fingerprint`. No fingerprint checks are done by default. Using this parameter requires Net::SSLeay 1.37 or later.

Here is an example of using TLS_CertificateFingerprint:

```
TLS_CertificateFingerprint
TLS_CertificateFingerprint
TLS_CertificateFingerprint
        12:D7:8E:79:A0:24:C0:DE:0B:88:A9:DB:3C
```

3.11.23. TLS_CertificateVerifyHook

This optional parameter specifies a Perl function that will be called for a custom verification of the peer certificate. It is passed the certificate, and various other details, and returns 0 for verification success, a new verification result code or < 0 for a failure, or an undefined value to continue Radiator builtin certificate verification.

Note

This parameter is currently available only for servers such as ServerRADSEC.

The function is passed the following arguments:

- `$_[0]`: $hostname, for servers, such as ServerRADSEC, the peer's IP address
- `$_[1]`: $x509_store_ctx, the OpenSSL store context (you can pass this to Net::SSLeay::X509_STORE_CTX_get_current_cert)
- `$_[2]`: $cert, the current certificate, result of Net::SSLeay::X509_STORE_CTX_get_current_cert($x509_store_ctx)
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- `_[3]`: `$subject_name`, the certificates subject name, result of `Net::SSLeay::X509_get_subject_name($cert)`
- `_[4]`: `$subject`, the certificate subject, result of `Net::SSLeay::X509_NAME_oneline($subject_name)`
- `_[5]`: `$object`, the Stream object created for this connection

```perl
<ServerRADSEC>
  ...
  # Accept immediately all certificates with O='OSC Demo Certificates'
  TLS_CertificateVerifyHook sub { my $subject = $_[4]; 
    my ($org) = $subject =~ /O=(\[^/\]*)/; 
    return unless $org eq 'OSC Demo Certificates'; return 0; }
</ServerRADSEC>
```

### 3.11.24. TLS_CertificateVerifyFailedHook

This optional parameter specifies a Perl function that will be called if verifying the peer certificate fails. It is passed the certificate (if present), and various other details.

The peer certificate `$cert` is not always present. An example of such case is a policy OID mismatch.

---

**Note**

This parameter is currently available only for servers such as `ServerRADSEC`.

---

`TLS_CertificateVerifyFailedHook` is passed the following arguments:

- `_[0]`: `$verify_error`
  - This is the OpenSSL store context verification code.
- `_[1]`: `$x509_store_ctx`
  - This is the OpenSSL store context.
- `_[2]`: `$cert`
  - This is the current certificate. May be undefined.
- `_[3]`: `$subject_name`
  - This is the certificate's subject name. Undefined when `$cert` is undefined.
- `_[4]`: `$subject`
  - This is the certificate subject. Undefined when `$cert` is undefined.
- `_[5]`: `$object`
  - This is the Stream object created for this connection.

`TLS_CertificateVerifyFailedHook` must return a single value. This value is used as an OpenSSL error code to set the verify result code as follows:

- > 0: Non-zero error code
  - This is a new verification result code.
- 0
  - This is a new verification result code.
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This changes verification failure to verification success.

- < 0
  The verification process is immediately stopped with "verification failed" state.
- Undefined
  This is handled as an OpenSSL error X509_V_ERR_APPLICATION_VERIFICATION.

Here are examples of using `TLS_CertificateVerifyFailedHook`.

```xml
<ServerRADSEC>
...
# Accept all certificates
# TLS_CertificateVerifyFailedHook sub { return 0; }

# Allow expired certificates; 10 is X509_V_ERR_CERT_HAS_EXPIRED
TLS_CertificateVerifyFailedHook sub { 
   if ($_[0] == 10) { return 0; } else { return $_[0]; } }
</ServerRADSEC>
```

Note
This parameter may cause security issues if not used properly. Use it only in special cases.

3.11.25. TLS_SRVName

`TLS_SRVName` is intended for use by `<AuthBy RADSEC>` and `<AuthBy DNSROAM>` to specify a DNS SRV Name that is matched against possible SubjectAltName:SRV extensions in the peer certificate. If `TLS_SRVName` is specified and the peer certificate contains SubjectAltName:SRV extensions, none of which match `TLS_SRVName`, the certificate is not accepted.

Format is `_service._transport.name` (this is the same format SRV names appear in DNS records). Only service and name are matched.

```xml
TLS_SRVName _radsec._tcp.example.com
```

3.11.26. TLS_UseCADefaultLocations

This is a flag parameter. When set, the default locations are used for loading CA certificates. This is not set by default.

The default CA certificate directory is `certs/` in the default OpenSSL directory. Use `SSL_CERT_DIR` environment variable to override the default location. The default CA certificate file is `cert.pm` in the default OpenSSL directory. Use `SSL_CERT_FILE` environment variable to override the default file name.

3.11.27. TLS_CAPartialChain

This is a flag parameter. When set, only a partial CA certificate chain is required to validate TLS peer certificates. This functionality is required when restricting valid CA certificates to only a subset of CA hierarchy. This is not set by default.
3.11.28. **TLS_NoClientCert**

This is a flag parameter. When set, it turns off any client certificate checks and disables loading of any CA certificates for client certificate verification. This allows you to simplify configuration when client certificates are not requested with `TLS_RequireClientCert`.

3.11.29. **TLS_OCSPCheck**

This flag defines if Online Certificate Status must be checked for revoked certificates. Using this parameter requires `LWP::UserAgent` and `HTTP::Request` Perl modules.

Here are the requirements for using OCSP parameters:

- OpenSSL 1.0.0 or later
- Net::SSLeay 1.59 or later. Net::SSLeay 1.82 or later is recommended.

If you use `TLS_OCSPStapling`, Net::SSLeay 1.82 or later is required.

3.11.30. **TLS_OCSPStapling**

This flag specifies that Online Certificate Status of our own certificate must be checked and returned to the peer as OCSP staple when running as a server. When running as a client, it requests OCSP staple. Using this parameter requires `LWP::UserAgent` and `HTTP::Request` Perl modules.

Using `TLS_OCSPStapling` does not require that `TSL_OCSPCheck` is set, but the same requirements apply when you use only `TLS_OCSPStapling`. See the requirements list in Section 3.11.29. **TLS_OCSPCheck** on page 83.

3.11.31. **TLS_OCSPURI**

This string defines OCSP URI that is used for all OCSP queries.

3.11.32. **TLS_OCSPFailureBackoffTime**

If the OCSP query fails, the query is not sent again to the failed OCSP URI. This integer defines the time for how long the failed OCSP URI is not contacted. The unit is seconds.

3.11.33. **TLS_OCSPStrict**

This optional flag parameter defines if Online Certificate Status must be checked successfully, otherwise the peer certificate is rejected.

When `TLS_OCSPStrict` is set, the certificate check must be successful in all phases. Here are some examples when the certificate check fails if `TLS_OCSPStrict` is set:

- `TLS_OCSPURI` is not set and the certificate does not have OCSP URI.
- OCSP responder is not responding.
- OCSP responder cannot be reached.

3.11.34. **TLS_OCSPCacheTime**

This integer defines the time for how long OCSP replies are saved in the cache. The unit is seconds. The default value is **1200**, that is 20 minutes.

3.11.35. **TLS_OCSPCacheSize**

This integer defines the maximum number of OCSP cache entries. The default value is **1000**.
3.11.36. UseTLS

This optional parameter forces the use of TLS for a configuration clause. When this parameter is enabled, the `TLS_*` parameters are available for use. For compliance with RFC 6614, it is enabled by default for RadSec clauses and `<AuthBy DNSROAM>`.

**CAUTION**

This option is obsolete. UseTLS enables TLSv1 only. For more information about the current preferred method of setting up TLS versions and parameters, see Section 3.11.1. TLS_Protocols on page 75 and Section 3.11.9. TLS_Ciphers on page 76.

Here is an example of using `UseTLS`:

```
UseTLS
```

3.11.37. UseSSL

This optional parameter forces the use of SSLv3, TLSv1.1, or TLSv1.2 for the configuration clause. The availability of TLS versions depends on if the TLS library supports them. When this parameter is enabled, the `TLS_*` parameters become available for use.

**CAUTION**

`UseSSL` is obsolete and use of SSLv3 is strongly discouraged. For more information about the current preferred methods of setting up TLS versions and parameters, see Section 3.11.1. TLS_Protocols on page 75 and Section 3.11.9. TLS_Ciphers on page 76.

Here is an example of using `UseSSL`:

```
UseSSL
```

3.11.38. TLS_SessionResumption

This is a flag that allows you to enable or disable support for TLS session resumption.

**CAUTION**

This parameter is obsolete. TLS Session resumption is not currently supported for the stream modules.

3.11.39. TLS_SessionResumptionLimit

This is an integer that specifies the limit how long (in seconds) after the initial session that a TLS session can be resumed.

**CAUTION**

This parameter is obsolete. TLS Session resumption is not currently supported for the stream modules.
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3.12. Gossip configuration

This section lists the parameters that are common to all Gossip modules.

3.12.1. Identifier

All Gossip backends, such as GossipRedis and GossipUDP, must be configured with Identifier. Identifier will be required in later releases to reference the chosen Gossip instance.

```bash
# Modules that require GossipRedis can refer to us with this Identifier
Identifier gossip-redis
```

3.12.2. Debug

Debug configuration parameter is available for all Gossip implementations. This optional flag enables debugging within the Radius::Gossip and its derived modules. It enables the logging of the details of all messages sent and received when Trace is set to 4 or higher. This is not set by default.

Requires Perl Data::Printer module.

```bash
# See all message details.
Debug
```

3.12.3. Secret

Secret is an optional parameter that enables encryption and decryption of Gossip messages. Secret does not store the key in an encrypted format and using EncryptedSecret is preferred. For more information, see Section 3.12.4. EncryptedSecret on page 86.

The format is $n,value where:

- $n$ is key index. The valid values are from 1 and 65535. The key index cannot be 0, it is a reserved value and an error is logged if 0 is used.
- $value$ is the key

Using Secret requires the following Perl modules:

- Crypt::GCM
- Crypt::Rijndael

CAUTION

If none of the Secret parameters can be successfully parsed, Gossip does not work and logs an error.

Here is an example of using Secret:

```xml
<GossipUDP>
    # Secret also works with GossipREDIS clause
    Secret 1,fred1
    Secret 2,fred2
    Secret 3,fred3
</GossipUDP>
```
3.12.4. EncryptedSecret

EncryptedSecret is an optional parameter that enables encryption and decryption of Gossip messages. EncryptedSecret stores the key in an encrypted format and thus it is preferable to use it instead of Secret.

The format is \( n, \{\text{method}\}^{\text{encrypted-value}} \) where:

- \( n \) is key index. The valid values are from 1 and 65535. The key index cannot be 0, it is a reserved value and an error is logged if 0 is used.
- \( \text{method} \) is the encryption method. Currently, there is one supported method, \( \text{rcrypt} \)
- \( \text{encrypted-value} \) is the key encrypted with the encryption method

Using EncryptedSecret requires the following Perl modules:

- Crypt::GCM
- Crypt::Rijndael

CAUTION

If none of the EncryptedSecret parameters can be successfully parsed and decrypted, Gossip does not work and logs an error.

Here is an example of using EncryptedSecret:

```<GossipUDP>
  # EncryptedSecret also works with GossipREDIS clause
  EncryptedSecret 1, {rcrypt}OjJXcK4bIA8sJERMzD2R0/Gx
  EncryptedSecret 2, {rcrypt}GyqZa52CYTRwsFQvsHNMWbc
  EncryptedSecret 3, {rcrypt}I1vIkmow6FgLJyg5/pMfO0v2
</GossipUDP>
```

3.13. <Client xxxxxxx>

The beginning of a Client clause. The clause continues until </Client> is seen on a line. A Client clause specifies a RADIUS client that this server will listen to. Requests received from any client not named in a Client clause in the configuration file will be silently ignored. The DEFAULT client (if defined) will handle requests from clients that are not defined elsewhere.

You must have a Client clause for every RADIUS client which your server is expected to serve, or else a DEFAULT Client. In each Client clause replace the xxxxxxx with either the DNS name or the IP address of the host machine where the RADIUS client is running, or with MAC; and the MAC address of the client. IPv4 and IPv6 addresses are supported. IPv6 addresses can only be received if an IPv6 BindAddress has been specified (See Section 3.7.9. BindAddress on page 31). IPv4 and IPv6 CIDR address notation is permitted.

DNS names are resolved only once when the client instance is created during the configuration. MAC address of the client is looked up from Called-Station-Id RADIUS attribute.

If an incoming request is capable of matching multiple Client clauses, the clause is chosen as follows:

- If multiple Client clauses have an exact IP match (same IP address or hostname resolving to the same IP address), the last one listed in the configuration is chosen. The same applies between multiple clauses with the same CIDR value: the last one listed in the configuration is chosen.
- Exact match is chosen over CIDR match
- Longer prefix CIDR match is chosen over shorter prefix CIDR match
- CIDR match is chosen over MAC match
- MAC match is chosen over DEFAULT

**Tip**
IPv6 addresses are not required to be prefixed with ‘ipv6:’ with Radiator 4.13 or later.

In the following example, the radius server will only respond to requests received from either oscar.open.com.au or from IPv4 address 203.63.154.7 or IPv4 network 203.10.1.0/24 or from IPv6 address 2001:db8:100::/64 and each client has a different shared secret. MAC match and DEFAULT client are commented out and thus not used.

**Note**
For more information about addresses starting with ::ffff, see Section 3.7.10. BindV6Only on page 31.

```xml
<Client oscar.open.com.au>
  Secret XG1gFty566
</Client>
<Client 203.63.154.7>
  # An IPv4 client
  Secret kj1fgkj77878&
</Client>
<Client 203.10.1.0/24>
  # An IPv4 class C address group
  Secret ljdfhjlsd
</Client>
<Client ::ffff:203.10.1.0/120>
  # See the note above
  Secret ljdfhjlsd
</Client>
<Client 2001:db8:100::/64>
  # An IPv6 /64 sized network
  Secret pqr
</Client>
<Client MAC:2a-1f-09-5a-25-2a>
  # Client identified by its MAC address
  # Secret gshgs
</Client>
## Handle all other clients with this secret
<Client DEFAULT>
  # Secret xyzzy
</Client>
```
Each Client clause can have a number of different parameters set, as described below.

**Tip**

If you are using an SQL database, you can list your clients in a RADCLIENTLIST table and use `<ClientListSQL>`. For more information, see Section 3.15. `<ClientListSQL>` on page 105 instead of listing them in your config file. This may be convenient, especially if you are using RAdmin to manage your RADIUS system.

### 3.13.1. Secret

This defines the shared secret that will be used to decrypt RADIUS messages that are received from this client. You must define a shared secret for each Client, and it must match the secret configured into the client RADIUS software. There is no default. The secret can be any number of ASCII characters. Any ASCII character except newline is permitted, but it might be easier if you restrict yourself to the printable characters. For a reasonable level of security, the Secret should be at least 16 characters, and a mixture of upper and lower case, digits and punctuation. You should not use just a single recognisable word.

```plaintext
# This better agree with the client at
# oscar.open.com.au or we won't understand them!
<Client oscar.open.com.au>
    Secret 666obaFGkmRNs666
</Client>
```

### 3.13.2. EncryptedSecret

This defines the shared secret that is used to decrypt RADIUS messages that are received from this client. You must define a shared secret for each Client, and it must match the secret configured into the client RADIUS software. EncryptedSecret is in encrypted format and is preferred over Secret. EncryptedSecret is currently experimental and will be documented later.

```plaintext
# This better agree with the client at
# oscar.open.com.au or we won't understand them!
<Client oscar.open.com.au>
    EncryptedSecret {rcrypt}1F67Kx6WXHKHpOuRZHSaIjdI
</Client>
```

### 3.13.3. DynAuthSecret

This defines the shared secret that is used to encrypt RADIUS dynamic authorisation requests that are sent to this client. The default is the client's Secret.

```plaintext
# oscar.open.com.au has separate secret for dynauth requests
<Client oscar.open.com.au>
    Secret 666obaFGkmRNs666
    DynAuthSecret 7e4+674.4a614A1b
</Client>
```

### 3.13.4. EncryptedDynAuthSecret

This defines the shared secret that is used to encrypt RADIUS dynamic authorisation requests which are sent to this client. EncryptedDynAuthSecret is in encrypted format and is preferred over DynAuthSecret.
3. Configuring Radiator

EncryptedDynAuthSecret is currently experimental and will be documented later.

```xml
<Client oscar.open.com.au>
  EncryptedSecret {rcrypt}1F67Kx6WXKHpOuRZHsAIJdI
  EncryptedDynAuthSecret {rcrypt}oVYMAWI/UUYp4zbo3l951Kk
</Client>
```

### 3.13.5. TACACSPLUSKey

This is a per-client TACACSPLUS key which is used as the TACACS+ key if there is no Key defined in the Server TACACSPLUS clause. Do not use this with RADIUS requests. For more information, see Section 3.120.1. Key on page 373.

### 3.13.6. EncryptedTACACSPLUSKey

This is a per-client TACACSPLUS key which is used as the TACACS+ key. EncryptedTACACSPLUSKey is in encrypted format and is preferred over TACACSPLUSKey. Do not use it with RADIUS requests. For more information, see Section 3.120.1. Key on page 373.

EncryptedTACACSPLUSKey is currently experimental and will be fully documented later.

### 3.13.7. DefaultRealm

This optional parameter can be used to specify a default realm to use for requests that have a User-Name that does not include a realm. The realm can then be used to trigger a specific `<Realm>` or `<Handler>` clause. This is useful if you operate a number of NASs for different customer groups and where some or all of your customers log in without specifying a realm.

```xml
# Realmless logins to this NAS will be treated
# as if they are for realm open.com.au
<Client accl.open.com.au>
  Secret ....
  DefaultRealm open.com.au
</Client>
<Realm open.com.au>
  .....  
</Realm>
```

**Tip**

Under some circumstances, some NASs send requests with no User-Name (usually for administrative reports). In that case, DefaultRealm will not add a realm to the User-Name, nor create a User-Name.

### 3.13.8. DupInterval

If more than one RADIUS request is received with the same source and destination IP address, source port, RADIUS authenticator and RADIUS Identifier within DupInterval seconds, the 2nd and subsequent requests are deemed to be duplicates or retransmissions. If the earlier request has already been replied to, then that reply will be resent back to the NAS. Otherwise the duplicate request will be dropped. A value of 0 means duplicates and retransmissions are always accepted, which might not be very wise, except during testing. RFC 5080 recommends a value between 5 and 30 seconds. Default is 10 seconds, which will detect and ignore duplicates.
due to multiple transmission paths and common retransmission intervals. In general you should never need to worry about or set this parameter. Ignore it and accept the default.

```
# brian.open.com.au is being tested
<Client brian.open.com.au>
  Secret 666obaFGkmRN666
  DupInterval 0
</Client>
```

### 3.13.9. RewriteUsername

This is an optional parameter. It enables you to alter the username in authentication and accounting requests. For more details and examples, see Section 8. Rewriting user names on page 454.

### 3.13.10. IdenticalClients

This optional parameter specifies a list of other clients that have an identical setup. You can use this parameter to avoid having to create separate Client clauses for lots of otherwise identical clients. The value is a list of client names or addresses, separated by white space or comma. Each client may be specified as an IP address (IPv4 or IPv6), a MAC address in the form MAC:aa-bb-cc-dd-ee-ff, or an IPv4 or IPv6 CIDR address in the form nn.nn.nn/nn. You can have any number of IdenticalClients lines.

**Tip**

When you use the Client-Id check item, it matches against the name or address in the `<Client xxxxxx>` line, but not against any of the values listed in IdenticalClients.

```
IdenticalClients 10.1.1.1 10.1.1.2 nas.mydomain.com
IdenticalClients 10.1.1.7 10.1.1.8 10.1.1.9
IdenticalClients 203.63.154.1 localhost
IdenticalClients MAC:11-22-33-44-55-66
IdenticalClients 203.10.1.0/24 220.10.0.0/16
```

### 3.13.11. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- **Client clause**

  `PreHandlerHook` is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.

- **AuthBy clause**

  The functionality depends on the used EAP authentication type:

  - **PEAP, EAP-TTLS, EAP-FAST**

    `PreHandlerHook` specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.

  - **LEAP**
If \textit{EAP\_LEAP\_MSCHAP\_Convert} flag is set, \textit{PreHandlerHook} specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- \textbf{EAP-MSCHAPv2}
  
  If \textit{EAP\_PEAP\_MSCHAP\_Convert} flag is set, \textit{PreHandlerHook} specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- \textbf{EAP-GTC}
  
  If \textit{EAP\_GTC\_PAP\_Convert} flag is set, \textit{PreHandlerHook} specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- \textbf{AuthBy DYN.Auth clause}
  
  \textit{PreHandlerHook} is called for each request created by the clause before the request is passed to a Realm or Handler clause.

- \textbf{ServerRADSEC clause}
  
  \textit{PreHandlerHook} is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

- \textbf{ServerDIAMETER clause}
  
  \textit{PreHandlerHook} is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

- \textbf{ServerTACACSPLUS clause}
  
  \textit{PreHandlerHook} is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's \textit{PrehandlerHook} is run before ServerTACASPLUS's \textit{PreHandlerHook}. Global and per-Client user name rewriting and other processing is done before the hooks are run.

A reference to the request is passed as the only argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (\) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

\textit{PreHandlerHook} can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using \textit{PreHandlerHook}:

```perl
# Fake a new attribute into the request
sub PreHandlerHook { 
  @{$_[0]}->add_attr('test-attr', 'test-value');
}
```

### 3.13.12. StatusServer

Normally, when a Status-Server request is received, Radiator replies with some statistics including the total number of requests handled, the current request rate and so on. You can control Status-Server response by setting \textit{StatusServer} to one of the following values:

- \textbf{off}
  
  Status-Server requests are ignored.

- \textbf{minimal}
  
  Reply without any attributes.
• default
  Reply with statistics.

### 3.13.13. StatusServerShowClientDetails

Normally, when a Status-Server request is received, Radiator will reply with some statistics including the total number of requests handled, the current request rate etc. When you set the optional StatusServerShowClientDetails for a Client, the reply to Status-Server will also include details about that Client. This can result in a lengthy reply packet. The default is not to send the additional Client details for any Clients.

```xml
<Client xxxxxxxx>
  # Show stats about this client in Server-Status replies
  StatusServerShowClientDetails
  Secret xxxxxxxx
  ....
</Client>
```

**Tip**
You can test sending Status-Server requests with `radpwtst -noacct -noauth -trace 4 -status`

### 3.13.14. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It can also be used in Client-Identifier matches with Handlers:

```xml
<Client 10.1.2.3>
  Identifier        www-proxy
  Secret            mysecret
</Client>
```

```xml
# www-proxy
<Handler Client-Identifier=www-proxy>
  <AuthBy FILE>
    Filename    %D/www-proxy-users
  </AuthBy>
</Handler>
```

### 3.13.15. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with `PacketTrace` set off or `0`.

`PacketTrace` is available for the following clauses:

- `Client`
- `Handler`
- `Realm`
- `AuthBy`
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- ServerDIAMETER
- ServerRADSEC
- ServerTACACSPLUS

Here is an example of using `PacketTrace`:

```bash
# Debug any packets that pass through here
PacketTrace
```

### 3.13.16. DefaultReply

This is similar to Section 3.13.20. AddToReply on page 94 except it adds attributes to an Access-Accept only if there would otherwise be no reply attributes. `StripFromReply` does never remove any attributes added by `DefaultReply`. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. You can use any of the special % formats in the attribute values. There is no default.

Although this parameter can be used in any AuthBy method, it is most useful in methods like `<AuthBy UNIX>` and `<AuthBy SYSTEM>`, which do not have a way of specifying per-user reply items. In other AuthBy methods you can also very easily set up a standard set of reply items for all users, yet you can still override reply items on a per-user basis.

```bash
# If the user had no reply items set some
DefaultReply Service-Type=Framed,Framed-Protocol=PPP
```

### 3.13.17. StripFromReply

Strips the named attributes from Access-Accepts before replying to the originating client. The value is a comma separated list of RADIUS attribute names. `StripFromReply` removes attributes from the reply before `AddToReply` adds any to the reply. There is no default. This is useful, for example, with AuthBy RADIUS to prevent downstream RADIUS servers sending attributes you do not like back to your NAS.

```bash
# Remove dangerous attributes from the reply
StripFromReply Framed-IP-Netmask,Framed-Compression
```

### 3.13.18. AllowInReply

This optional parameter is the complement to `StripFromReply`: It specifies the only attributes that are permitted in an Access-Accept. It is useful, for example, to limit the attributes that are passed back to the NAS from a proxy server. This way you can prevent downstream customer RADIUS servers from sending back illegal or troublesome attributes to your NAS.

`AllowInReply` does not prevent other attributes being added locally by `DefaultReply`, `AddToReply` and `AddToReplyIfNotExist`.

```bash
# Only permit a limited set of reply attributes.
AllowInReply Session-Timeout, Framed-IP-Address
```

### 3.13.19. AllowInReject

This optional parameter specifies the only attributes that are permitted in an Access-Reject. This can be useful in Handlers with multiple AuthBys where the attributes added before a rejecting AuthBy need to be stripped from the resulting Access-Reject.

`AllowInReject` is not set by default and does not remove anything from Access-Rejects.
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3.13.20. AddToReply

Adds attributes to reply packets. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromReply removes attributes from the reply before AddToReply adds any to the reply. You can use any of the special % formats in the attribute values. There is no default. AddToReply adds attributes to replies to all types of request that are handled by this clause.

Although this parameter can be used in any AuthBy method, it is most useful in methods like AuthBy UNIX, which don’t have a way of specifying per-user reply items.

```bash
# Append some necessary attributes for our pops
AddToReply cisco-avpair="ip:addr_pool=mypool"
```

3.13.21. AddToReplyIfNotExist

This is similar to AddToReply, but only adds an attribute to a reply if and only if it is not already present in the reply. Therefore, it can be used to add, but not override a reply attribute. This is contributed by Vincent Gillet <vgi@oleane.net>.

3.13.22. NoIgnoreDuplicates

This optional parameter specifies one or more RADIUS packet types where duplicates are not ignored. NoIgnoreDuplicates is a comma or space separated list of request types, such as:

- Access-Request
- Accounting-Request
- Status-Server

By default any request with an identical identifier received from the same NAS within the DupInterval period will be ignored or the previous reply retransmitted. If the request type is specified in NoIgnoreDuplicates, it will not be ignored, irrespective of the time since reception of a previous copy.

```bash
# Always handle dups of Accounting-Request packets
NoIgnoreDuplicates Accounting-Request
```

3.13.23. StripFromRequest

Strips the named attributes from the request before passing it to any Handlers or Realms. The value is a comma separated list of attribute names. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. There is no default.

```bash
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port
```

3.13.24. AddToRequest

Adds attributes to the request before passing it to any Handlers or Realms. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```bash
# Append a Filter-ID and host name
```
### 3. Configuring Radiator

#### 3.13.25. AddToRequestIfNotExist

Adds attributes to the request before passing it to any Handlers or Realms. Unlike AddToRequest, an attribute will only be added if it does not already exist in the request. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```text
# Append a Filter-ID and host name if they are not there already
AddToRequestIfNotExist Calling-Station-Id=1,Login-IP-Host=%h
```


This hook will be called for each request after the request has been decoded but before any other per-Client processing is done. A reference to the current request is passed as the only argument.

#### 3.13.27. RequireMessageAuthenticator

The `Client` clause usually checks the value of any `Message-Authenticator` attribute in incoming EAP or other requests, if there is any `Message-Authenticator` present. An incorrect authenticator causes the request to be ignored.

The optional `RequireMessageAuthenticator` flag causes the Client to require a correct `Message-Authenticator` attribute to be present in all incoming requests that support `Message-Authenticator` attribute. Most of the request types support `Message-Authenticator`. Accounting-Request is an exception.

#### 3.13.28. DynAuthPort

This defines a destination port to which RADIUS dynamic authorisation requests are sent. There is no default. This allows modules, such as `AuthBy DYNAUTH`, to provide a per request value that is not overwritten by this parameter. When set, a common value is 3799.

```text
# Certain vendor may default to non-standard port
<Client 172.3.2.2>
    Secret 666obaFGkmRNs666
    DynAuthPort 1700
</Client>
```

#### 3.13.29. UseMessageAuthenticator

This flag parameter adds a `Message-Authenticator` attribute to dynauth requests sent to this Client. Disabled by default.

```text
# This NAS requires Message-Authenticator for dynauth requests
<Client 172.3.2.3>
    Secret 666obaFGkmRNs666
    DynAuthPort 1700
    UseMessageAuthenticator
</Client>
```
3. Configuring Radiator

3.13.30. VsaVendor

VsaVendor sets the NAS vendor name for VsaTranslateIn and VsaTranslateOut. The NAS vendor names correspond to Perl modules in Radiator's /Radius/Nas/ directory. For more information about VSA translation, see Section 3.13.32. VsaTranslateIn on page 96.

3.13.31. VsaType

VsaVendor sets the NAS vendor type for VsaTranslateIn and VsaTranslateOut. Each NAS vendor module in Radiator can have multiple types, for example, IOS and IOS XE for Cisco. For more information about VSA translation, see Section 3.13.32. VsaTranslateIn on page 96.

3.13.32. VsaTranslateIn

Attributes in incoming and outgoing RADIUS messages can be translated to and from internal presentations. For example, different MAC address formats can be normalised for logging and values for reply attributes can now be set based on the Client or <AuthBy RADIUS> vendor type. The general format for VsaTranslateIn and VsaTranslateOut is:

\[
\text{VsaTranslateIn source_attr, dest_attr[, translation, strip|nostrip, extras]}
\]

- **source_attr** is the translation source attribute.
- **dest_attr** defines the name for the newly translated attribute.
- **translation** defaults to copy which does no modification. The available translation depend on the VsaVendor and VsaType configuration parameters.
- **strip** or **nostrip** defaults to **nostrip** for VsaTranslateIn and **strip** for VsaTranslateOut.
- **extras** depends on the translation, VsaVendor and VsaType.

Full example showing VsaVendor, VsaType, VsaTranslateIn, VsaTranslateOut, and the related configuration parameters is in goodies/vsa-translate.cfg.

```plaintext
# Translate incoming MAC address to common internal format
# and copy the DNS address in a VSA
<Client 192.168.3.49>
   Identifier juniper
   Secret mysecret

   # These control how the translation is done
   VsaVendor Juniper
   VsaType junos

   # macaddr transforms MAC addresses to and from internal presentation
   VsaTranslateIn Unisphere-Pppoe-Description, OSC-Mac-Address, macaddr

   # Convert internal presentation to what this client expects
   VsaTranslateOut OSC-DNS-Address1, Unisphere-Primary-Dns
</Client>
```

3.13.33. VsaTranslateOut

VsaTranslateOut an optional translation of attributes sent by Radiator to RADIUS clients. See VsaTranslateIn on page 96 for more information.
3. Configuring Radiator

3.13.34. NasType

This optional parameter specifies the vendor type of this Client. It is required if you want Radiator to directly query the NAS to check on simultaneous sessions.

You can specify the maximum number of sessions allowable for a single user with the Simultaneous-Use check item, or for all the users in a Realm with the MaxSessions parameter in <Realm> or <Handler> clauses. In either case, during authentication, Radiator first checks its Session Database to see if the user's session count is exceeded. For more information, see Section 3.17. <SessionDatabase SQL> on page 108 and Section 3.19. <SessionDatabase DBM> on page 113. Since this count can be inaccurate in the face of NAS reboots, lost packets etc. Radiator can also double check the count by interrogating the NAS directly (you enable this by specifying NasType in the Client clause).

If you specify unknown or do not specify any value at all, Radiator will never try to contact the NAS to check the user's sessions, and it will always assume that the sessions it thinks are present are correct. If you specify ignore, Radiator will never try to contact the NAS to check the users sessions, and it will always assume that there are no multiple sessions.

**Tip**

If Radiator detects problems or time-outs when using finger to verify simultaneous connections, it assumes that the user is still online (i.e. it assumes that the Session Database is correct).

**Tip**

You can also use NasType as a check item, to confirm that a request came from a client with a specific NasType.

The allowable values for NasType are:

<table>
<thead>
<tr>
<th>NasType</th>
<th>Method used to connect to NAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livingston</td>
<td>SNMP</td>
</tr>
<tr>
<td>Portslave</td>
<td>Finger</td>
</tr>
<tr>
<td>PortslaveLinux</td>
<td>Finger. For use with Portslave running on a Linux host, understands Linux finger format.</td>
</tr>
<tr>
<td>PortslaveMoxa</td>
<td>Finger, requires ctiportslove to be installed as fingerd on the target Linux host. Supports Linux running Portslave and a Moxa multiport.</td>
</tr>
<tr>
<td>Cisco</td>
<td>SNMP</td>
</tr>
<tr>
<td>CiscoVPDN</td>
<td>SNMP, detects users terminated on a l2tp, pptp or l2f tunnel.</td>
</tr>
<tr>
<td>Colubris</td>
<td>SNMP</td>
</tr>
<tr>
<td>Ascend</td>
<td>Finger</td>
</tr>
<tr>
<td>AscendSNMP</td>
<td>SNMP</td>
</tr>
<tr>
<td>Computone</td>
<td>Finger</td>
</tr>
</tbody>
</table>
### NasType | Method used to connect to NAS
---|---
Cyclades | SNMP
Hiper | SNMP
NomadixSNMP | SNMP
Redback | SNMP
Shiva | Finger
TotalControl | pmwho
TotalControlSNMP | SNMP
Bay, Bay5399SNMP, Bay8000SNMP | SNMP
Bay4000SNMP | SNMP
BayFinger | Finger
Tigris, TigrisNew | SNMP for new version of the Tigris MIB (i.e. firmware revision 10.1.4.14 or greater)
TigrisOld | SNMP for old versions of the Tigris MIB
NortelCVX1800 | SNMP
Xyplex | Finger
Patton | SNMP
Portmaster3 | SNMP
Portmaster4 | pmwho For use with Portmaster 4’s running ComOS 4.1 or later
Ping | Verifies a login by ICMP pinging the Framed-IP-Address of the dialup user. This is not foolproof if the IP address has been reallocated. Requires that Radiator be run with root permissions (on Unix).
ignore | Does not contact NAS under any circumstances. Always assumes that there are no multiple logins.
unknown | The default value. Does not connect to the NAS under any circumstances. Always assumes the Session Database is correct.
CiscoSessionMIB | SNMP, using the Session MIB available in Cisco IOS 12.2.15T and later.

**Tip**

You can add support for a new or custom NasTypes by adding a suitably named module to the Radius/Nas directory. Your new module should implement the isOnline function. See the existing Radius/Nas/*pm modules for examples. If you do implement your own module, send us a copy so we may include it in future releases.

Radiator uses a number of global parameters to specify how to communicate with the NAS. See Section 3.7.22. SnmpgetProg on page 34, Section 3.7.24. FingerProg on page 35, Section 3.7.25.
3. Configuring Radiator


# Make Radiator ask the NAS to confirm multiple logins.
# Its a Total Control box
NasType TotalControl

3.13.35. SNMPCommunity

This optional parameter specifies the SNMP Community name to use to connect to the NAS when NasType uses SNMP. It is ignored for any other NasType. Defaults to public.

SNMPCommunity private

3.13.36. FramedGroup

This optional parameter acts similarly to Framed-Group reply items, but it applies to all Access-Requests authenticated by this clause. If FramedGroup is set and a matching FramedGroupBaseAddress is set in the Client from where the request came, then a Framed-IP-Address reply item is automatically calculated by adding the NASPort in the request to the FramedGroupBaseAddress specified by FramedGroup. For more information, see Section 3.13.37. FramedGroupBaseAddress on page 99.

Note

You can override the value of FramedGroup for a single user by setting a Framed-Group reply item for the user.

# Work out the users IP address from the first
# FramedGroupBaseAddress specified in out client
FramedGroup 0

3.13.37. FramedGroupBaseAddress

This optional parameter is used in conjunction with the Framed-Group reply attribute or the FramedGroup AuthBy parameter to automatically generate IP addresses for users logging in. It is ignored unless the user has a Framed-Group reply item, or unless their AuthBy clause contains a FramedGroup parameter. You can have as many FramedGroupBaseAddress items as you like.

You would only need to use this mechanism if you are using a NAS that is unable to choose IP addresses from an address pool, or if you want a more complicated address allocation policy than your NAS can support.

When a user logs in, Radiator can automatically choose an IP address for the user and return it to the NAS in a Framed-IP-Address reply attribute. To make this happen, you must specify one or more FramedGroupBaseAddress items in each Client clause, and you must specify a Framed-Group reply item for each user for whom you want address allocation. If the user is authenticated, Radiator will generate a Framed-IP-Address using Framed-Group reply item and the NAS-Port in the request. The Framed-Group in a user record selects the nth FramedGroupBaseAddress (0 based) from the Client they are logging in to, and NAS-Port is added to the last byte (modulo 255 or FramedGroupMaxPortsPerClassC) to generate a Framed-IP-Address.
3. Configuring Radiator

Tip
Radiator also includes a much more sophisticated mechanism for allocating IP addresses from an SQL database or DHCP. For more information, see Section 3.55. <AuthBy DYNADDRESS> on page 227.

In the example below, if the user logs in on the Client at port 5, and their Framed-Group reply item is 1, they will be allocated a Framed-IP-Address of 10.0.1.6 (i.e. 10.0.1.1 + 5).

In the Radiator configuration file:

```
<Client ..>
  # This is the base address for Framed-Group = 0
  FramedGroupBaseAddress 10.0.0.1
  # This is the base address for Framed-Group = 1
  FramedGroupBaseAddress 10.0.1.1
  # This is the base address for Framed-Group = 2
  FramedGroupBaseAddress 10.0.2.1
  ....
</Client>
```

In the users file for each user you want to allocate an address for:

```
mikem       User-Password = "fred"
  Framed-Group = 1,
  Framed-Protocol = PPP,
  etc.
```

Alternatively, in an AuthBy clause:

```
<AuthBy whatever...>
  # This will cause all users authorised by this clause to get
  # an address allocated from the block starting 10.0.1.1,
  # unless overridden by a user-specific Framed-Group
  FramedGroup 1
  ....
</AuthBy>
```

### 3.13.38. FramedGroupMaxPortsPerClassC

This optional parameter defines the maximum number of ports that can be mapped to a class C or class B FramedGroupBaseAddress. The default is 255, which means that any address from 0 up to 255 in the 3rd or 4th octets will be permitted. It actually specifies the modulus for computing the 3rd and 4th octets of addresses calculated from FramedGroupBaseAddress. You might use this to limit the number of addresses used in each address block, or to prevent the allocation of the last address in a class C address block.

### 3.13.39. UseContentsForDuplicateDetection

This optional flag causes the Client to use an alternative duplicate detection algorithm. Normally, Client detects duplicate requests by looking at the source IP address, source IP port, the RADIUS request authenticator and the RADIUS request identifier of incoming requests. Requests with those identical attributes received in the last DupInterval seconds are deemed to be duplicates.
3. Configuring Radiator

Note
This parameter is not needed in a ServerFarm environment when shared duplicate cache is used by the farm workers. See Section 3.7.54. DupCache on page 41.

In a ServerFarm environment, where the server farm is being used to load balance using, say, the EAPBALANCE module, the back end servers will receive requests (and potentially duplicate requests) from any of the front end servers in the server farm. This can defeat the normal duplicate detection algorithm. UseContentsForDuplicateDetection causes Client to look only at the contents of the request that would not be altered by passing through a proxy server, allowing duplicates to be reliably detected, even in a server farm. The packet contents used for duplicate detection when UseContentsForDuplicateDetection is set are:

• RADIUS authenticator
• User-Name
• Called-Station-Id
• Calling-Station-Id

It is essential that this parameter be defined in the Client clauses of back end servers of an EAPBALANCE Server Farm architecture, otherwise duplicate detection will not be performed correctly.

3.13.40. DynamicReply

This optional parameter specifies a reply item that will be eligible for run-time variable substitution. That means that you can use any of the % substitutions in Section 3.3. Special formatters on page 19 in that reply item. You can specify any number of DynamicReply lines, one for each reply item you want to do replacements on. Any packet-specific replacement values will come from the Access-Accept message being constructed, and not from the incoming Access-Request. That means that special characters like %n will not be replaced by the received User-Name, because User-Name is in the request, but not the reply.

In the following example, substitution is enabled for USR-IP-Input-Filter in an AuthBy clause. When a user authenticates, the %a in the filter will be replaced by the users IP Address, which makes the filter an anti-spoof filter.

```<AuthBy whatever>
    ......
    UseAddressHint
    DynamicReply USR-IP-Input-Filter
</AuthBy>
```

In the users file:

```DEFAULT User-Password = "UNIX"
    Framed-IP-Address = 255.255.255.254,
    Framed-Routing = None,
    Framed-IP-Netmask = 255.255.255.255,
    USR-IP-Input-Filter = "1 REJECT src-addr != %a;",
    Service-Type = Framed-User```
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**Note**
This parameter used to be called Dynamic. That name is still recognised as a synonym for DynamicReply.

### 3.13.41. IgnoreAcctSignature

If you define IgnoreAcctSignature, it prevents the server from checking the authenticator Authenticator field in requests received from this client. Contrary to its name, it applies to all message types and also prevents checking the Message-Authenticator attribute. This parameter is useful because some clients do not send Authenticators that conform to RADIUS RFCs.

By default, the server logs and ignores messages that do not have a correct Authenticator, or any messages that do not have a correct Message-Authenticator attribute. Regardless of the setting of this parameter, the server always sends a correctly computed Authenticator and Message-Authenticator attribute.

**CAUTION**
This parameter is seldom required with current RADIUS implementations. You should first check that the shared secret between Radiator and client is correct before enabling this parameter.

If you get bad authenticator log messages and the accounting requests are not being stored even though authentication as such does not fail, and you have checked that the shared secrets are correct, try enabling IgnoreAcctSignature. The bad authenticator log message looks this:

| Bad authenticator in request from <client name> (<nas identifier>) |

If you get bad EAP Message-Authenticator log messages and you have checked that the shared secrets are correct, it is possible that the NAS is sending an incorrect implementation of Message-Authenticator. Try enabling IgnoreAcctSignature. The bad EAP Message-Authenticator log message looks this:

| Bad EAP Message-Authenticator |

**Tip**
Some NASs have separate secrets for authentication and accounting requests.

---

# brian.open.com.au has a broken legacy NAS

```xml
<Client 10.20.30.40>
  Identifier brian.open.com.au
  Secret 666obaFGkmRNs666
  IgnoreAcctSignature
</Client>
```

### 3.13.42. LivingstonOffs

Specifies the value of where the last S port is before the one or two ports specified in LivingstonHole are skipped (usually 22 for US, 29 for Europe). This optional parameter is only used if you are using Simultaneous-Use with a NasType of Livingston in this Client clause. Defaults to the global value of LivingstonOffs, see Section 3.7.27. LivingstonOffs on page 35.
3.13.43. LivingstonHole

Specifies the value of the size of the hole in the port list (usually 1 for US, 2 for Europe) that occurs at LivingstonOffs. This optional parameter is only used if you are using Simultaneous-Use with a NasType of Livingston in this Client clause. Defaults to the global value of LivingstonOffs, see Section 3.7.28. LivingstonHole on page 35.

3.13.44. UseOldAscendPasswords

This optional parameter tells Radiator to decode all passwords received from this Client using the old style (non RFC compliant) method that Ascend used to use on some NASs. The symptom that might indicate a need for this parameter is that passwords longer than 16 characters are not decoded properly.

3.14. <ClientListLDAP>

This optional clause allows you to specify your RADIUS clients in an LDAP database in addition to or instead of your Radiator configuration file. When Radiator starts up and receives a SIGHUP signal, it queries the LDAP database with the Search-Filter. The results of that query are used to add details of RADIUS Clients that Radiator responds to. One Client clause is created for each matching LDAP record found. <ClientListLDAP> fetches the LDAP attributes specified by the ClientAttrDef parameters, and uses them to set the parameters in each Client clause. You can have some client details in your Radiator configuration file and some in <ClientListLDAP> although this can be confusing to future administrators.

This clause supports all the common LDAP configuration parameters. For more information about the LDAP configuration parameters, see Section 3.9. LDAP configuration on page 50.

Tip
There is a sample LDAP schema compatible with the default behaviour of <ClientListLDAP> in goodies/radiator-ldap.schema in your Radiator distribution. There are some example LDAP records for this schema in goodies/radiator-ldap.ldif.

Tip
There is an example configuration file showing how to configure <ClientListLDAP> in goodies/ldapradius.cfg in your Radiator distribution.

3.14.1. BaseDN

This is the base DN, where searches are made. It is used in similar way as with all LDAP modules. For more information, see Section 3.9.1. BaseDN on page 50.

Special formatting characters are permitted.

This BaseDN use example is specifically for <ClientListLDAP>:

```
# Start looking here
BaseDN ou=RadiusClients, o=University of Michigan, c-US
```

3.14.2. SearchFilter

This parameter specifies the LDAP search filter that is used to find the LDAP records that contain Client data. The default value is (objectclass=oscRadiusClient), which is compatible with the example
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The schema provided in goodies/radiator-ldap.schema in your Radiator distribution. Special characters are supported.

This example finds oscRadiusClient LDAP objects, but only the ones for a specific location. It shows how you can use LDAP boolean expressions to select records from the LDAP database:

```plaintext
SearchFilter (&(objectclass=oscRadiusClient)(location=my_pop_1))
```

### 3.14.3. ClientAttrDef

This optional parameter specifies the name of an LDAP attribute to fetch, and the name of the Client parameter that it will be used for in the Client clause. The format is:

```plaintext
ClientAttrDef ldapattrname,clientparamname
```

where `ldapattrname` is the name of the LDAP attribute to fetch, and `clientparamname` is the name of the Client clause parameter. For more information, see Section 3.13. <Client xxxxx> on page 86. There can be (and usually are) multiple `ClientAttrDef` parameters. If the specified `ldapattrname` is not present in a record, then the matching `clientparamname` will not be set and will assume its default value according to the normal behaviour of the Client clause.

If no `ClientAttrDef` lines are defined, defaults to the equivalent of the following, which is compatible with the example schema provided in goodies/radiator-ldap.schema. Note that not all these attributes are required in your LDAP database. The only ones that must be provided are for Name and Secret.

```plaintext
ClientAttrDef oscRadiusClientName,Name
ClientAttrDef oscRadiusSecret,Secret
ClientAttrDef oscRadiusIgnoreAcctSignature,IgnoreAcctSignature
ClientAttrDef oscRadiusDupInterval,DupInterval
ClientAttrDef oscRadiusNasType,NasType
ClientAttrDef oscRadiusSNMPCommunity,SNMPCommunity
ClientAttrDef oscRadiusLivingstonOffs,LivingstonOffs
ClientAttrDef oscRadiusLivingstonHole,LivingstonHole
ClientAttrDef oscRadiusFramedGroupBaseAddress,FramedGroupBaseAddress
ClientAttrDef oscRadiusFramedGroupMaxPortsPerClassC,FramedGroupMaxPortsPerClassC
ClientAttrDef oscRadiusFramedGroupPortOffset,FramedGroupPortOffset
ClientAttrDef oscRadiusRewriteUsername, RewriteUsername
ClientAttrDef oscRadiusUseOldAscendPasswords, UseOldAscendPasswords
ClientAttrDef oscRadiusStatusServerShowClientDetails, StatusServerShowClientDetails
ClientAttrDef oscRadiusPreHandlerHook, PreHandlerHook
ClientAttrDef oscRadiusPacketTrace, PacketTrace
ClientAttrDef oscRadiusIdenticalClients, IdenticalClients
ClientAttrDef oscRadiusNoIgnoreDuplicates, NoIgnoreDuplicates
ClientAttrDef oscRadiusDefaultReply, DefaultReply
ClientAttrDef oscRadiusFramedGroup, FramedGroup
ClientAttrDef oscRadiusStripFromReply, StripFromReply
ClientAttrDef oscRadiusAllowInReply, AllowInReply
ClientAttrDef oscRadiusAddToReply, AddToReply
ClientAttrDef oscRadiusAddToReplyIfNotExist, AddToReplyIfNotExist
ClientAttrDef oscRadiusDynamicReply, DynamicReply
ClientAttrDef oscRadiusStripFromRequest, StripFromRequest
ClientAttrDef oscRadiusAddToRequest, AddToRequest
ClientAttrDef oscRadiusAddToRequestIfNotExist, AddToRequestIfNotExist
ClientAttrDef oscRadiusDefaultRealm, DefaultRealm
```
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3.14.4. RefreshPeriod

If this optional parameter is set to non-zero, it specifies the time period in seconds that ClientListLDAP will refresh the client list by rereading the database. If set to 0, then ClientListLDAP will only read the client list from the database at startup and on SIGHUP. Defaults to 0. The % formats are permitted.

```
# Reread the client list every hour
RefreshPeriod 3600
```

3.14.5. PostSearchHook

This optional parameter allows you to define a Perl function that is called after the LDAP search results have been received, and after Radiator has processed the attributes it is interested in. Hook authors can use LDAP library routines to extract other attributes and process them in any way.

`PostSearchHook` is called once for each LDAP result and allows changing client's parameters before it is instantiated.

`PostSearchHook` has the following arguments:

- Handle to the current ClientListLDAP object
- Reference to client Name. To change the name, set the reference to this argument
- Reference to a hash with client configuration parameter values collected from the entry.
- Search result entry

Here is an example of `PostSearchHook`:

```
# Do not add clients that have 'test' in their name
PostSearchHook sub {my $name = $_[1]; $$name = '' if $$name =~ 'test';}
```

**Tip**

You can change client Name as shown in the above example. If you set the name to empty string, Radiator will skip this client.

3.15. `<ClientListSQL>`

This optional clause allows you to specify your RADIUS clients in an SQL database table in addition to (or instead of) your Radiator configuration file. When Radiator starts up (and when it receives a SIGHUP signal), it queries the SQL database with the `GetClientQuery` SQL query, and the results of that query are used to add details of RADIUS Clients that Radiator will respond to. If you wish, you can have some client details in your Radiator configuration file, and some in ClientListSQL (although this might be confusing to future administrators).

This clause supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.
Tip
The example database schemas provided in the goodies directory of your Radiator distribution all include an example RADCLIENTLIST table that will work with ClientListSQL.

3.15.1. GetClientQuery

This parameter specifies the SQL query that is used to fetch client details from the SQL database specified by DBSource. The database can store all the same parameters that are used to configure a <Client> clause. For more information, see Section 3.13. <Client xxxxxx> on page 86.

The default for this parameter is:

```
select NASIDENTIFIER, SECRET, IGNOREACCTSIGNATURE, DUPINTERVAL,
   DEFAULTREALM, NATYPE, SNMPCOMMUNITY, LIVINGSTONOFFS,
   LIVINGSTONHOLE, FRAMEDGROUPBASEADDRESS,
   FRAMEDGROUPMAXPORTSPERCLASSC, REWRITEUSERNAME,
   NOIGNOREDUPDATES, PREHANDLERHOOK from RADCLIENTLIST
```

The default GetClientQuery works with the sample database schemas provided in the goodies/ of your Radiator distribution.

Your database table must include at least the first and second fields, which are the NAS name or IP address or MAC address and the shared secret. All the other fields are optional, but if they occur, they must occur in the given order. When they occur, they are used to initialise the Client parameter of the same name as shown above. The FRAMEDGROUPBASEADDRESS column may contain multiple comma-separated base addresses. The PREHANDLERHOOK column can contain either the text of a hook or a hook filename in the form 'file:/path/to/hook'. You can customise the GetClientQuery select clause to have additional fields. If they are present in the result of GetClientQuery, they are used as described below. Field number 0 as the first field, so for example Identifier, field 14 has an index of 14, but is the 15th entry in the returned array.

- Identifier field as field 14
- DefaultReply as field 15
- FramedGroup as field 16
- StripFromReply as field 17
- AllowInReply as field 18
- AddToReply as field 19
- AddToReplyIfNotExist as field 20
- DynamicReply as field 21
- AddToRequest as field 22
- StripFromRequest as field 23
- AddToRequestIfNotExist as field 24
- ClientHook as field 25
- UseContentsForDuplicateDetection as field 26

- A comma-separated list of flag names as field 27. Each comma-separated name in the field is used to set a Client flag type parameter. For example, if field 27 has the value "IgnoreAcctSignature, UseOldAscendPasswords, StatusServerShowClientDetails", it sets
the IgnoreAcctSignature, UseOldAscendPasswords, and StatusServerShowClientDetails flag parameters in the resulting Client.

```
# Our custom client table only has NAS identifier, # shared secret and default realm in it:
GetClientQuery select NAME,SECRET,NULL,NULL,DREALM from CLIENTS
```

### 3.15.2. RefreshPeriod

If this optional parameter is set to non-zero, it specifies the time period in seconds that ClientListSQL will refresh its client list by rereading the database. If set to 0, then ClientListSQL will only read the client list from the database once at startup and on SIGHUP. Defaults to 0. The % formats are permitted.

When the RefreshPeriod expires and the list of clients is read from the SQL database, any Clients previously created by this ClientList are cleared and a new set of clients read from the database. This means that Clients defined in the configuration file will not be removed. It also means that multiple ClientListSQL clauses with non-zero RefreshPeriods will not remove each others Clients.

```
# Reread the client list every hour
RefreshPeriod 3600
```

### 3.15.3. DisconnectAfterQuery

This optional parameter causes the SQL database to be disconnected after each database query. This can be helpful in cases where firewalls etc close connections that have been idle for a long time.

### 3.15.4. ConnectionHook

This optional parameter specifies a Hook that is run every time this clause connects or reconnects to the SQL database. This is most useful for executing func() to configure the database connection in customised ways. The hook is called with 2 arguments. The first is a reference to the clause object that is making the connection. The second argument is the DBH handle to the newly connected database.

In the following example, the hook calls DBI func() to configure an Interbase database connection for custom requirements:

```
ConnectionHook sub {$_[1]->func(-access_mode => 'read_write',
    -isolation_level => 'read_committed',
    -lock_resolution => 'wait',
    'ib_set_tx_param')}
```

### 3.15.5. ConnectionAttemptFailedHook

You can run this hook whenever Radiator attempts to connect to an SQL database and fails to connect. The default is to log the failure. The hook is called with 4 arguments: $object, $dbsource, $dbusername, $dbauth. $object is the SqlDb object trying to connect. The other parameters are the currently used values for DBSource, DBUsername, and DBAuth.

In the following example the default hook is replaced with a hook that logs unobscured password.

```
ConnectionAttemptFailedHook sub { \
    my $self = $_[0]; my $dbsource = $_[1]; \
    my $dbusername = $_[2]; my $dbauth = $_[3]; \
    $self->log($main::LOG_ERR, "Could not connect to SQL database with DBI->connect \
            $dbsource, $dbusername, $dbauth: $@ $DBI::errstr"); }
```
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3.15.6. NoConnectionsHook

You can run this hook whenever Radiator fails to connect to any SQL server. The default is to log the failure. The hook is called with 1 argument: $object. $object is the $SqlDb object that was trying to connect.

In the following example the default hook is replaced with a hook that logs a very short message.

```perl
NoConnectionsHook sub { 
  my $self = $_[0]; 
  $self->log($main::LOG_ERR, "Could not connect to any SQL database"); }
```

3.16. <SessionDatabase xxxxxx>

The Session Database is used to hold information about current sessions as part of Simultaneous-Use limit checking. It can also be used by external utilities for querying the on-line user population. If you do not specify a SessionDatabase clause in your configuration file, the database will be kept internal to `radiusd`, which is faster, but cannot be used to synchronise multiple instances of Radiator.

If you want to enforce Simultaneous-Use limits and you are running multiple instances of Radiator, you must specify an external Session Database for each Radiator, and you must ensure that all instances of Radiator use the same Session Database. If you fail to do this, Radiator will not be able to correctly enforce Simultaneous-Use limits, and may allow people to log in who have already exceeded their limit.

3.16.1. Identifier

This optional parameter assigns a name to the Session Database, so it can be referred to in other parts of the configuration file, such as the SessionDatabase parameter in `Handler`.

```plaintext
# Here is a useful name for this Session Database
Identifier xxxxxx
```

3.17. <SessionDatabase SQL>

This optional clause specifies an external SQL Session Database for `radiusd`.

`SessionDatabase SQL` has a number of customisable SQL statements (AddQuery, DeleteQuery, UpdateQuery, ReplaceQuery, ClearNasQuery and CountQuery). These statements are used to add, remove, maintain and count the entries in the SQL Session Database. The default statements will work with the example RADONLINE table in the example SQL schemas in the goodies directory. If you wish, you can use more or fewer columns in your SQL Session Database, and you can change the names of the columns or the table. If you do use a different table schema, you will probably have to change statements to match your schema.

Radiator 4.22 added new SQL statements AddSessionQuery, GetSessionQuery, UpdateSessionQuery and DeleteSessionQuery. See `goodies/hotspost.sql` for a sample database schema used by `goodies/hotspot-fidelio.cfg`.

You can configure the SQL database(s) that `SessionDatabase SQL` uses by defining one or more DBSource, DBUsername and DBAuth lines. For more information about SQL configuration and failure behaviour, see Section 3.8. SQL configuration on page 43.

`SessionDatabase SQL` is tolerant of database failures. If your database server goes down, Radiator will try to reconnect to a database as described above, starting again at the first database you specified. Whichever database Radiator connects to, it will stay connected to it until that database becomes unreachable, at which time it will again search for a database, starting at the first again. If on the other hand, Radiator is not able to connect to any SQL server, it will stop enforcing Simultaneous-Use limits until one of its databases comes back on line.
SessionDatabase SQL understands also the same parameters as SessionDatabase xxxxxx. For more information, see Section 3.16. SessionDatabase xxxxxx on page 108. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

### 3.17.1. SQL Bind Variables

All SessionDatabase SQL statements support SQL bind variables. For more information, see Section 3.8.1. SQL bind variables on page 45. An example of DeleteQuery with bind variables is:

```sql
DeleteQuery delete from RADONLINE where NASIDENTIFIER =? and NASPORT=?
DeleteQueryParam %1
DeleteQueryParam %2
```

### 3.17.2. AddQuery

This SQL statement is executed whenever a new user session starts (i.e., when an Accounting-Request Start message is received). It is expected to record the details of the new session in the SQL database. Special formatting characters may be used (the %{attribute} ones are probably the most useful). Special formatting characters may be used. %1 by the NAS IP address, %2 by the NAS-Port, %3 by the SQL quoted Acct-Session-Id. If AddQuery is defined as an empty string, then the query will not be executed.

%0 is replaced by the quoted original user name or rewritten user name, see Section 3.30.23. SessionDatabaseUseRewrittenName on page 140.

It defaults to:

```sql
insert into RADONLINE (USERNAME, NASIDENTIFIER, NASPORT, ACCTSESSIONID, TIME_STAMP, FRAMEDIPADDRESS, NASPORTTYPE, SERVICETYPE) values (%0, '%1', %2, %3, %{Timestamp}, '%{Framed-IP-Address}', '%{NAS-Port-Type}', '%{Service-Type}')
```

### 3.17.3. DeleteQuery

This SQL statement is executed whenever a user session finishes (i.e., when an Accounting-Request Stop message is received). It is expected to remove the details of the session from the SQL database. Special formatting characters may be used. %1 by the NAS IP address, %2 by the NAS-Port, %3 by the SQL quoted Acct-Session-Id and %4 by the Framed-IP-Address. If DeleteQuery is defined as an empty string, then the query will not be executed.

%0 is formatted as defined in section Section 3.17.2. AddQuery on page 109. Section 3.8.1. SQL bind variables on page 45 are supported.

It defaults to:

```sql
delete from RADONLINE where NASIDENTIFIER='%1' and NASPORT=0%2
```

### 3.17.4. UpdateQuery

This SQL statement is executed whenever Accounting-Request Alive or Interim-Update message is received. It is expected to update the details of the session in the SQL database. Special formatting characters may be used (the %{attribute} ones are probably the most useful). %1 by the NAS IP address, %2 by the NAS-Port, %3 by the SQL quoted Acct-Session-Id. If UpdateQuery is defined as an empty string, then the query will not be executed and ReplaceQuery, if defined, or AddQuery otherwise, will be used. The default is the empty string.
%0 is formatted as defined in section Section 3.17.2. AddQuery on page 109. Section 3.8.1. SQL bind
variables on page 45 are supported.

### 3.17.5. ClearNasQuery

This SQL statement is executed whenever a NAS reboot is detected. It is expected to clear the details of all
sessions on that NAS from the SQL database. Special formatting characters may be used (the %{attribute} ones
are probably the most useful). %0 is replaced by the NAS identifier. If ClearNasQuery is defined as an empty
string, then the query will not be executed. SQL bind variables are supported.

It defaults to:

```sql
delete from RADONLINE where NASIDENTIFIER='%0'
```

### 3.17.6. CountQuery

This SQL statement is executed whenever a Simultaneous-Use check item or MaxSessions must be checked
during an Access-Request. It is expected to find and return details of all the user sessions currently in the
Session Database for the given User-Name. For each entry, it is expected to return the NAS-Identifier, NAS-
Port and Acct-Session-Id, IP Address and optionally a user name (in that order) of each session currently
in the Session Database. The returned rows are counted, and if there are apparently too many sessions,
SessionDatabase SQL will query each NAS and port to confirm if the user is still on line at that port with that
session ID. If a user name is present as the fifth field returned by the query, that is the user name that will be
used to confirm the user is still on line. If CountQuery is defined as an empty string, then the query will not be
executed, and the current session count will be fixed at 0.

%0 is formatted as defined in section Section 3.17.2. AddQuery on page 109. %1 replaced by the AuthBy’s
DefaultSimultaneousUse, Simultaneous-Use check item or Handler's Max-Sessions value, depending on the
context. SQL bind variables are supported.

It defaults to:

```sql
select NASIDENTIFIER, NASPORT, ACCTSESSIONID, FRAMEDIPADDRESS, 
       FRAMEDIPADDRESS from RADONLINE where USERNAME=%0
```

---

**Tip**

You can make SessionDatabase SQL count sessions in different ways depending on how you want
to restrict your sessions. For example, you could limit the number of users permitted to log in to a
particular realm with something like:

```sql
CountQuery select NASIDENTIFIER, NASPORT, ACCTSESSIONID, FRAMEDIPADDRESS, 
       FRAMEDIPADDRESS from RADONLINE where USERNAME like ? 
CountQueryParam %@@%R
```

If your Session Database table included the Called-Station-Id for each session, you could limit the
maximum number of users with the same Called-Station-ID with something like:

```sql
CountQuery select NASIDENTIFIER, NASPORT, ACCTSESSIONID, FRAMEDIPADDRESS, 
       FRAMEDIPADDRESS from RADONLINE where CALLEDSTATIONID = ? 
CountQueryParam %{Called-Station-Id}
```

---

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### 3.17.7. ReplaceQuery

If this optional parameter is defined, it will be used to replace a record in the session database. If it is not defined, DeleteQuery and AddQuery will be used instead. By default, ReplaceQuery is not defined. %1 by the NAS IP address, %2 by the NAS-Port, %3 by the SQL quoted Acct-Session-Id.

%0 is formatted as defined in section Section 3.17.2. AddQuery on page 109. Section 3.8.1. SQL bind variables on page 45 are supported.

This option is provided because some databases (such as MySQL) offer a more efficient way to ‘insert or replace’ queries. Special formatting characters may be used.

### 3.17.8. CountNasSessionsQuery

This SQL statement is executed whenever Radiator needs the number of sessions currently logged on to a particular NAS. This is only required if HandleAscendAccessEventRequest is defined and an Ascend-Access-Event-Request is received. %1 is replaced by the NAS IP address. SQL bind variables are supported.

It defaults to:

```sql
SELECT ACCTSESSIONID FROM RADONLINE WHERE NASIDENTIFIER='%0'
```

### 3.17.9. ClearNasSessionQuery

This SQL statement is executed whenever Radiator needs the number of sessions currently logged on to a particular NAS. This is only required if HandleAscendAccessEventRequest is defined and an Ascend-Access-Event-Request is received and Radiator finds that there is a session in the session database that is not recorded in the NAS. %0 is replaced by the NAS IP address and %1 is replaced by the session ID. SQL bind variables are supported.

It defaults to:

```sql
DELETE FROM RADONLINE WHERE NASIDENTIFIER='%0' AND ACCTSESSIONID = %1
```

### 3.17.10. SessionIdentifier

This optional parameter sets the name of a Radius attribute which is used to identify a session. It is useful, for example, when the authentication request contains the session identifier attribute for the subsequent accounting session. The default value is Acct-Session-Id.

# This vendor sends id of subsequent accounting session during authentication
```
SessionIdentifier Vendor=Session-Id
```

### 3.17.11. AddSessionQuery

An SQL statement to add a new session. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If AddSessionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are replaced with session parameter names and their values, respectively, and can not currently be used as SQL bind parameters.

AddSessionQuery defaults to:

```sql
INSERT INTO SESSIONS (%0) VALUES (%1)
```
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3.17.12. GetSessionQuery

An SQL statement to get a session. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If GetSessionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are undefined.

GetSessionQuery defaults to:

```
SELECT * FROM SESSIONS WHERE tenant_id=%2 AND (name=%4 OR id=%3)
```

3.17.13. UpdateSessionQuery

An SQL statement to update an existing session. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If UpdateSessionQuery is defined as an empty string, then the query will not be executed.

%0 contains list of session key=value pairs and can not currently be used as a SQL bind parameter. %1 is undefined.

UpdateSessionQuery defaults to:

```
UPDATE SESSIONS SET %0 WHERE tenant_id=%2 AND id=%3
```

3.17.14. DeleteSessionQuery

An SQL statement to delete a session. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If DeleteSessionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are undefined.

DeleteSessionQuery defaults to:

```
DELETE FROM SESSIONS WHERE tenant_id=%2 AND id=%3
```

3.18. <SessionDatabase REDIS>

(SessionDatabase REDIS) provides support for using GossipRedis as session database backend. For more information about GossipRedis, see Section 3.134. <GossipRedis> on page 400. <SessionDatabase REDIS> supports SessionDatabase methods to query all sessions and specific sessions for a user. These provide support for RFC 5176 dynamic authorisation support for sending Disconnect-Request and CoA-Request messages. See SessionDatabase REDIS sample file goodies/sess-redis.cfg.

(SessionDatabase REDIS) is currently experimental and will be fully documented later.

(SessionDatabase REDIS) understands also the same parameters as <SessionDatabase xxxxxx>. For more information, see Section 3.16. <SessionDatabase xxxxxx> on page 108.

3.18.1. SessionIdentifier

This optional parameter sets the name of a Radius attribute which is used to identify a session. It is useful, for example, when the authentication request contains the session identifier attribute for the subsequent accounting session. The default value is Acct-Session-Id.

```
# This vendor sends id of subsequent accounting session during authentication
SessionIdentifier Vendor-Session-Id
```
3.19. <SessionDatabase DBM>

This optional clause specifies an external DBM file Session Database for \textit{radiusd}. The Session Database is used to hold information about current sessions as part of Simultaneous-Use limit checking. It can also be used by external utilities for querying the online user population. If you do not specify a SessionDatabase clause, the database will be kept internal to \textit{radiusd}, which is faster, but does not make the data available to other processes.

\textbf{CAUTION}

Because Radiator does not lock the DBM file, a single SessionDatabase DBM file should never be used by more than one instance of Radiator. When attempting to enforce Simultaneous-Use limits across multiple Radiator servers, always use Session-Database SQL.

Radiator will choose the best format of DBM file available to you, depending on which DBM modules are installed on your machine. (Hint: You can force it to choose a particular format by using the \texttt{DBType} parameter)

\texttt{<SessionDatabase DBM>} understands also the same parameters as \texttt{<SessionDatabase xxxxxx>}. For more information, see Section 3.16. \texttt{<SessionDatabase xxxxxx>} on page 108.

3.19.1. Filename

Specifies the filename that holds the Session Database. Defaults to \texttt{%D/online}. The actual file names will depend on which DBM format Perl selects for you, but will usually be something like \texttt{online.dir} and \texttt{online.pag} in \texttt{DbDir}. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19.

\begin{verbatim}
# Session database in called online2.* in DbDir
Filename %D/online
\end{verbatim}

3.19.2. DBType

By default, Radiator and Perl will choose the ‘best’ format of DBM file available to you, depending on which DBM modules are installed on your machine. You can override this choice by specifying \texttt{DBType} as the name of one of the DBM formats supported on your platform. The typical choices are:

- \texttt{AnyDBM\_File}
- \texttt{NDBM\_File}
- \texttt{DB\_File}
- \texttt{GDBM\_File}
- \texttt{SDBM\_File}
- \texttt{ODBM\_File}

But not may be available on your platform. The default is \texttt{AnyDBM\_File}, which chooses the best available implementation.

\begin{verbatim}
# Force it to use DB\_File
DBType DB\_File
\end{verbatim}
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3.19.3. SessionIdentifier

This optional parameter sets the name of a Radius attribute which is used to identify a session. It is useful, for example, when the authentication request contains the session identifier attribute for the subsequent accounting session. The default value is Acct-Session-Id.

```
# This vendor sends id of subsequent accounting session during authentication
SessionIdentifier Vendor-Session-Id
```

3.20. <SessionDatabase NULL>

This type of session database stores no session details and always permits multiple logins. It is useful in environments with large user populations, and where no simultaneous-use prevention is required. <SessionDatabase NULL> uses much less memory and fewer CPU cycles than <SessionDatabase INTERNAL> (which is the default session database). The code for <SessionDatabase NULL> was contributed by Daniel Senie (dts@senie.com).

(SessionDatabase NULL) understands also the same parameters as <SessionDatabase xxxxxx>. For more information, see Section 3.16. <SessionDatabase xxxxxx> on page 108.

3.21. <ServiceDatabase xxxxxx>

A Service Database holds information about services and subscriptions. Examples of services are data plans and pre-paid packages offered by hotspot services. Service attributes can be data and time quota, bandwidth limitations, pre- and post-paid requirements. Some services may also place restrictions to re-subscribing the service and have special requirements to the action taken when quota is exceeded.

When a user subscribes to a service, a Service Database also keeps track of per-user subscription state. For example, if a user currently has no active session, there is no entry in a Session Database, but any resources applicable for a service that the user has subscribed to, is tracked by a subscription entry in a Service Database.

If you are running multiple instances of Radiator which all provide the same service, for example a hotspot service, you must specify an external Service Database for each Radiator, and you must ensure that all instances of Radiator use the same Service Database. If you fail to do this, Radiator will not be able to correctly track usage. This requirement is similar to SessionDatabase, see Section 3.16. <SessionDatabase xxxxxx> on page 108 for more information.

See goodies/README.hotspot and goodies/hotspot.cfg for a configuration sample.

3.21.1. Identifier

This optional parameter assigns a name to the Service Database, so it can be referred to in other parts of the configuration file, such as the ServiceDatabase parameter in AuthBy HOTSPOT.

```
# Allow other parts of configuration to refer to this Service Database
Identifier xxxxxx
```

3.21.2. Tenant

This optional parameter assigns a name to the Service Database. For example, if the same SQL database is used with multiple Service Databases that need to be disjoint, these databases should be configured with different Tenant value. This parameter defaults to default.

```
# We use one database for multiple hotels
Tenant hotspot-hotell
```
3.22. `<ServiceDatabase INTERNAL>`

This optional clause specifies an internal Service Database for `radiusd`.

`SessionDatabase SQL` is simple to configure but can not be used to synchronise multiple instances of `Radiator`. Internal Service Database loses all information when `radiusd` is shut down.

`ServiceDatabase INTERNAL` understands also the same parameters as `ServiceDatabase xxxxxx`. For more information, see Section 3.21. `<ServiceDatabase xxxxxx>` on page 114.

3.22.1. Service

This optional parameter defines one service for a Service Database. You can define multiple `Service` parameters. Format is "key1:value1 key2:value2 ...".

Supported keys are:

- id
- name
- price
- poolIPv4
- poolIPv6
- checkItems
- replyItems
- requireConfirm
- expiry
- prepaidTime
- postpaidTime
- prepaidQuota
- postpaidQuota
- allowQuotaToExceed
- disallowResubscribe
- prepaidUpRate
- prepaidDownRate
- postpaidUpRate
- postpaidDownRate
- throtUpRate
- throtDownRate

For example a sample configuration, see goodies/README.hotspot and goodies/hotspot.cfg. Here is an example of defining multiple Services.

```
# Service 1: free, 1 hour, 50M data, no policers
Service name:free price:0 prepaidTime:1h prepaidQuota:50M \ 
    replyItems:"OSC-AVPAIR=Test1,OSC-AVPAIR=Test2"

# Service 2: price 1000 cents, 1 day, 100M data, 100M/10M policers
```
3. Configuring Radiator

Service name: premium price: 1000 prepaidTime: 24h prepaidQuota: 100M
  prepaidUpRate: 10M prepaidDownRate: 100M

# Service 3: price 2000 cents, 1 day, 1G data, 100M/100M polcers
Service name: gold price: 2000 prepaidTime: 24h prepaidQuota: 1G
  prepaidUpRate: 100M prepaidDownRate: 100M

3.23. <ServiceDatabase SQL>

This optional clause specifies an external SQL Service Database for \textit{radiusd}.

\texttt{ServiceDatabase SQL} has a number of customisable SQL statements (AddServiceQuery, GetServiceQuery, UpdateServiceQuery, DeleteServiceQuery, AddSubscriptionQuery, GetSubscriptionQuery, UpdateSubscriptionQuery and DeleteSubscriptionQuery). These statements are used to access the entries in the SQL Service Database. The default statements will work with the example SERVICES and SUBSCRIPTIONS tables in the example SQL schema in file \texttt{goodies/hotspot.sql}. If you wish, you can use more or fewer columns in your SQL Service Database, and you can change the names of the columns or the table. If you do use a different table schema, you will probably have to change statements to match your schema.

You can configure the SQL database(s) that \texttt{ServiceDatabase SQL} uses by defining one or more DBSource, DBUsername and DBAuth lines. For more information about SQL configuration and failure behaviour, see Section 3.8. SQL configuration on page 43.

\texttt{ServiceDatabase SQL} understands also the same parameters as \texttt{ServiceDatabase xxxxxx}. For more information, see Section 3.21. \texttt{<ServiceDatabase xxxxxx>} on page 114. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

3.23.1. SQL Bind Variables

All ServiceDatabase SQL statements support SQL bind variables. Certain exceptions are documented for each query. For more information, see Section 3.8.1. SQL bind variables on page 45. An example of DeleteSubscriptionQuery with bind variables is:

\begin{verbatim}
DeleteSubscriptionQuery DELETE FROM SUBSCRIPTIONS WHERE tenant_id=? AND id=?
DeleteSubscriptionQueryParam %2
DeleteSubscriptionQueryParam %3
\end{verbatim}

3.23.2. AddServiceQuery

An SQL statement to add a new service. Special formatting characters may be used. Special variable \%2 contains a tenant id, \%3 contains object's id and \%4 contains object's name. If AddServiceQuery is defined as an empty string, then the query will not be executed.

\%0 and \%1 are replaced with service parameter names and their values, respectively, and can not currently be used as SQL bind parameters.

\texttt{AddServiceQuery} defaults to:

\begin{verbatim}
INSERT INTO SERVICES (\%0) VALUES (\%1)
\end{verbatim}

3.23.3. GetServiceQuery

An SQL statement to get a service. Special formatting characters may be used. Special variable \%2 contains a tenant id, \%3 contains object's id and \%4 contains object's name. If GetServiceQuery is defined as an empty string, then the query will not be executed.
%0 and %1 are undefined.

GetServiceQuery defaults to:

```
SELECT * FROM SERVICES WHERE tenant_id=%2 AND (name=%4 OR id=%3)
```

### 3.23.4. UpdateServiceQuery

An SQL statement to update an existing service. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If UpdateServiceQuery is defined as an empty string, then the query will not be executed.

%0 contains list of service key=value pairs and can not be currently used as a SQL bind parameter. %1 is undefined.

UpdateServiceQuery defaults to:

```
UPDATE SERVICES SET name=%4 WHERE tenant_id=%2 AND id=%3
```

### 3.23.5. DeleteServiceQuery

An SQL statement to delete a service. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If DeleteServiceQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are undefined.

DeleteServiceQuery defaults to:

```
DELETE FROM SERVICES WHERE tenant_id=%2 AND id=%3
```

### 3.23.6. AddSubscriptionQuery

An SQL statement to add a new subscription. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If AddSubscriptionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are replaced with subscription parameter names and their values, respectively, and can not currently be used as SQL bind parameters.

AddSubscriptionQuery defaults to:

```
INSERT INTO SUBSCRIPTIONS (%0) VALUES (%1)
```

### 3.23.7. GetSubscriptionQuery

An SQL statement to get a subscription. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If GetSubscriptionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are undefined.

GetSubscriptionQuery defaults to:

```
SELECT * FROM SUBSCRIPTIONS WHERE tenant_id=%2 AND (name=%4 OR id=%3)
```
3.23.8. UpdateSubscriptionQuery

An SQL statement to update an existing subscription. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If UpdateSubscriptionQuery is defined as an empty string, then the query will not be executed.

%0 contains list of subscription key=value pairs and can not currently be used as a SQL bind parameter. %1 is undefined.

UpdateSubscriptionQuery defaults to:

```
UPDATE SUBSCRIPTIONS SET %0 WHERE tenant_id=%2 AND id=%3
```

3.23.9. DeleteSubscriptionQuery

An SQL statement to delete a subscription. Special formatting characters may be used. Special variable %2 contains a tenant id, %3 contains object's id and %4 contains object's name. If DeleteSubscriptionQuery is defined as an empty string, then the query will not be executed.

%0 and %1 are undefined.

DeleteSubscriptionQuery defaults to:

```
DELETE FROM SUBSCRIPTIONS WHERE tenant_id=%2 AND id=%3
```

3.24. <Log FILE>

This optional clause creates a FILE logger, which logs all messages with a priority level of Trace or more to a file. The logging is in addition to any logging to the file defined by global LogFile. For more information, see Section 3.7.13. LogFile on page 32. The log file is opened, written, and closed for each message, which means you can rotate it at any time.

**Tip**
The logger becomes active when it is encountered in the configuration file. It logs parse errors from later in the configuration file and subsequent run-time events. Parse errors from earlier in the configuration file are not logged through this clause.

**CAUTION**
Logging to STDOUT by specifying Filename as a single dash – is no longer supported in Radiator 4.18.

**Tip**
Global LogFile and Trace configuration parameters are basically the same as the following:

```
<Log FILE>
  #Trace 0
  Filename filename
</Log>
```
## Tip
You can place `<Log xxxxxx>` clause inside any clause in the configuration file. This causes messages originating from within that clauses code to be logged with the logger prior to being logged with any global loggers. This can be handy for debugging or tracing only certain Handler or AuthBy clauses:

```xml
<Handler>
  # This logs messages from within the Handler
  <Log FILE>
    Trace 4
    Filename xxxxxx
    ...
  </Log>
</Handler>
```

### 3.24.1. Filename
This specifies the name of the log file. The file name can include special characters. For more information, see Section 3.3. Special formatters on page 19. The default value is `%L/logfile`, a file named logfile in LogDir. For more information, see Section 3.7.12. LogDir on page 32. Special character `%0` is replaced by the priority integer and `%1` by the log message.

Here is an example of using `Filename`:

```
# Log file goes in /var/log, with year number
Filename /var/log/%Y-radius.log
```

If `Filename` starts with a vertical bar character `|`, the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output is appended to the named file.

```
# Pipe to my-log-prog
Filename |/usr/local/bin/my-log-prog
```

### 3.24.2. Trace
This parameter defines the priority level of messages to be traced. For more information, see Section 3.7.3. Trace on page 28.

**Note**
Packet dumps appear only if the global Trace level is set to 4 or more.

### 3.24.3. LogMicroseconds
This optional parameter makes `<Log FILE>` to log the current microseconds at the end of the time string.

### 3.24.4. LogTraceId
`LogTraceId` flag parameter allows logging messages related to an authentication exchange and to its subsequent accounting session with a tracing identifier. `LogTraceId` can be configured for global level and Log clause level. `LogTraceId` enables prepending a tracing ID to messages logged to STDOUT, when `LogStdout` is enabled, and to log file configured with `<Log FILE>` and `<Log SYSLOG>`. For more information, see Section 3.7.2. LogStdout on page 28.
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**Tip**
Support for using the same tracing identifier with accounting messages requires enabling parameter in the authenticating Handler clause. For more information, see Section 3.30.37. AutoClass on page 144.

Tracing ID works in conjunction with the Radiator load balancer allowing coordinated log message indexing and lookup between frontend load balancers and backend workers.

```bash
# Prepend tracing id to log messages
LogTraceId
```

### 3.24.5. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It can also be referred to by `Log xxxxxxx` in any other clause.

Here is an example of using **Identifier**:

```bash
<AuthBy whatever>
    # With an Identifier, can refer to this logger from other clauses
    <Log FILE>
        Identifier mylogger
        Filename xxxxxxx
    </Log>
    ....
</AuthBy>
<AuthBy whatever>
    # This AuthBy will log to the Log FILE above
    Log mylogger
    ..... 
</AuthBy>
```

### 3.24.6. IgnorePacketTrace

This parameter excludes this logger from **PacketTrace** debugging. For more information, see Section 3.13.15. PacketTrace on page 92.

### 3.24.7. LogFormat

This optional parameter permits you to customise the log string when **LogFormatHook** is not defined. Special formatting characters are permitted. The variables are replaced as follows:

- `%0` by the message severity as an integer
- `%1` by the severity as a string
- `%2` by the log message
- `%3` by tracing identifier string

When using `<Log FILE>`, there is no default value for **LogFormat** and the format is similar to `LogFormat %1:%1:%2`.

When using `<Log SYSLOG>`, there is no default value for **LogFormat** and the format is similar to `LogFormat %2`. 
3.24.8. LogFormatHook

This specifies an optional Perl hook that runs for each log message when defined. The hook must return the formatted log message. By default, no hook is defined and LogFormat or the default format is used. The hook parameters are the following:

- Message severity (integer)
- Log message
- Reference to the current request
- Tracing identifier (string)

See goodies/logformat.cfg for a sample configuration file with JSON and CEF (ArcSight Common Event Format) formats.

**Note**
Consider installing JSON::XS for higher performance JSON encoding.

3.25. `<Log SYSLOG>`

This optional clause creates a SYSLOG logger, which logs all messages with a priority level of Trace or more to the syslog system. `<Log SYSLOG>` requires Sys::Syslog. The logging is in addition to any logging to the file defined by LogFile. For more information, see Section 3.7.13, LogFile on page 32.

Messages are logged to syslog with priority levels that depend on the severity of the message. There are 5 defined priority levels and they are logged to the equivalent syslog priority. See the Trace parameter for a description of the priority levels supported.

Ensure that your host's syslog is configured to do something with err, warning, notice, info, and debug priority messages from the Syslog facility you specify, otherwise you do not see any messages. See `/etc/syslog.conf` or its equivalent on your system.

**Tip**
The logger becomes active when it is encountered in the configuration file. It logs parse errors from later in the configuration file and subsequent run-time events. Parse errors from earlier in the configuration file are not logged through this clause.

**Tip**
You can place a `<Log xxxxxx>` clause inside any clause in the configuration file. This causes messages originating from within that clauses code to be logged with the logger prior to being logged with any global loggers. This can be handy for debugging or tracing only certain Realms or AuthBy clauses:

```xml
<Handler>
    # This will log messages from within the Handler
    <Log SYSLOG>
        #Trace 2
    ...
</Log>
```
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3.25. Facility

This defines the name of the syslog facility that will be logged to. The default value is `user`. Here is an example of using `Facility`:

```
# Log to the syslog facility called 'radius'
Facility radius
```

3.25.2. Trace

This defines the priority level of messages to be traced. For more information, see Section 3.7.3. Trace on page 28.

**Tip**

Packet dumps appear only if the global Trace level is set to 4 or more.

3.25.3. IgnorePacketTrace

Exclude this logger from PacketTrace debugging.

3.25.4. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It can also be referred to by `<Log xxxxxx>` in any other clause.

```
<AuthBy whatever>
    # With an Identifier, can refer to this logger from
    # other clauses
    <Log SYSLOG>
        Identifier mylogger
        Facility user
    </Log>
    ....
</AuthBy>
<AuthBy whatever>
    # This AuthBy will log to the Log SYSLOG above
    Log mylogger
    ....
</AuthBy>
```

3.25.5. LogSock

This optional parameter specifies what type of socket to use to connect to the syslog server. The possible values are:

- `native`
- `eventlog`
- `unix`
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- **inet**
  This means that TCP is tried first, then UDP.
- **tcp**
- **udp**
- **stream**
- **pipe**
- **console**

The default is to use the `Sys::Syslog` default of `native, tcp, udp, unix, pipe, stream, console`.

---

**CAUTION**

Due to limitations in the `Sys::Syslog` Perl module, if you have multiple Auth-Log SYSLOG or Log SYSLOG clauses and if any one has `LogSock` defined, all of them must have `LogSock` defined.

---

**Note**

If you use TCP, we recommend you to define both `LogHost` and `LogPort`. If you have not defined `LogPort` and you see error "TCP service unavailable", this means `Sys::Syslog` is unable to find the destination port. To resolve this, either use `LogPort` to define the port or add `syslog/tcp` or `syslogng/tcp` definitions to `/etc/services` file. For more information about `LogPort`, see Section 3.25.10. LogPort on page 124.

---

### 3.25.6. LogPath

When `LogSock` is set to unix or stream or pipe, this optional parameter specifies the syslog path. Defaults to `_PATH_LOG` macro (if your system defines it).

```bash
LogPath /run/mysyslog/log.sock
```

### 3.25.7. LogHost

When `LogSock` is set to tcp or udp or inet, this optional parameter specifies the name or address of the syslog host. Defaults to the local host. Special characters are supported.

**Note**

The `LogHost` parameter is passed directly to Perl's `Sys::Syslog` module which will likely do a DNS query for each logged message. This can cause performance problems and high number of DNS requests with verbose log levels. It is recommended to log to local host and let the local syslog to do remote logging.

```bash
# Log to a remote host via syslog over udp:
LogSock udp
LogHost your.syslog.host.com
```
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3.25.8. LogOpt

This optional parameter allows control over the syslog options passed to Sys::Syslog::openlog. LogOpt is a comma separated list of words from the set:

- cons
- ndelay
- nofatal
- nowait
- perror
- pid

As described in the Perl Sys::Syslog documentation.

Defaults to **pid**. Special characters are supported.

LogOpt pid,perror

3.25.9. LogIdent

This optional parameter specifies an alternative ident name to be used for logging. Defaults to the executable name used to run radiusd. Special characters are supported.

3.25.10. LogPort

This optional parameter specifies an alternative TCP or UDP destination port on the syslog host. There is no default, which means Sys::Syslog chooses the port. Here is an example of using LogPort:

LogPort 5514

**CAUTION**

This parameter requires Sys::Syslog 0.28 or later.

3.25.11. LogFormat

This optional parameter permits you to customise the log string when LogFormatHook is not defined. Special formatting characters are permitted. The variables are replaced as follows:

- %0 by the message severity as an integer
- %1 by the severity as a string
- %2 by the log message
- %3 by tracing identifier string

When using `<Log FILE>`, there is no default value for LogFormat and the format is similar to LogFormat %1:%1:%2.

When using `<Log SYSLOG>`, there is no default value for LogFormat and the format is similar to LogFormat %2.
3.25.12. LogFormatHook

This specifies an optional Perl hook that runs for each log message when defined. The hook must return the formatted log message. By default, no hook is defined and `LogFormat` or the default format is used. The hook parameters are the following:

- Message severity (integer)
- Log message
- Reference to the current request
- Tracing identifier (string)

See `goodies/logformat.cfg` for a sample configuration file with JSON and CEF (ArcSight Common Event Format) formats.

**Note**
Consider installing JSON::XS for higher performance JSON encoding.

3.25.13. MaxMessageLength

This optional parameter specifies a maximum message length (in characters) for each message to be logged. If specified, each log message is truncated to the specified number of characters prior to logging. Defaults to 0, which means no truncation.

3.26. <Log SQL>

This optional clause creates an SQL logger, which will log all messages with a priority level of Trace or more to an SQL database. The logging is in addition to any logging to the file defined by LogFile. For more information, see Section 3.7.13. LogFile on page 32. This clause supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

The messages are inserted with the following SQL statement:

```
insert into tablename (TIME_STAMP, PRIORITY, MESSAGE)
values (time, priority, 'message')
```

You must create a table to insert into before you can use this clause. There are example logging tables created in the example SQL files in the `goodies/` directory of the Radiator distribution.

**Tip**
The logger becomes active when it is encountered in the configuration file. It will log parse errors from later in the configuration file and subsequent run-time events. Parse errors from earlier in the configuration file will not be logged through this clause.

**Tip**
You can place a `<Log xxxxxx>` clause inside any clause in the configuration file. This will cause messages originating from within that clauses code to be logged with the logger prior to being logged.
with any global loggers. This can be handy for debugging or tracing only certain Realms or AuthBy clauses:

```xml
<Handler>
  # This will log messages from within the Handler
  <Log SQL>
    #Trace 2
    DBSource dbi:......
    ...
  </Log>
</Handler>
```

**Tip**
It is good practice to use a different DBSource than for other SQL clauses in your configuration file. This allows SQL errors on DBSource to be logged.

### 3.26.1. Table

Defines the name of the SQL table to insert into. Defaults to ‘RADLOG’. Special formatting characters are permitted.

```xml
# Insert into a table called mylog
Table mylog
```

**Tip**
You could have Log SQL log to a different table every month with something like:

```xml
Table RADLOG%Y%m
```

### 3.26.2. Trace

Defines the priority level of messages to be traced. For more information, see Section 3.7.3. Trace on page 28.

**Note**
Packet dumps will only appear if the global Trace level is set to 4 or more.

### 3.26.3. IgnorePacketTrace

Exclude this logger from PacketTrace debugging.

### 3.26.4. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It can also be referred to by `<Log xxxxxx>` in any other clause.
3.26.5. LogQuery

This optional parameter allows you to control the SQL query that is used to insert log messages into the database. Special formatting characters are permitted.

The default is:

```
insert into %3 (TIME_STAMP, PRIORITY, MESSAGE)
values (%t, %0, %2)
```

The variables are:

- `%t` is translated as a special character to the current time.
- `%0` is converted to the message priority (in integer in the range 0 to 4 inclusive).
- `%1` is converted to an ASCII string describing the message priority.
- `%2` is converted to the log message, quoted and escaped.
- `%3` is converted to the table name defined by the Table parameter above.
- `%4` is replaced by the SQL quoted User-Name (or ‘NULL’ if there is no current Access-Request).
- `%5` is replaced by the tracing identifier string.

**Tip**

You might want to use either `%1` or `%2` in your query, but rarely both.

3.26.6. LogQueryParam

This optional parameter specifies a bind variable to be used with LogQuery. Special formatting characters `%0 - %5` are not quoted when used with LogQueryParam. For more information, see Section 3.8.1. SQL bind variables on page 45.

**Note**

Many databases do not allow the table name to be defined as a bind variable. If you need `%3` and want to use LogQueryParam, use something like this:
### 3.26.7. MaxMessageLength

This optional parameter specifies a maximum message length (in characters) for each message to be logged. If specified, each log message is truncated to the specified number of characters prior to logging. Defaults to 0, which means no truncation.

Truncation is done prior to SQL quoting of escapes. MaxMessageLength is useful for some types of SQL server that complain if given a string longer than the column it is going in to.

### 3.27. <Log EMERALD>

This logging module is based on Log SQL and is used to log messages to the Emerald RadLogs table. Emerald is a third-party commercial ISP billing package.

<Log EMERALD> understands the same parameters as <Log SQL>.

### 3.28. <SNMPAgent>

This optional clause enables an SNMP Agent that will allow you to fetch statistics from Radiator using SNMP version 1 or 2c. Radiator supports all the SNMP objects described in the draft IETF standard defined in draft-ietf-radius-servmib-04.txt, as well as:

- RFC2619 - RADIUS Authentication Server MIB
- RFC2621 - RADIUS Accounting Server MIB
- RFC4669 - RADIUS Authentication Server MIB for IPv6
- RFC4671 - RADIUS Accounting Server MIB for IPv6

Copies of the standards documents are included in the doc directory of the Radiator distribution.

SNMPAgent requires SNMP_Session-0.92.tar.gz or later to be installed first.

RedHat and CentOS users can install the vendor supplied perl-SNMP_Session RPM package. For .deb based systems the package may be available as libsnmp-session-perl or other similar name. The source package is available for download from SNMP-session [https://github.com/sleinen/snmp-session](https://github.com/sleinen/snmp-session)

If you do not include this clause in your Radiator configuration file, it will not respond to any SNMP requests.

```plaintext
# Example, showing how to enable SNMP handling
<SNMPAgent>
    ROCommunity mysnmpsecret
</SNMPAgent>
```

If you enable SNMPAgent, you will be able to collect server statistics using a 3rd party SNMP package such as MRTG, Open View etc. You can also use SNMP to reset the server.

You can test that it is working properly with a command on Unix like this one, that gets the value of `radiusServIdent` from the old draft MIB:

```plaintext
$ snmpget -c public -v 1 localhost .iso.org.dod.internet.
```
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3.79.1.1.1

SNMPv2-SMI::experimental.79.1.1.1.1 = STRING: "Radiator 3.6 on zulu"

And this gets the uptime from the new Authentication server MIB:

```
$ snmpget -c public -v 1 localhost .1.3.6.1.2.1.67.1.1.1.1.2
SNMPv2-SMI::mib-2.67.1.1.1.1.2 = Timeticks: (200) 0:00:02.00
```

3.28.1. Port

This optional parameter specifies the UDP port number that the SNMP Agent is to listen on. It defaults to 161. There should only rarely be any reason to change it. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services/ (or its moral equivalent on your system). Port may contain special formatting characters. A typical use of special formatting characters is with GlobalVar and command line arguments.

```
# Use a non-standard port
Port 9991
```

3.28.2. BindAddress

This optional parameter specifies a single host address to listen for SNMP requests on. It is only useful if you are running Radiator on a multi-homed host (i.e. a host that has more than one network address). Defaults to the global value of BindAddress, usually 0.0.0.0 i.e. listen on all networks connected to the host. For more information, see Section 3.7.9. BindAddress on page 31 BindAddress can include special formatting characters. Requires SNMP_Session version 0.92 or greater.

```
# Only listen on one network, not all the ones connected
BindAddress 203.63.154.0
```

3.28.3. Community

SNMP V1 provides a weak method of authenticating SNMP requests, using the ‘community name’. This optional parameter allows you to specify the SNMP V1 community name that will be honoured by SNMPAgent. Any SNMP request that does not include the correct community name will be ignored. Defaults to nothing. We strongly recommend that you choose a community name and keep it secret.

Community is now deprecated, but is still honoured for backwards compatibility. New implementations should use ROCommunity and/or RWCommunity.

```
# Use a secret community.
Community mysnmpsecret
```

3.28.4. ROCommunity

SNMP V1 provides a weak method of authenticating SNMP requests, using the ‘community name’. This optional parameter allows you to specify the SNMP V1 community name that will be honoured by SNMPAgent for read-only access. Defaults to nothing, you have to define one by yourself.

We strongly recommend that you choose a community name and keep it secret.

```
# Use a secret community.
ROCommunity mysnmprosecret
```
3.28.5. RWCommunity

This optional parameter allows you to specify the SNMP V1 community name that will be used by SNMPAgent to authenticate read-write access. Knowing this secret you are able to reset Radiator via SNMP. Defaults to nothing. If you do not need resetting via SNMP use only ROCommunity.

```
# only necessary for resetting via SNMP
RWCommunity extremelysecure
```

3.28.6. Managers

This optional parameter specifies a list of SNMP managers that have access to SNMPAgent. The value is a list of host names or addresses, separated by white space or comma. You can have any number of Managers lines. Defaults to nothing with all hosts allowed.

```
# allowed SNMP managers
Managers    foo.bar.edu 192.168.1.11, noc.rz.uni-ulm.de
Managers    baz.bar.com,10.1.1.254
```

3.28.7. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It is not used by the standard Radiator code.

3.28.8. SNMPVersion

This optional parameter allows you to specify the SNMP version the agent uses. Currently supported versions are 1 and 2c. Defaults to 1.

3.28.9. PacketTrace

This is an optional flag parameter. It enables logging of received and sent SNMP messages in human-readable form on trace level 4. This is a useful feature during testing and debugging.

3.29. <Realm realmname>

**Note**

We recommend using Handler clauses for all new configurations. Handlers provide more flexibility for defining how to match requests and make future configuration changes easier to manage.

**Note**

Using both Realms and Handlers in the same configuration is allowed but may make the Realm/Handler selection hard to understand. For more information, see Section 3.30. <Handler attribute=value,attribute=value, ....> on page 132.

A Realm can be easily converted to a Handler. For example: `<Realm example.com> becomes <Handler Realm=example.com>` and `<Realm /.example\.com$/> becomes <Handler Realm=/\.example \.com$/>. The closing `<Realm>` must also be changed to `</Handler>`.
The beginning of a Realm clause. The clause continues until </Realm> is seen on a line. A Realm clause specifies a single RADIUS realm that this server will service. A realm is the part of the users login name that follows the '@' sign. For example if a user logs in as “mikem@open.com.au”, then “open.com.au” is the realm. All requests from all users with the realm named in the <Realm realmname> line will be handled in the way specified by the rest of the Realm clause. You can configure one or more realms into your server, possibly with a different AuthBy authentication method for each.

The realmname can be either an exact realm name or it can be a Perl regular expression (regexp) including the opening and closing slashes that will match zero or more realms. You can also use the ‘x’ and ‘i’ modifiers. If you use a regexp, you should be very careful to check that you regexp will match only those realms you mean it to. Consult your Perl reference manual for more information on writing Perl regexps.

If you omit the realm name from the <Realm> line, the clause will match requests with a NULL realm (i.e. where the user did not enter a realm-qualified user name, such as a bare “fred” or “alice”).

When Radiator looks for a <Realm realmname> clause to match an incoming request, it first looks for an exact match with the Realm name. If no match is found, it will try to do a regexp match against Realm names that look like regexps (i.e. have slashes at each end). If still no match, it looks for a Realm called DEFAULT. If still no match, it logs an error and ignores (i.e. does not reply to) the request. For more information about exceptions, see Section 3.30. <Handler attribute=value,attribute=value, ....> on page 132.

The special DEFAULT realm (if it is defined) will be used to handle requests from users in realms for which there is no other matching Realm clause.

```xml
# Handle requests with no realm with UNIX,
# from user@open.com.au with SQL
# from any realm ending in .au by forwarding
# and from any other realm with DBFILE
<Realm>
   <AuthBy UNIX>
       ....
   </AuthBy>
</Realm>
<Realm open.com.au>
   <AuthBy SQL>
       ....
   </AuthBy>
</Realm>

# Any realm ending in .au
<Realm /.*/.au/>
   <AuthBy RADIUS>
       ....
   </AuthBy>
</Realm>

# Any realm ending in .au, .AU, .Au, .aU (ie its case
# insensitive)
<Realm /.*/.au/i>
   <AuthBy RADIUS>
       ....
   </AuthBy>
</Realm>
```
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# Any other realm
<Realm DEFAULT>
   <AuthBy DBFILE>
       ......
   </AuthBy>
</Realm>

A <Realm> is a special type of <Handler>, and you can use all the same parameters that are described in Section 3.30. <Handler attribute=value,attribute=value, ....> on page 132. However, you can only use realms for selecting the requests. This will not work: <Realm example.com, Client-Identifier=mynas>.

3.30. <Handler attribute=value,attribute=value, ....>

This begins a <Handler> clause. When using the <Handler> clause, all requests with a specific set of attributes are handled in the same way. You can configure one or more <Handler> clauses into your server, possibly with a different AuthBy authentication methods for each.

The difference between <Handler> and <Realm> is that <Handler> groups together requests based on the value of any attributes in the request, not just the user's realm as <Realm> does. That makes <Handler> clauses more powerful but they are not required as often. A common situation is that you need to distinguish between authentication methods based on the user's realm. Use <Handler> instead of <Realm> if you need to choose authentication methods based on other attribute than Realm, such as Called-Station-Id, Request-Type, or some other attribute in the incoming RADIUS request.

In <Handler checklist> the checklist expression is a list of request attributes that must all match before <Handler> is used to handle the request. The format is similar as a list of check items in a user file: a list of attribute=value pairs, separated by commas. For more information, see Section 7.1. Check items on page 432.

If you omit the expression name from the <Handler> line, the clause matches all requests.

When Radiator looks for <Handler> to match an incoming request, it searches each <Handler> clause in the order in which they appear in your configuration file. It continues searching until <Handler> is found where every check item in the expression matches the request. If any check item does not match, it continues onto the next <Handler> until all the Handlers are exhausted. If none of the <Handler> clauses match, Access-Request is rejected and Accounting-Request is accepted.

Radiator uses the following algorithm to find the <Realm> or <Handler> to handle each request:

1. Look for a Realm with an exact match on the realm name.
2. Look for a matching regular expression Realm.
3. Look for a <Realm DEFAULT>.
4. Look at each Handler in the order they appear in the configuration file until one where all the check items match the request.
5. Ignore the request.

It is possible to use both <Handler> and <Realm> clauses in the same configuration file but it is not recommended. Using them together may lead to complicated handler selections and behaviour.

The following example configuration uses 3 authentication methods used in different requests:

- <AuthBy SQL>

  This used when Called-Station-Id is 662543 and Service-Type is Framed-User.

- <AuthBy DBM>
This is used when Called-Station-Id is 678771 and Realm is open.com.au.

- **<AuthBy RADIUS>**

  This is used authenticating all the requests that do not match to the previous criteria.

```xml
<Handler Called-Station-Id=662543,Service-Type=Framed-User>
  <AuthBy SQL>
    ....
  </AuthBy>
</Handler>
<Handler Called-Station-Id=678771,Realm=open.com.au>
  <AuthBy DBM>
    ....
  </AuthBy>
</Handler>
# Handles anything that was not handled above:
<Handler>
  <AuthBy RADIUS>
    ....
  </AuthBy>
</Handler>
```

All instances of the given attribute are checked, so it is possible to define a check that requires a request to contain multiple values. Here are 2 examples of multiple values, both of them are allowed:

```plaintext
# Request has attributes in a following order:
# OSC-Group-Identifier=A
# OSC-Group-Identifier=B

# Does match
<Handler OSC-Group-Identifier=B>
  ....
</Handler>

# Request has attributes in a following order:
# OSC-Group-Identifier=A
# OSC-Group-Identifier=B

# Does not match
<Handler OSC-Group-Identifier=B,OSC-Group-Identifier=C>
  ....
</Handler>

# Does match
<Handler OSC-Group-Identifier=B,OSC-Group-Identifier=A>
  ....
</Handler>
```

### 3.30.1. RewriteUsername

This is an optional parameter. It enables you to alter the username in authentication and accounting requests. For more details and examples, see Section 8. Rewriting user names on page 454.
3.30.2. RewriteFunction

This optional parameter allows you to define your own special Perl function to rewrite user names. You can define an arbitrarily complex Perl function that might call external programs, search in databases or whatever. The user name is changed to whatever is returned by this function.

If you define a RewriteFunction for a Realm or Handler, it will be used in preference to any RewriteUsername. RewriteUsername will be ignored for that Realm or Handler.

```perl
# Strip out NULs, trailing realms, translate to lower case and remove single quotes
RewriteFunction sub { my($a) = shift; $a =~ s/[000]//g; $a =~ s/([^@]+).*$/1/; $a =~ tr/[A-Z]/[a-z]/; $a =~ s/'//g; $a; }
```

3.30.3. AcctLogFileName

The names of the files used to log Accounting-Request messages in the standard radius accounting log format. All Accounting-Request messages will be logged to the files, regardless of their Acct-Status-Type. For more information about log file format, see Section 9.5. Accounting log file on page 460. If no AcctLogFileName is defined, accounting messages will not be logged for this realm. The default is no logging. The file name can include special formatting characters as described in Section 3.3. Special formatters on page 19, which means that, for example, using the %c specifier, you can maintain separate accounting log files for each Client. The AcctLogFileName files are always opened written and closed for each message, so you can safely rotate them at any time.

If the AuthBy module you select does no special accounting logging, you may want to enable this parameter for the Realm. Note that logging to AcctLogFileName is in addition to any recording that a specific AuthBy module might do (such as, say, AuthBy SQL). The user name that is recorded in the log file is the rewritten user name when RewriteUsername is enabled.

You can specify any number of AcctLogFileName parameters. Each one will result in a separate accounting log file.

If the file name starts with a vertical bar character ('|') then the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output will be appended to the named file:

```bash
# Pipe to my-log-prog
AcctLogFileName |/usr/local/bin/my-log-prog
```

Tip

You can change the logging format with AcctLogFileFormat:

```bash
# Log all accounting to a single log file in LogDir
AcctLogFileFormat %L/details
```

3.30.4. AcctLogFileFormat

This optional parameter is used to alter the format of the accounting log file from the standard radius format when AcctLogFileFormatHook is not defined. AcctLogFileFormat is a string containing special formatting characters. It specifies the format for each line to be printed to the accounting log file. A newline will be automatically appended. It is most useful if you use the %{attribute} style of formatting characters (to print the value of the attributes in the current packet).
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```markdown
AcctLogFileFormat %{Timestamp} %{Acct-Session-Id} %{User-Name}
```

### 3.30.5. AcctLogFileFormatHook

Specifies an optional Perl hook that will is used to alter the format of the accounting log file from the standard radius format when defined. The hook must return the formatted accounting record. A newline will be automatically appended. By default no hook is defined and AcctLogFileFormat or the default format is used. The hook parameter is the reference to the current request.

See `goodies/logformat.cfg` for a sample configuration file with JSON format.

**Tip**

Consider installing JSON::XS for higher performance JSON encoding.

### 3.30.6. AccountingHandled

This parameter forces Radiator to acknowledge Accounting requests, even if the AuthBy modules for the Realm or Handler would have normally ignored the request. This is useful if you do not really want to record Accounting requests, but your NAS keeps retransmitting unless it gets an acknowledgment.

**Note**

All backend processing, such as SQL queries, is done first, before the reply is sent back to the NAS.

```plaintext
# My AuthBy SQL ignores accounting
AccountingHandled
```

### 3.30.7. AccountingAccepted

This is a flag parameter. When set, it forces Radiator to acknowledge an Accounting request when it is received, even if the AuthBy modules for the Realm or Handler would otherwise ignore or reject the request. This is useful if you want to send an acknowledge to NAS immediately. Usually this parameter is not used.

### 3.30.8. PreProcessingHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PreProcessingHook is called for each request before per-Realm user name rewriting, before accounting log files are written, and before any PreAuthHooks. A reference to the current request is passed as the first argument, and a reference to the reply packet currently being constructed is passed as the second argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes \) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

PreProcessingHook Can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

```plaintext
# Fake a new attribute into the request, so its logged in the accounting log file
```
3. Configuring Radiator

PreProcessingHook sub { ${$_[0]}->add_attr('My-Realm', \ 'some.realm.com');}

3.30.9. PostProcessingHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PostProcessingHook is called for each request after all authentication methods have been called and just before a reply is sent back to the requesting NAS. A reference to the current request is passed as the first argument, and a reference to the reply packet currently being constructed is passed as the second argument. If the processing results in no reply (for example, if the request is proxied) then PostProcessing-Hook is not called.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes ()) are parsed by Radiator into one long line. Therefore, you should not use trailing comments in your hook.

PostProcessingHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current reply or many other things.

  # Fake a new attribute into the reply
  PostProcessingHook sub { ${$_[1]}->add_attr('Class', \ 'billing rate 1');}

3.30.10. PreAuthHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PreAuthHook is called for each request after per-Realm user name rewriting and before it is passed to any AuthBy clauses. A reference to the current request is passed as the first argument, and a reference to the reply packet currently being constructed is passed as the second argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes ()) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

PreAuthHook Can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

  # Fake a new attribute into the request
  PreAuthHook sub { ${$_[0]}->add_attr('test-attr', \ 'test-value');}

3.30.11. PostAuthHook

This optional parameter allows you to define a Perl function that is called during packet processing. PostAuthHook is called for each request after it has been passed to all the AuthBy clauses. A reference to the current request is passed as the first argument, and a reference to the reply packet currently being constructed is passed as the second argument. The third argument is a reference to the result of the authentication ($main::ACCEPT, $main::REJECT and so on). The fourth argument is a reference to a string variable holding the reason for a reject, or undefined if none is available. To change the type of reply, set the reference to third argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook is executed. Multiline hooks, with trailing backslashes (\), are parsed by Radiator into a one long line. Therefore do not use trailing comments in your hook.
PostAuthHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

```perl
PostAuthHook sub { ${$_[1]}->add_attr('test-attr', 'test-value') 
    if ${$_[2]} == $main::REJECT 
    && ${$_[1]}->attr_count() <= 1; }
```

### 3.30.12. AuthByPolicy

This parameter allows you to control how multiple AuthBy clauses in this Handler or Realm are used. For more information, see Section 3.37.1. AuthByPolicy on page 165.

### 3.30.13. AuthBy

This specifies that the Handler is to be authenticated with an <AuthBy> clause that is defined elsewhere. The argument must specify the Identifier of the AuthBy clause to use. The AuthBy clause may be defined anywhere else: at the top level, or in a Realm or Handler clause. You can have as many AuthBy parameters as you wish. They will be used in the order that they appear in the configuration file (subject to AuthByPolicy) in the same way as <AuthBy> clauses.

**Tip**

This is a convenient way to reuse the same authenticator for many Realms or Handlers.

```xml
<AuthBy xxxxxx>
    Identifier myidentifier
</AuthBy>
<Realm xxxxxx>
    # This authenticates through the AuthBy defined above
    AuthBy myidentifier
</Realm>
```

### 3.30.14. Identifier

This optional parameter acts as a label that can be useful for custom code in hooks. It is not used by the standard Radiator code.

### 3.30.15. StripFromRequest

Strips the named attributes from the request before passing it to any authentication modules. The value is a comma separated list of attribute names. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. There is no default.

```perl
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port
```

### 3.30.16. AddToRequest

Adds attributes to the request before passing it to any authentication modules. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes
attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

# Append a Filter-ID and host name
AddToRequest Calling-Station-Id=1/Login-IP-Host=%h

### 3.30.17. AddToRequestIfNotExist

Adds attributes to the request before passing it to any authentication modules. Unlike AddToRequest, an attribute will only be added if it does not already exist in the request. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

# Append a Filter-ID and host name if they are not there already
AddToRequestIfNotExist Calling-Station-Id=1/Login-IP-Host=%h

### 3.30.18. <AuthBy xxxxxx>

This marks the beginning of an AuthBy clause in a Handler or Realm, which defines how to authenticate and record accounting information for all the users in this Realm or Handler. The xxxxxx is the name of a specific AuthBy module. For more information about configuring specific AuthBy clauses, see the relevant sections.

You can have 0 or more AuthBy clauses in a Handler or Realm. The AuthBy clauses will be executed in order until the AuthByPolicy for the Realm or Handler is satisfied.

/AuthBy xxxxxx/ both defines an authentication method and specifies where it should be used.

Note that something like

```xml
<Realm xxxxxx>
  <AuthBy xxxxxx>
    ....
  </AuthBy>
  ....
</Realm>
```

Is equivalent to

```xml
<AuthBy xxxxxx>
  Identifier myidentifier
  ....
</AuthBy>
<Realm xxxxxx>
  # This authenticates through the AuthBy defined above
  AuthBy myidentifier
  ....
</Realm>
```

### 3.30.19. UsernameCharset

This optional parameter checks that every user name consists only of the characters in the specified character set. This can be useful to reject requests that have user names that cannot be valid. The value of the parameter is a Perl character set specification. See your Perl reference manual for details about how to construct Perl
character set specifications. Note that the some special characters must be escaped with a backslash. This parameter is not set by default and no character set check is done.

UsernameCharset is available as a global and Handler level parameter. The character set checks are done for both User-Name attribute and EAP identity.

When a request is processed by a Handler, User-Name attribute must pass both global and per Handler UsernameCharset checks. When an EAP-Response/Identity message is handled by an AuthBy, the EAP identity must pass both global and per Handler UsernameCharset checks. The Handler is the last Handler that processed the request before it was passed to the AuthBy.

This example permits only alphanumeric, period, underscore, the @-sign, and dash. Note that a dash at the end of character class needs not to be escaped with a backslash:

UsernameCharset a-zA-Z0-9._@-

### 3.30.20. RejectHasReason

Normally, when Radiator rejects an Access-Request, it sets the reply message to "Request Denied". This optional parameter forces Radiator to put an additional Reply-Message into Access-Reject indicating why the rejection occurred. This may be useful for debugging in some cases, since some NASs will display the Reply-Message during an interactive login. However it should be noted that some PPP clients do not show the Reply-Message to the end user.

```bash
# Show any rejection reason to the end user (maybe)
RejectHasReason
```

### 3.30.21. SessionDatabase

This optional parameter specifies a particular Session Database to use for the enclosing Realm or Handler. The value of the parameter must be the Identifier of a SessionDatabase clause. The default behaviour is to use the last global SessionDatabase specified in the configuration file. If no SessionDatabases are specified in the configuration file, then the default INTERNAL session database will be used.

SessionDatabaseOptions is available for changing how a Handler uses its session database. For more information, see Section 3.30.22. SessionDatabaseOptions on page 140.

---

**Tip**

The user name used to access the session database depends on the setting of SessionDatabaseUseRewrittenName and SessionDatabaseOptions.

---

**Tip**

This is an advanced use parameter. Only very unusual configurations need this parameter to be set. The default behaviour suits for most situations.

```xml
<Handler xxxxxxx>
    # If this was not here, we would default to
    # myspecialsessiondb2 (the last one in the config file)
    SessionDatabase myspecialsessiondb1
    ......
</Handler>
```
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```xml
<Handler>
  <SessionDatabase SQL>
    Identifier myspecialsessiondb1
    ....
  </SessionDatabase>
  <SessionDatabase SQL>
    Identifier myspecialsessiondb2
    ....
  </SessionDatabase>
</Handler>
```

### 3.30.22. SessionDatabaseOptions

SessionDatabaseOptions allows controlling how Handler communicates with its session database.

The following options are available:

- **NoDeleteBeforeAuthentication** suppresses the call to delete a session from session database when Access-Request is received. Calling delete is useful, for example, when a NAS port can only have a single active session. An Access-Request indicates that a new session is starting and calling delete allows to clear the old session if its accounting Stop was lost.

- **AddBeforeAuthentication** causes this Handler to add a new session before passing the Access-Request to AuthBys

- **AddAfterAuthentication** causes this Handler to add a new session after successful authentication without waiting for Accounting Start

- **UseRewrittenName** tells the Handler to use rewritten user name with session database. If the option is set, the rewritten user name (as rewritten by RewriteUsername etc) is used. Otherwise the original User-Name attribute from the request is used.

- **NoDeleteOnSessionStop** replaces a call to delete a session from session database with a call to update a session when an accounting stop is received. This allows the session database to hold records of ended sessions.

Enabling UseRewrittenName provides the same functionality as setting the SessionDatabaseUseRewrittenName (for more information, see Section 3.30.23. SessionDatabaseUseRewrittenName on page 140). New configurations must use this option instead of setting the configuration parameter.

### 3.30.23. SessionDatabaseUseRewrittenName

This optional parameter controls the user name used to update and access the session database for this Handler. If SessionDatabaseUseRewrittenName is true, the rewritten user name (as rewritten by RewriteUsername and the others) is used. Otherwise the original User-Name attribute from the request is used. This is false by default.

New configurations must use SessionDatabaseOptions to control this and any other possible options. For more information, see Section 3.30.22. SessionDatabaseOptions on page 140.

### 3.30.24. AuthLog

This specifies that the Handler is to log all authentications with an `<AuthLog>` clause that is defined elsewhere. The argument must specify the Identifier of the AuthLog clause to use. The AuthLog clause may be defined anywhere else: at the top level, or in a Realm or Handler clause. You can have as many AuthLog parameters as you wish. They will be used in the order that they appear in the configuration file in the same way as `<AuthLog xxxxxx>` clauses.
Tip
This is a convenient way to reuse the same authentication logger for many Realms or Handlers.

```
<AuthLog xxxxxx>
  Identifier myidentifier
  ....
</AuthLog>
<Realm xxxxxx>
  # This logs through the AuthLog defined above
  AuthLog myidentifier
</Realm>
```

### 3.30.25. `<AuthLog xxxxxx>`

Indicates that logging of authentication success and failure should be handled in a special way. `<AuthLog FILE>` and `<AuthLog SQL>` are currently supported. When authentication is complete, each of the AuthLog clauses defined for the handler will be executed in order. For each AuthLog, the authentication details will be logged according to the parameters for that clause. You can have as many `<AuthLog xxxxxx>` clauses as you wish, or none at all.

`<AuthLog xxxxxx>` both defines a logging method and specifies where it should be used.

Note that something like

```
<Realm xxxx>
  <AuthLog xxxxxx>
  ....
</AuthLog>
  ....
</Realm>
```

Is identical to

```
<AuthLog xxxxxx>
  Identifier myidentifier
</AuthLog>
<Realm xxxxxx>
  # This logs through the AuthLog defined above
  AuthLog myidentifier
</Realm>
```

### 3.30.26. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with `PacketTrace` set off or `0`.

`PacketTrace` is available for the following clauses:

- `Client`
- `Handler`
- `Realm`
3. Configuring Radiator

- **AuthBy**
- **ServerDIAMETER**
- **ServerRADSEC**
- **ServerTACACSPLUS**

Here is an example of using `PacketTrace`:

```bash
# Debug any packets that pass through here
PacketTrace
```

### 3.30.27. LogRejectLevel

Log level for rejected authentication attempts. Defaults to global LogRejectLevel value.

### 3.30.28. DefaultReply

This is similar to Section 3.13.20. AddToReply on page 94 except it adds attributes to an Access-Accept only if there would otherwise be no reply attributes. `StripFromReply` does never remove any attributes added by `DefaultReply`. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. You can use any of the special `%` formats in the attribute values. There is no default.

Although this parameter can be used in any AuthBy method, it is most useful in methods like `<AuthBy UNIX>` and `<AuthBy SYSTEM>`, which do not have a way of specifying per-user reply items. In other AuthBy methods you can also very easily set up a standard set of reply items for all users, yet you can still override reply items on a per-user basis.

```bash
# If the user had no reply items set some
DefaultReply Service-Type=Framed,Framed-Protocol=PPP
```

### 3.30.29. StripFromReply

Strips the named attributes from Access-Accepts before replying to the originating client. The value is a comma separated list of RADIUS attribute names. StripFromReply removes attributes from the reply before AddToReply adds any to the reply. There is no default. This is useful, for example, with AuthBy RADIUS to prevent downstream RADIUS servers sending attributes you do not like back to your NAS.

```bash
# Remove dangerous attributes from the reply
StripFromReply Framed-IP-Netmask,Framed-Compression
```

### 3.30.30. AllowInReply

This optional parameter is the complement to `StripFromReply`: It specifies the only attributes that are permitted in an Access-Accept. It is useful, for example, to limit the attributes that are passed back to the NAS from a proxy server. This way you can prevent downstream customer RADIUS servers from sending back illegal or troublesome attributes to your NAS.

`AllowInReply` does not prevent other attributes being added locally by DefaultReply, AddToReply and AddToReplyIfNotExist.

```bash
# Only permit a limited set of reply attributes.
AllowInReply Session-Timeout, Framed-IP-Address
```
3.30.31. AddToReply

Adds attributes to reply packets. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromReply removes attributes from the reply before AddToReply adds any to the reply. You can use any of the special % formats in the attribute values. There is no default. AddToReply adds attributes to replies to all types of request that are handled by this clause.

Although this parameter can be used in any AuthBy method, it is most useful in methods like AuthBy UNIX, which don’t have a way of specifying per-user reply items.

```python
# Append some necessary attributes for our pops
AddToReply cisco-avpair="ip:addr_pool=mypool"
```

3.30.32. AddToReplyIfNotExist

This is similar to AddToReply, but only adds an attribute to a reply if and only if it is not already present in the reply. Therefore, it can be used to add, but not override a reply attribute. This is contributed by Vincent Gillet <vgi@oleane.net>.

3.30.33. AddExtraCheck

This is a string that adds check items before passing to the authentication modules. The value is a list of comma-separated check items value pairs.

3.30.34. RejectReason

This optional parameter specifies a string that is used as the Reply-Message if `<AuthBy INTERNAL>` rejects a request. The enclosing Realm or Handler must also have `RejectHasReason` enabled.

Here is an example of using `RejectReason`:

```bash
RejectReason Your account has been disabled
```

3.30.35. DynamicReply

This optional parameter specifies a reply item that will be eligible for run-time variable substitution. That means that you can use any of the % substitutions in Section 3.3. Special formatters on page 19 in that reply item. You can specify any number of DynamicReply lines, one for each reply item you want to do replacements on. Any packet-specific replacement values will come from the Access-Accept message being constructed, and not from the incoming Access-Request. That means that special characters like %n will not be replaced by the received User-Name, because User-Name is in the request, but not the reply.

In the following example, substitution is enabled for USR-IP-Input-Filter in an AuthBy clause. When a user authenticates, the %a in the filter will be replaced by the users IP Address, which makes the filter an anti-spoof filter.

```xml
<AuthBy whatever>
    ......
    UseAddressHint
    DynamicReply USR-IP-Input-Filter
</AuthBy>
```

In the users file:

```ini
DEFAULT User-Password  = "UNIX"
    Framed-IP-Address = 255.255.255.254,
```
3. Configuring Radiator

Framed-Routing = None,
Framed-IP-Netmask = 255.255.255.255,
USR-IP-Input-Filter = "1 REJECT src-addr != %a;",
Service-Type = Framed-User

Note
This parameter used to be called Dynamic. That name is still recognised as a synonym for DynamicReply.

3.30.36. MaxSessions

This parameter allows you to apply a simple limit to the number of simultaneous sessions a user in this Realm is permitted to have. It is most common to limit users to either one session at a time or unlimited, but Radiator also supports other numbers.

MaxSessions works by looking at each accounting request for a realm when it arrives. Whenever Start is seen for a user, the count of their number if current sessions is incremented, and whenever a Stop is seen, it is decremented. When an access request is received, the number of sessions current for that user is compared to MaxSessions. If the user already has MaxSessions sessions or more, Radiator replies with an access denial. By setting MaxSessions to 0, you can temporarily deny access to all users in the realm.

MaxSessions applies a hard limit that cannot be overridden by DefaultSimultaneousUse parameter or by per-user Simultaneous-Use check items. For more information, see Section 3.31.17. DefaultSimultaneousUse on page 152. For many applications, you may wish to consider using DefaultSimultaneousUse instead of MaxSessions. You can control the maximum number of sessions on a per-user basis with the Simultaneous-Use check item. For more information, see Section 7.1.15. Simultaneous-Use on page 440.

The session count for each user is stored entirely within Radiator (unless you specify a SessionDatabase clause). This means that if you restart or reinitialise Radiator, it will lose count of the number of current sessions for each user. Radiator can use SNMP to confirm whether a user is already logged in or not. For more information, see Section 3.13.34. NasType on page 97.

Note that if Radiator fails to receive an accounting Stop request, it may result in incorrectly assume the users are not permitted to log in when, in fact, they are. Correct this by restarting Radiator, or by sending an artificial accounting stop for the user using the radpwtst utility or by configuring Radiator to query the NAS directly. For more information, see Section 6.3. radpwtst on page 422 and Section 3.13.34. NasType on page 97.

# Limit all users in this realm to max of 1 session
MaxSessions 1

Tip
You can set the maximum number of simultaneous sessions for individual users with the Simultaneous-Use check item. In this case, the smaller of MaxSessions and the users Simultaneous-Use will apply.

3.30.37. AutoClass

This optional parameter will force Radiator to automatically reply with a Class attribute with Access-Accept. The Class attribute should be echoed back by the NAS with the subsequent Accounting-Request messages that relate to this authentication. The Class attribute works in conjunction with tracing identifier, for more
information about logging authentication and accounting messages, see Section 3.7.4. LogTraceId on page 28. AutoClass is currently experimental.

Even if you do not plan to use tracing identifier, enabling AutoClass may be useful for matching authentication logs with accounting sessions.

```
# Turn on global LogTraceId
LogTraceId

# Generate a Class attribute that NAS will echo back
<Handler ...
    ......
    AutoClass
</Handler>
```

AutoClass supports optional parameters for further Class attribute formatting. These arguments are added to the values that AutoClass adds by default. The currently support arguments are `uuid` and `formatted` which add a hex value UUID or Radiator formatted string. The format is specified after a whitespace, see below for an example. The default is not to do further formatting.

```
# Add a v3 UUID to Class
AutoClass uuid
```

**Note**
Perl module Data::UUID is required for the `uuid` parameter.

```
# Add the farm instance to Class
AutoClass formatted %O
```

### 3.30.38. WtmpFileName

The name of a Unix SVR4 wtmp format file to log Accounting-Request messages. All Accounting-Request messages will be logged. If WtmpFileName is not defined, no messages will be logged in this format. The default is no logging. The file name can include Section 3.3. Special formatters on page 19, which means that, for example, using the `%c` specifier, you can maintain separate accounting log files for each Client. The WtmpFileName file is always opened written and closed for each message, so you can safely rotate it at any time. Start messages are logged as USER_PROCESS (7), all other messages are logged as DEAD_PROCESS (8).

You may wish to use your standard Unix administration tools (such as `last(1)`) to process information in the wtmp file.

**Tip**
RedHat Linux 6.1 and later uses a modified format for wtmp files, compared with earlier versions. In order to use RedHat tools like `last` on a wtmp file produced by Radiator, you will need to use the `-o` flag (which specifies lib5c format).
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3.30.39. FramedGroup

This optional parameter acts similarly to Framed-Group reply items, but it applies to all Access-Requests authenticated by this clause. If FramedGroup is set and a matching FramedGroupBaseAddress is set in the Client from where the request came, then a Framed-IP-Address reply item is automatically calculated by adding the NASPort in the request to the FramedGroupBaseAddress specified by FramedGroup. For more information, see Section 3.13.37. FramedGroupBaseAddress on page 99.

Note

You can override the value of FramedGroup for a single user by setting a Framed-Group reply item for the user.

```bash
# Work out the users IP address from the first
# FramedGroupBaseAddress specified in out client
FramedGroup 0
```

3.30.40. PasswordLogFileName

The name of file to log authentication attempts to. Attempts where the user is not found, are not logged. The default is no logging. The file name can include Section 3.3. Special formatters on page 19, which means that using the %C, %c and %R specifiers, you can maintain separate password log files for each Realm or Client or a combination.

Each login attempt that generates a password check will be logged to the file, one attempt per line. For more information about file format, see Section 9.5. Accounting log file on page 460.

```bash
# Help desk want to see all password attempts
PasswordLogFileName %L/password.log
```

If the file name starts with a vertical bar character ('|') then the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output will be appended to the named file:

```bash
# Pipe to my-log-prog
PasswordLogFileName |:/usr/local/bin/my-log-prog
```

3.30.41. ExcludeFromPasswordLog

For security reasons, you can exclude certain users from the passwords logged to PasswordLogFileName. The value is a white space separated list of user names.

```bash
# Do not log password from our sysadmin or root
ExcludeFromPasswordLog root admin ceo nocboss
```

3.30.42. ExcludeRegexFromPasswordLog

Similar to ExcludeFromPasswordLog, but the value is a Perl regular expression.

```bash
# Do not log password from anyone that begins with root
ExcludeRegexFromPasswordLog ^root
```
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3.30.43. HandleAscendAccessEventRequest

This optional parameter causes Radiator to respond to Ascend-Access-Event-Request messages. These messages are sent by some types of specially configured Ascend NASs. They contain a count of the number of sessions the NAS thinks it currently has in each Class.

When HandleAscendAccessEventRequest is enabled, it causes Radiator to confirm that its SQL Session Database is up to date. If the session counters do not agree, Radiator will use snmpwalk to confirm the existence of its sessions, deleting from the SQL Session Database the ones that do not really exist.

Tip
HandleAscendAccessEventRequest requires that an SQL Session Database is configured for this Handler or Realm. See Section 3.30.21, SessionDatabase on page 139.

Tip
You must set NasType to Ascend for the SNMP session confirmation to work correctly.

# handle Ascend-Access-Event-Request messages
HandleAscendAccessEventRequest

3.31. <AuthBy xxxxxx>

This marks the beginning of an AuthBy clause, which defines how to authenticate and record accounting information. The xxxxxx is the name of a specific AuthBy module. This section lists the parameters all AuthBys use. AuthBys may also use other parameters that are specific for that AuthBy. AuthBy clauses may be defined at the top level or within a Realm or Handler clause.

Under special circumstances, you can have more than one AuthBy clause for a Realm or Handler or may want to use <AuthBy GROUP>, see Section 3.37. <AuthBy GROUP> on page 165. This makes the Handler or Realm or <AuthBy GROUP> try each AuthBy method in turn until one of them either Accepts or Rejects the request. You can change this with AuthByPolicy. For more information, see Section 3.37.1, AuthByPolicy on page 165. For example, it is useful to have an <AuthBy SQL> followed by an <AuthBy RADIUS>, which causes all authentication and accounting requests to be forwarded, and also all accounting requests will be recorded in SQL. This is good for keeping track of all requests forwarded to, say a global roaming server.

If there are no AuthBy clauses in a Realm or Handler, then Access requests will be rejected, and Accounting requests will be ignored.

3.31.1. Fork

The parameter forces the authentication module to fork(2) before handling the request. Fork should only be set if the authentication module or the way you have it configured is slow, so that it takes more than a fraction of a second to process the request.

If you do not understand what forking is for or how it can improve the performance of your Radiator server, talk about it with someone who does before using it. Not all authentication methods will benefit from forking. Fork has no effect on Windows platforms.
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**Note**

In particular, it does not usually make sense to use Fork with AuthBy SQL, AuthBy FILE, AuthBy LDAP or any of the other common authentication methods provided with Radiator. Further, some SQL and LDAP client libraries are not robust across forks. You might want to consider using Fork with AuthBy EXTERNAL or a custom authentication module if it needs to do significant amounts of IO, or to communicate with a remote system.

```plaintext
# This AuthBy EXTERNAL program is very slow, and does lots of IO
Fork
```

### 3.31.2. UseAddressHint

This optional parameter forces Radiator to honour a Framed-IP-Address in an Access-Request request unless it is overridden by a Framed-IP-Address in the user's reply items. If you enable this, then users will get the IP Address they ask for. If there is a Framed-IP-Address reply item for a user, that will override anything they might request.

```plaintext
# Let users get addresses they ask for
UseAddressHint
```

### 3.31.3. DynamicReply

This optional parameter specifies a reply item that will be eligible for run-time variable substitution. That means that you can use any of the % substitutions in Section 3.3. Special formatters on page 19 in that reply item. You can specify any number of DynamicReply lines, one for each reply item you want to do replacements on.

Any packet-specific replacement values will come from the Access-Accept message being constructed, and not from the incoming Access-Request. That means that special characters like %n will not be replaced by the received User-Name, because User-Name is in the request, but not the reply.

In the following example, substitution is enabled for USR-IP-Input-Filter in an AuthBy clause. When a user authenticates, the %a in the filter will be replaced by the users IP Address, which makes the filter an anti-spoof filter.

```xml
<AuthBy whatever>
    ......
    UseAddressHint
    DynamicReply USR-IP-Input-Filter
</AuthBy>
```

In the users file:

```plaintext
DEFAULT User-Password = "UNIX"
    Framed-IP-Address = 255.255.255.254,
    Framed-Routing = None,
    Framed-IP-Netmask = 255.255.255.255,
    USR-IP-Input-Filter = "1 REJECT src-addr != %a;",
    Service-Type = Framed-User
```

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Note
This parameter used to be called Dynamic. That name is still recognised as a synonym for DynamicReply.

3.31.4. DynamicCheck

This optional parameter specifies a check item that will be eligible for run-time variable substitution prior to authentication. That means that you can use any of the % substitutions in table at Section 3.3. Special formatters on page 19 in that check item. You can specify any number of Dynamic-Check lines, one for each check item you want to do replacements on.

In the following example, substitution is enabled for the Group check item. When a user authenticates, the %Shiva-VPN-Group in the check item will be replaced with the value of the Shiva-VPN-Group attribute in the authentication request. You could use this mechanism to verify that the user is in the Unix group corresponding to their Shiva-VPN-Group.

```xml
<AuthBy whatever>
    ......
    DynamicCheck Group
</AuthBy>
```

In the users file:

```
DEFAULT Group=%{Shiva-VPN-Group}
    Framed-IP-Address = 255.255.255.254,
    Framed-Routing = None,
    Framed-IP-Netmask = 255.255.255.255,
    ........
```

3.31.5. Identifier

This allows you to assign a symbolic name to an AuthBy clause and its configuration. This allows you to refer to it by name in an Auth-Type check item when authenticating a user.

The most common use of this is to create a “System” authenticator, typically with an <AuthBy UNIX> clause. A typical example configuration file that uses this feature might be:

```xml
<Realm DEFAULT>
    <AuthBy FILE>
    </AuthBy>
</Realm>
<AuthBy UNIX>
    Identifier System
</AuthBy>
```

You can then have something like this in your users file:

```
DEFAULT Auth-Type = System
    Framed-IP-Netmask ..... 
    ........
```

In this example, all users in all realms will match the DEFAULT user in the users file. This will in turn check their user name and password against a UNIX password file as configured by the AuthBy UNIX clause in the
configuration file. If the password checks out, they will get the RADIUS attributes specified in the second and subsequent lines of the DEFAULT user entry in the users file (in this example, Framed-IP-Netmask).

### 3.31.6. StripFromReply

Strips the named attributes from Access-Accepts before replying to the originating client. The value is a comma separated list of RADIUS attribute names. StripFromReply removes attributes from the reply before AddToReply adds any to the reply. There is no default. This is useful, for example, with AuthBy RADIUS to prevent downstream RADIUS servers sending attributes you do not like back to your NAS.

```
# Remove dangerous attributes from the reply
StripFromReply Framed-IP-Netmask,Framed-Compression
```

### 3.31.7. AllowInReply

This optional parameter is the complement to StripFromReply: It specifies the only attributes that are permitted in an Access-Accept. It is useful, for example, to limit the attributes that are passed back to the NAS from a proxy server. This way you can prevent downstream customer RADIUS servers from sending back illegal or troublesome attributes to your NAS.

AllowInReply does not prevent other attributes being added locally by DefaultReply, AddToReply and AddToReplyIfNotExist.

```
# Only permit a limited set of reply attributes.
AllowInReply Session-Timeout, Framed-IP-Address
```

### 3.31.8. AllowInReject

This optional parameter specifies the only attributes that are permitted in an Access-Reject. This can be useful in Handlers with multiple AuthBys where the attributes added before a rejecting AuthBy need to be stripped from the resulting Access-Reject.

AllowInReject is not set by default and does not remove anything from Access-Rejects.

```
# Only permit a limited set of attributes in a reject.
AllowInReject Message-Authenticator, EAP-Message
```

### 3.31.9. AddToReply

Adds attributes to reply packets. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromReply removes attributes from the reply before AddToReply adds any to the reply. You can use any of the special % formats in the attribute values. There is no default. AddToReply adds attributes to replies to all types of request that are handled by this clause.

Although this parameter can be used in any AuthBy method, it is most useful in methods like AuthBy UNIX, which don’t have a way of specifying per-user reply items.

```
# Append some necessary attributes for our pops
AddToReply cisco-avpair="ip:addr_pool=mypool"
```

### 3.31.10. AddToReplyIfNotExist

This is similar to AddToReply, but only adds an attribute to a reply if and only if it is not already present in the reply. Therefore, it can be used to add, but not override a reply attribute. This is contributed by Vincent Gillet <vgi@oleane.net>.
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3.31.11. DefaultReply

This is similar to Section 3.13.20. AddToReply on page 94 except it adds attributes to an Access-Accept only if there would otherwise be no reply attributes. StripFromReply does never remove any attributes added by DefaultReply. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. You can use any of the special % formats in the attribute values. There is no default.

Although this parameter can be used in any AuthBy method, it is most useful in methods like <AuthBy UNIX> and <AuthBy SYSTEM>, which do not have a way of specifying per-user reply items. In other AuthBy methods you can also very easily set up a standard set of reply items for all users, yet you can still override reply items on a per-user basis.

```
# If the user had no reply items set some
DefaultReply Service-Type=Framed,Framed-Protocol=PPP
```

3.31.12. FramedGroup

This optional parameter acts similarly to Framed-Group reply items, but it applies to all Access-Requests authenticated by this clause. If FramedGroup is set and a matching FramedGroupBaseAddress is set in the Client from where the request came, then a Framed-IP-Address reply item is automatically calculated by adding the NASPort in the request to the FramedGroupBaseAddress specified by FramedGroup. For more information, see Section 3.13.37. FramedGroupBaseAddress on page 99.

**Note**

You can override the value of FramedGroup for a single user by setting a Framed-Group reply item for the user.

```
# Work out the users IP address from the first
# FramedGroupBaseAddress specified in out client
FramedGroup 0
```

3.31.13. NoDefault

Normally if Radiator searches for a user in the database and either does not find one, or finds one but the users check items fail, Radiator will then consult the DEFAULT user entry. However, if the NoDefault parameter is set, Radiator will never look for a DEFAULT.

```
# Save time by never looking for a default
NoDefault
```

3.31.14. NoDefaultIfFound

Normally if Radiator searches for a user in the database and finds one, but the users check items fail, Radiator will then consult the DEFAULT user entry. However, if the NoDefaultIfFound parameter is set, Radiator will only look for a DEFAULT if there were no entries found in the user database for the user.

```
# do not fall through to DEFAULT if a users check item failed
NoDefaultIfFound
```

3.31.15. DefaultLimit

This optional parameter specifies the maximum number of DEFAULT users to look up in the database.
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3.31.16. AcceptIfMissing

Normally, if a user is not present in the user database, they will always be rejected. If this optional parameter is set, and a user is not in the database they will be unconditionally accepted. If they are in the database file, they will be accepted if and only if their check items pass in the normal way.

This option is usually only useful in conjunction with a following AuthBy that will actually check all passwords. It can therefore be used to impose additional checks on a subset of your user population.

**Note**
When you specify AcceptIfMissing, all reply attributes set for this AuthBy (such as DefaultReply, AddToReply, AddToReplyIfNotExist etc.) will be applied even if the user is not explicitly named in the file.

**Note**
This does not automatically accept DEFAULT users.

```plaintext
# Apply some extra checks for those users in the users file,
# then authenticate them with PLATYPUS
<Realm xxxxxx>
  AuthByPolicy ContinueWhileAccept
  <AuthBy FILE>
    AcceptIfMissing
    Filename %D/users
  </AuthBy>
  <AuthBy PLATYPUS>
    # whatever
  </AuthBy>
</Realm>
```

3.31.17. DefaultSimultaneousUse

This optional parameter defines a default value for Simultaneous-Use check items that will apply only if the user does not have their own user-specific Simultaneous-Use check item.

```plaintext
# Use sim-use of 2 unless there is a user-specific entry
DefaultSimultaneousUse 2
```

3.31.18. AuthenProto

`AuthenProto` specifies which authentication protocols are permitted for authentication. It is an optional parameter. `AuthenProto` is available for all `AuthBy` modules but its functionality depends on the specific `AuthBy`. It does not affect proxying or special `AuthBy` modules, such as `<AuthBy INTERNAL>` which do their own request handling.

If the authentication request is rejected because of this parameter setting, the failure is logged as a `WARNING` in Radiator log, and available for all `AuthLog` clauses as the failure reason.

Allowed values for `AuthenProto` are:

- PAP
• CHAP
• MSCHAP
• MSCHAPv2
• SIPDigest
• EAP
• AuthorizeOnly
• Unknown

The default value is PAP, CHAP, MSCHAP, MSCHAPv2, EAP, AuthorizeOnly. The value is AuthorizeOnly if the request does not match any of the other values but has Service-Type attribute set to Authorize-Only. The value is Unknown when the authentication protocol cannot be determined. The default for AuthenProto covers the usual user authentication protocols. Add Unknown to those AuthBys that need to handle the authentication requests that do not have the correct combination of any of the following:

• CHAP attributes
• MSCHAP attributes
• MSCHAPv2 attributes
• User-Password attribute
• EAP-Message attributes
• Service-Type attribute set to Authorize-Only

Here is an example of using AuthenProto:

```
# Allow PAP only
AuthenProto PAP

# Allow all CHAP variants
AuthenProto CHAP, MSCHAP, MSCHAPv2

# Empty list allows nothing
AuthenProto

# Unknown allows anything else. This allows PAP and requests that are not
# CHAP, MSCHAP, MSCHAPv2, SIPDigest, EAP or AuthorizeOnly
AuthenProto PAP, Unknown
```

### 3.31.19. CaselnsensitivePasswords

This optional parameter permits case insensitive password checking for authentication methods that support plaintext password checks, such as FILE, SQL, DBFILE and some others. It has no effect on CHAP or MSCHAP passwords, or on password checking involving any encrypted passwords.

```
# Permit case insensitive password checks
CaseInsensitivePasswords
```

### 3.31.20. RejectEmptyPassword

This optional parameter forces any Access-Request with an empty password to be rejected. This is provided as a work around for some broken remote RADIUS servers (VMS RADIUS server in particular) that incorrectly accept requests with empty passwords.
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# Reject anything with an empty password
RejectEmptyPassword

3.31.21. AuthenticateAccounting

This optional parameter forces Radiator to authenticate accounting requests (as well as the normal Access-Requests). It is very rarely required.

3.31.22. IgnoreAuthentication

This optional parameter causes the AuthBy to IGNORE all authentication requests. This can be useful for providing fine control over authentication with multiple AuthBy clauses.

3.31.23. IgnoreAccounting

This optional parameter causes the AuthBy to IGNORE all accounting requests. This can be useful for providing fine control over authentication with multiple AuthBy clauses.

3.31.24. RcryptKey

This optional parameter indicates that the passwords in the user database may have been reversibly encrypted using Rcrypt. Any password in the database read by this AuthBy and which is in the form {rcrypt}anythingatall will be interpreted as an Rcrypt password and the function $Radius::Rcrypt::decrypt() will be used to decrypt it before any password comparisons are made. Rcrypt encrypted passwords are compatible with PAP, CHAP, and MS-CHAP.

Rcrypt reversible encryption allows you keep your user password database reasonably secure, but still support CHAP, MS-CHAP and other authentication methods that require access to the plaintext password. Rcrypt encryption is supported as an option by the RAdmin RADIUS user administration package from Open System Consultants.

Tip

The value of RcryptKey must exactly match the key that was used to originally encrypt the passwords.

Tip

You can add Rcrypt encryption and decryption to other programs with the $Radius::Rcrypt Perl module supplied with Radiator.

3.31.25. TranslatePasswordHook

This optional parameter specifies a Perl hook that can be used to convert, translate or transform plaintext passwords after retrieval from a user database and before comparison with the submitted password received from the client. The hook is passed the following arguments:

- $_[0] The correct password as retrieved from the user database.
- $_[1] A reference to the current AuthBy module object.
- $_[2] The user name being authenticated.
- $_[3] A flag saying whether the correct password is encrypted by crypt() or MSCHAP.
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- \$_[4] A reference to the current RADIUS request.

The hook is expected to return a single scalar value containing the transformed password. In the following example, all passwords are transformed to uppercase.

```
# Translate all passwords to UPPERCASE
TranslatePasswordHook sub {\$_[0] =~ tr/a-z/A-Z/; return \$_[0]}
```

### 3.31.26. CheckPasswordHook

This optional parameter specifies a Perl hook that can be used to compare password retrieved from a user database with the submitted password received from the client. The retrieved passwords must start with the leading prefix {OSC-pw-hook}. The hook must return true when the password is deemed correct. This hook is for proprietary hash formats and other custom password check methods. This hook runs after TranslatePasswordHook. The hook is passed the following arguments:

- \$_[0] A reference to the current RADIUS request
- \$_[1] The password submitted by the user
- \$_[2] The correct password as retrieved from the user database without the prefix

### 3.31.27. AutoMPPEKeys

Some NASs, PPoE, VPDN, wireless controllers and wireless access points require MPPE key attributes in the Access-Accept message for setting up encryption. If this AuthBy is doing MS-CHAP V1 authentication, then setting this parameter will force Radiator to automatically reply with MS-CHAP-MPPE-Keys. If this AuthBy is doing MS-CHAP V2 or EAP authentication, then setting this parameter will force Radiator to automatically reply with MS-MPPE-Send-Key and MS-MPPE-Recv-Key.

This flag parameter is optional and defaults to not set. Keys may be computed from the plaintext password, password NT hash or derived by some other means that depends on the AuthBy or AuthBy’s EAP method. For example AuthBy LSA and AuthBy NTLM derive the keys with the help of Active Directory. Not all EAP methods support MPPE keys.

When keys are computed based on the password, the password must be available in one of the previously mentioned formats and the user must have User-Password check item.

With TLS based EAP methods, such as EAP-FAST, EAP-TLS, EAP-TTLS and PEAP, MS-MPPE-Send-Key and MS-MPPE-Recv-Key are computed based on TLS handshake results and do not depend on password availability.

**Tip**

This option is almost always required with AuthBys that authenticate TLS based EAP methods or other EAP methods used with 802.1X authentication for wireless and wired networks.

### 3.31.28. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with `PacketTrace` set off or 0.

`PacketTrace` is available for the following clauses:

- `Client`
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- **Handler**
- **Realm**
- **AuthBy**
  - **ServerDiameter**
  - **ServerRADSEC**
  - **ServerTACACSPLUS**

Here is an example of using `PacketTrace`:

```bash
# Debug any packets that pass through here
PacketTrace
```

## 3.31.29. CachePasswords

This parameter enables a user password cache in this AuthBy. It can be used to improve the performance of slow AuthBy clauses, or when large number of identical requests for the same user are likely to occur, or when multiple request might result from a one-time password (in a multi-link or wireless roaming environment) etc.

If this parameter is set, all Access-Requests will first be checked against a password cache that contains a copy of the last valid Access-Accept for that user. If the cache contains a matching password that has not exceeded its CachePasswordExpiry, the previous reply will be sent back, without looking up the user again in this AuthBy. Therefore the possibly slow process of consulting the user database or proxying the request can be sometimes avoided.

---

**Tip**

Not all AuthBy clauses support this parameter (or CachePasswordExpiry and CacheReplyHook), but the ones that do include UNIX, FILE, DBFILE, EMERALD, SQL, LDAP, ACE, OPIE, PLATYPUS, RADMIN and RADIUS. Other AuthBy clauses may or may not support this parameter.

---

**Tip**

Use of this parameter with a large user population can cause large amounts of memory use by the Radiator process.

---

**Tip**

If Radiator is restarted, the password cache is lost.

---

**Note**

Matching of cached passwords can never succeed for CHAP or MS-CHAP authentication requests.
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3.31.30. CachePasswordExpiry

If CachePasswords is enabled, this parameter determined the maximum age (in seconds) for cached passwords. Defaults to 86400 seconds (1 day). Cached passwords that are more than this number of seconds old will not be used.

3.31.31. CacheReplyHook

This optional parameter allows you to define a Perl hook that runs when a cached reply is about to be returned to the NAS because of CachePasswords.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

The hook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change or set up environment variables, umasks etc.

The arguments passed to the hook are:

- Argument 0 is the object handle for this AuthBy object.
- Argument 1 is the user name being authenticated.
- Argument 2 is the received request packet.
- Argument 3 is the cached reply packet that is about to be returned to the NAS.

3.31.32. ClearTextTunnelPassword

This optional parameter prevents Radiator from encrypting Tunnel-Password attributes in replies. This is provided in order to support older NASs that do not support encrypted Tunnel-Password.

Old NAS does not support encrypted Tunnel-Password
ClearTextTunnelPassword
AddToReply Tunnel-Password=xxxxxx

3.31.33. NoCheckPassword

This optional parameter causes AuthBy not to check the password. This means that any password entered by the user will be accepted. This parameter is useful in conjunction with other authentication methods where the password check is done elsewhere.

3.31.34. ConsumePassword

This is a string parameter. When set, the used AuthBy removes part or all of the user's password before authentication. This allows the AuthBy to use just the certain part of password. This is a useful feature with the AuthBys that implement two-factor or one-time password authentication.

Here are the possible arguments for ConsumePassword:

- Positive number
  - This defines how many characters are removed from the beginning of the password. If the number is bigger than password length, the password is fully consumed and the next AuthBy gets an empty password.
- Negative number
This defines how many characters are removed from the end of the password. If the number is bigger than password length, the password is fully consumed and the next AuthBy gets an empty password.

- One or more other characters

This defines the separator. If the separator is not a part of the password, the password is fully removed and the next AuthBy gets an empty password.

- Empty

The password is fully removed. The next AuthBy gets an empty password.

For example, if the password is `part1:part2:part3` and the `ConsumePassword` argument is `:`, the password the next AuthBy gets is `part2:part3`. If the password is `1234asdfghj` and the `ConsumePassword` argument is `4`, the password the next AuthBy gets is `asdfghj`.

See more configuration examples in `goodies/duo.cfg` and `goodies/digipassStatic.cfg`.

### 3.31.35. AuthenticateAttribute

This optional parameter allows you to control which RADIUS attribute is used to look up the user database. Normally, Radiator uses the User-Name RADIUS attribute as the key to find a user in the user database. If the `AuthenticateAttribute` parameter is defined, it specifies the name of an alternative RADIUS attribute that will be used as the key during the lookup in the user database. This is useful in order to do authentication based on, say, the Calling-Station-Id:

```plaintext
# look up database based on Calling-Station-Id
AuthenticateAttribute Calling-Station-Id
```

### 3.31.36. UsernameMatchesWithoutRealm

This optional parameter forces authenticators to strip any realm from the user name before authenticating the name. This allows users to log in with user@realm, even though their user database user name is just user.

### 3.31.37. Blacklist

Reverses the sense of authentication checks, making it easier to implement blacklists. If the user name matches the user database, then they will be rejected. If there is no match they will be accepted.

### 3.31.38. EAPErrorReject

If an EAP error occurs, REJECT instead of IGNORE. The RFCs say that IGNORE is the correct behaviour, but REJECT can work better in some load balancing situations.

### 3.31.39. PasswordPrompt

For AuthBys that support the feature, specifies the prompt to be used when asking for a password.

### 3.31.40. PostAuthHook

This optional parameter allows you to define a Perl function that is called during packet processing. `PostAuthHook` is called for each request when the `AuthBy` is done processing the request and has returned.

The hook parameters and behaviour are the same as for Handler's `PostAuthHook`. For more information, see Section 3.30.11. `PostAuthHook` on page 136.
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3.31.41. AllowNULInUsername

By default, user names with NUL octets cause a reject with user database lookups. This optional flag parameter allows user database lookups when the looked up user name contains a NUL octet. This is not set by default.

Here is an example of using AllowNULInUsername:

```bash
# User-Name attributes and EAP identities are allowed to have NUL octets
AllowNULInUsername
```

3.31.42. AddExtraCheck

This is a string that adds check items before passing to the authentication modules. The value is a list of comma-separated check items value pairs.

3.31.43. RejectReason

This optional parameter specifies a string that is used as the Reply-Message if `<AuthBy INTERNAL>` rejects a request. The enclosing Realm or Handler must also have `RejectHasReason` enabled.

Here is an example of using RejectReason:

```bash
RejectReason Your account has been disabled
```

3.32. `<AuthBy ACE>`

The `<AuthBy ACE>` module performs authentication directly to an RSA Security Authentication manager (formerly SecurID ACE/Server). For more information, see RSA website [https://www.rsa.com/en-us]. RSA Security Authentication Manager provides a token-based one-time password system. `<AuthBy ACE>` requires the Authen-ACE4 Perl module from CPAN. Compile it for your chosen Perl distribution. For more information, see Section 2.1.2. CPAN on page 3. You can also contact OSC in case you need help with your Authen-ACE4 setup.

**Tip**

`<AuthBy ACE>` works with RSA Authentication Manager 7.1 and later. If you have AM 7.1 or later you might consider using `<AuthBy RSAAM>`, since it is more capable and more portable.

Before using this AuthBy method ensure that you have the following things:

- Installed and configured Authentication Manager
- Purchased tokens for each user from RSA Security
- Added the users that you wish to authenticate to Authentication Manager, and assigned each one a token
- In Authentication Manager, added an ‘Agent Host’ for each Radiator server host you intend to operate. If Radiator will run on the same host as Authentication Manager, make sure you add an Agent Host for that host.
- Followed the installation instructions in `goodies/ace.txt` in the Radiator distribution package

 `<AuthBy ACE>` works also with EAP-Generic-Token-Card and EAP-PEAP-Generic-Token-Card authentication, as well as RADIUS PAP and TTLS-PAP.
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Tip
There are more detailed installation and testing instructions in the goodies/ace.txt file in your distribution.

Tip
An alternative to using <AuthBy ACE> is to proxy requests to the optional RADIUS server that comes with Authentication Manager (although that RADIUS server has many fewer features and supported platforms than Radiator).

Tip
There is an example Radiator configuration file for <AuthBy ACE> in goodies/ace.cfg in your Radiator distribution.

Tip
<AuthBy ACE> uses the State reply item to get the RADIUS client to carry the context from one step of authentication to the next. If you wish to test <AuthBy ACE> with radpwtst, use the -interactive flag.

radpwtst -interactive -user fred -password 1234574424

Tip
<AuthBy ACE> and Authen-ACE4 can work across the network to a remote Authentication Manager on another host. For more information about configuring remote Agent access, see RSA website [https://www.rsa.com/en-us].

3.32.1. Using RSA Security token cards to log in with AuthBy ACE

RSA Security produce 2 main types of hardware tokens. ‘Standard cards’ and ‘key fobs’ tokens have an LCD display that changes every 60 seconds, but no other buttons or switches. ‘Pinpad’ cards have an LCD display, and also 0-9 keys, a diamond button and a ‘P’ button. The way you generate your password depends on the type of token you have.

In RSA terminology, the number displayed by a token is called the ‘tokencode’. The number is typically 6 or 8 digits long and changes every 60 seconds. The ‘PIN’ is a secret 4 digit or longer number that you will be assigned (or may have selected) and which you must remember. The ‘passcode’ is what you use as your password to log in, and consists of the PIN followed by the tokencode.

For standard tokens, the passcode is formed from the PIN followed by the tokencode displayed on the token at that time. So, for example, if the PIN you have remembered that was assigned to you is ‘1234’, and the token is currently displaying the tokencode ‘627351’, then the passcode that you will use as your password is ‘1234627351’ (that is 10 digits). See Figure 1. Making a password from an RSA Security Token Code (not for Pinpads) on page 161.
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Figure 1. Making a password from an RSA Security Token Code (not for Pinpads)

When a standard token is set to New PIN Mode by the ACE administrator, you must first login in with your PIN and the current tokencode, and you will then be prompted by Radiator for your new PIN. If the token is set to New PIN mode and also has a Cleared PIN, you must omit your PIN.

For Pinpad tokens, you have to enter the PIN into the token to generate the passcode. If for example, your remembered PIN is 1234, enter the PIN into the Pinpad one digit at a time (press 1 - 2 - 3 - 4), then press the diamond button. The token will then display a new tokencode, say '736284'. You would then use 736284 (that’s only 6 digits) as your password. When a Pinpad token is set to New Pin Mode by the ACE administrator, you must create your passcode in the usual way and then the system will prompt them for their new PIN. When a Pinpad is in New Pin Mode and also has a cleared PIN, the user must enter the tokencode showing on the token (without using a PIN) first, and then the system will prompt them for their new PIN.

Note that some types of tokens display an 8 digit tokencode, rather than a 6 digit tokencode. AuthBy ACE understands the following parameters as well as those described in Section 3.31. <AuthBy xxxx> on page 147.

3.32.2. ConfigDirectory

This optional parameter specifies the location of the ACE Agent sdconf.rec file, which the ACE Agent client libraries use to find the location of the ACE server(s). It is also the directory where the node secret files will be saved. The user ID that runs Radiator must have read and write access to this directory. The file sdconf.rec must be present on the machine where AuthBy ACE is running. Defaults to the value of the VAR_ACE environment variable, if set, else /var/ace/. This parameter has no effect on Windows.

```
ConfigDirectory /opt/ace/data
```

3.32.3. Timeout

This optional parameter specifies the maximum time that a single ACE authentication is allowed to take. A typical ACE authentication will require several RADIUS transactions, involving multiple requests and challenges until the final Access-Accept is sent, and there is no guarantee that the user will complete the authentication process. If the total time for the authentication exceeds this number of seconds, the authentication will be abandoned. Defaults to 300 seconds (5 minutes).

3.32.4. EnableFastPINChange

Some NASs, notably some Juniper devices, have non-standard behaviour in New Pin Mode: when the user is asked whether they want to set their PIN, the NAS automatically gets the new PIN from the user and returns it to the Radiator server, which is expected to use it to set the PIN immediately. This flag enables compatibility with this behaviour if the user/device enters a PIN instead of ‘y’ or ‘n’. If EnableFastPINChange is enabled and the token is in New PIN mode and the users response does not look like ‘y’ or ‘n’, then the response will be used to set the new PIN, bypassing the PIN confirmation dialogues. Defaults to disabled.
3.33. <AuthBy TEST>

The AuthBy TEST module always accepts authentication requests, and ignores (but replies to) accounting requests. It is implemented in AuthTEST.pm. It is useful for testing purposes, but you should be sure not to leave them lying around in your configuration file, otherwise you might find that users are able to be authenticated when you really did not want them to.

AuthBy TEST can also serve as a useful template for developing your own AuthBy modules. For more information, see Section 10. High availability for radiusd on page 461.

3.33.1. Identifier

This allows you to assign a symbolic name to an AuthBy clause and its configuration. This allows you to refer to it by name in an Auth-Type check item when authenticating a user.

3.34. <AuthBy FILE>

AuthBy FILE authenticates users from a user database stored in a flat file. It ignores (but replies to) accounting requests. It is implemented in AuthFILE.pm. It understands standard Livingston user files. For more information about Livingston user files, see Section 9.2. Flat file user database on page 458.

For performance reasons, AuthBy FILE opens and reads the user database at start-up, reinitialisation and whenever the file’s modification time changes, (i.e. the database is cached within Radiator). Since the user database is cached in memory, large databases can require large amounts of memory.

AuthBy FILE supports a Nocache parameter that causes the user database to not be cached, and forces the file to be reread for every authentication. It will do a linear search for the user. You should be very careful about using this because it could be very slow for more than 1000 users or so. Also, authentication speed will depend on the user's position in the file, and will be faster for users near the beginning of the file. If you need Nocache in a production setting, you should consider DBFILE instead.

When attempting to authenticate a user, AuthBy FILE will first compare all the check items associated with the user. It understands and handles check items. For more information, see Section 7.1. Check items on page 432.

If all the check items agree with the attributes in the Access-Request message, AuthBy FILE will reply with an Access-Accept message containing all the attributes given as reply attributes in the user database. Some reply attributes are given special handling. For more information, see Section 7.2. Reply items on page 449. If the user does not appear in the database, or if any check attribute does not match, an Access-Reject message is sent to the client.

<AuthBy FILE> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.34.1. Filename

This specifies the filename that holds the user database. The default value is %D/users, which means the file named users in DbDir. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19.

Here is an example of using Filename:

```plaintext
# user database is called rad_users in DbDir
Filename %D/rad_users
```
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Tip
Do not use %U or %u (which are replaced by the user name) in Filename, otherwise the filename changes with every authentication.

3.34.2. GroupFilename

This defines the filename that holds the user group database. The default value is %D/groups, which means the file named groups in DbDir. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19.

For usage examples, see goodies/authorize-group1.cfg and goodies/authorize-group2.cfg.

3.34.3. Nocache

Disables caching of the user database, and forces Filename to be reread for every Authentication. If not set, AuthBy FILE will only reread the user database when the files modification time changes. Do not use this parameter unless you have to, because it can be very slow for any more than 1000 users or so. If you need think you need Nocache, you should consider DBFILE instead.

```bash
# Do not cache so we can do some simple testing
# without restarting the server all the time
Nocache
```

3.35. <AuthBy DBFILE>

AuthBy DBFILE authenticates users from a user database stored in a DBM file in the standard Merit DBM format. It is implemented in AuthDBFILE.pm. It does not log (but does reply to) accounting requests. For more information about file formats, see Section 9.3. DBM user database on page 459. DBM files can be built from flat file user databases with the builddbm utility. For more information about builddbm, see Section 6.1. builddbm on page 419.

AuthBy DBFILE opens and reads the user database for every authentication. This means that if you change the user database DBM file, it will have an immediate effect. The DBM file is not locked when it is accessed.

When attempting to authenticate a user, AuthBy DBFILE will first compare all the check items associated with the user in the same way as <AuthBy FILE>. For more information, see Section 3.34. <AuthBy FILE> on page 162. If all those match the attributes in the Access-Request message, AuthBy DBFILE will reply with an Access-Accept message containing all the attributes given as reply attributes in the user database. If the user does not appear in the database, or if any check attribute does not match, an Access-Reject message is sent to the client.

<AuthBy DBFILE> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.35.1. Filename

Specifies the filename that holds the user database. Defaults to %D/users, i.e. files named users.dir and users.pag in DbDir. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19. Depending on the actual DBM module that Perl chooses, the database files may have other extensions.

```bash
# user database is called rad_users in DbDir
Filename %D/rad_users
```
3.35.2. DBType

By default, Radiator and Perl will choose the ‘best’ format of DBM file available to you, depending on which DBM modules are installed on your machine. You can override this choice by specifying DBType as the name of one of the DBM formats supported on your platform. The typical choices are:

- AnyDBM_File
- NDBM_File
- DB_File
- GDBM_File
- SDBM_File
- ODBM_File

but not may be available on your platform. The default is AnyDBM_File, which chooses the best available implementation.

```bash
# Force it to use DB_File
DBType DB_File
```

Tip

If you alter this, you will probably have to use the -t flag set to the same type on `builddbm` to force it to build a compatible database.

3.36. <AuthBy CDB>

<AuthBy CDB> authenticates users from a user database stored in a CDB database file. CDB is a fast, reliable, lightweight package for creating and reading constant databases. For more details about CDB, see cdb website [https://cr.yp.to/cdb.html](https://cr.yp.to/cdb.html). It is implemented in AuthCDB.pm, which was contributed by Pedro Melo (melo@ip.pt). It does not log accounting requests but replies to them. To use <AuthBy CDB>, install the CDB_File package from CPAN. For more information, see Section 2.1.2. CPAN on page 3.

<AuthBy CDB> opens and reads the user database for every authentication. This means that if you change the user database CDB file, it has an immediate effect. The CDB file is not locked when it is accessed.

The CDB is indexed by user name and the value is the check items followed by a newline followed by the reply items.

When attempting to authenticate a user, <AuthBy CDB> first compares all the check items associated with the user in the same way as <AuthBy FILE> (for more information, see Section 3.34. <AuthBy FILE> on page 162). If all those match to the attributes in the Access-Request message, <AuthBy CDB> replies with an Access-Accept message containing all the attributes given as reply attributes in the user database. If the user does not appear in the database or if any check attribute does not match, an Access-Reject message is sent to the client.

<AuthBy CDB> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.36.1. Filename

Specifies the filename that holds the user database. Defaults to %D/users.cdb. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19.
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\[ \text{user database is called rad_users.cdb in DbDir} \]
\[ \text{Filename $D/rad_users.cdb} \]

### 3.37. \texttt{<AuthBy GROUP>}

\texttt{<AuthBy GROUP>} allows you to conveniently define and group multiple \texttt{AuthBy} clauses. It is implemented in \texttt{AuthGROUP.pm}. This is most useful where you need to be able to have multiple sets of authentication clauses, perhaps with different \texttt{AuthByPolicy} settings for each group. You can use an \texttt{<AuthBy GROUP>} (containing any number of \texttt{AuthBy} clauses) anywhere that a single \texttt{AuthBy} clause is permitted. \texttt{<AuthBy GROUP>} can be nested to any depth.

\texttt{<AuthBy GROUP>} will try each \texttt{AuthBy} method in turn until one of them either Accepts or Rejects the request. You can change this using \texttt{AuthByPolicy}. For more information, see Section 3.37.1. \texttt{AuthByPolicy} on page 165.

\begin{verbatim}
<AuthBy GROUP>
  AuthByPolicy ContinueUntilReject
  <AuthBy SQL>
    ...
  </AuthBy>
  <AuthBy DBM>
    ...
  </AuthBy>
  <AuthBy GROUP>
    AuthByPolicy ContinueUntilAccept
    RewriteUsername s/^(.+)$/cyb-$1/
    <AuthBy FILE>
      ...
    </AuthBy>
    <AuthBy FILE>
      ...
    </AuthBy>
  </AuthBy>
</AuthBy>
\end{verbatim}

\texttt{<AuthBy GROUP>} understands also the same parameters as \texttt{<AuthBy xxxxxx>}. For more information, see Section 3.31. \texttt{<AuthBy xxxxxx>} on page 147.

#### 3.37.1. \texttt{AuthByPolicy}

This parameter allows you to control the behaviour of multiple \texttt{AuthBy} clauses inside this \texttt{<AuthBy GROUP>}. In particular, it allows you to specify under what conditions Radiator tries the next \texttt{AuthBy} clause. If you only have one \texttt{AuthBy} clause, \texttt{AuthByPolicy} is not relevant and is ignored.

You can specify more than one \texttt{AuthBy} clause for a single Realm, Handler, or \texttt{<AuthBy GROUP>}. The normal behaviour of Radiator is to try to authenticate with the first one. If that authentication method either Accepts or Rejects the request, then Radiator immediately sends a reply to the NAS. If the \texttt{AuthBy} ignores the request, then the next one is tried. That is the default behaviour, you can change it using \texttt{AuthByPolicy}. The permissible values of \texttt{AuthByPolicy} are:

- **ContinueWhileIgnore**
  
  This is the default. Continue trying to authenticate until either Accept, Challenge, or Reject.

- **ContinueUntilIgnore**
Continue trying to authenticate until Ignore.

• **ContinueWhileAccept**
  Continue trying to authenticate as long as it is Accepted.

• **ContinueUntilAccept**
  Continue trying to authenticate until it is Accepted.

• **ContinueWhileChallenge**
  Continue trying to authenticate as long as it is Challenged.

• **ContinueUntilChallenge**
  Continue trying to authenticate until it is Challenged.

• **ContinueWhileReject**
  Continue trying to authenticate as long as it is Rejected.

• **ContinueUntilReject**
  Continue trying to authenticate until it is Rejected.

• **ContinueWhileAcceptOrChallenge**
  Continue trying to authenticate as long as it is either Accepted or Challenged.

• **ContinueUntilAcceptOrChallenge**
  Continue trying to authenticate until it is either Accepted or Challenged.

• **ContinueUntilRejectOrChallenge**
  Continue trying to authenticate until it is either Reject or Challenged.

• Anything else
  Always do every authentication method. Returns the result of the last one.

Here is an example of using *AuthByPolicy*:

```xml
# Authenticate with SQL, but if they are rejected
# fall back to a flat file
 AuthByPolicy ContinueWhileReject
        <AuthBy SQL>
            ....
        </AuthBy>
        <AuthBy FILE>
            ....
        </AuthBy>
```

You can only have one *AuthByPolicy* parameter and it applies to all the AuthBy clauses. You cannot change it between AuthBy clauses.

**Tip**

*ContinueUntilAcceptOrChallenge* is the most useful one when using EAP requests in an `<AuthBy GROUP>` with multiple internal AuthBys.
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3.37.2. RewriteUsername

This is an optional parameter. It enables you to alter the username in authentication and accounting requests. For more details and examples, see Section 8. Rewriting user names on page 454.

3.37.3. StripFromRequest

Strips the named attributes from the request before passing it to any lower authentication modules. The value is a comma separated list of attribute names. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. There is no default.

```plaintext
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port
```

3.37.4. AddToRequest

Adds attributes to the request before passing it to any lower authentication modules. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```plaintext
# Append a Filter-ID and host name
AddToRequest Calling-Station-Id=1,Login-IP-Host=%h
```

3.37.5. AddToRequestIfNotExist

Adds attributes to the request before passing it to any lower authentication modules. Unlike AddToRequest, an attribute will only be added if it does not already exist in the request. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest and AddToRequestIfNotExist adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```plaintext
# Append a Filter-ID and host name if they are not there already
AddToRequestIfNotExist Calling-Station-Id=1,Login-IP-Host=%h
```

3.38. <AuthBy UNIX>

<AuthBy UNIX> authenticates users from a user database stored in a standard Unix password file or similar format. It is implemented in AuthUNIX.pm. It does not log (but does reply to) accounting requests. For more information about the file format, see Section 9.4. Unix password file on page 460. Since Unix password files only have encrypted passwords, <AuthBy UNIX> can not work with CHAP or MSCHAP authentication.

For performance reasons, <AuthBy UNIX> opens and reads the password and group files at start-up, reinitialisation and whenever the file modification times change, (i.e. they are cached within Radiator). Since these files are cached in memory, large password files can require large amounts of memory. If you set the Nocache parameter, the files will be reread for every authentication, and will not be cached internally (this can be slow if you have a large password or group files, and should rarely be necessary).

It is not necessary to be running on a Unix host in order to use <AuthBy UNIX>. It will work equally well on Windows and NT, but you are probably less likely to need it there.

By using the Match parameter you can also specify other file formats if you need to.

When attempting to authenticate a user, <AuthBy UNIX> will encrypt the password from the user and compare it to the one in the password file. If the encrypted passwords match, AuthBy UNIX will reply with an Access-Accept message. If the user does not appear in the password file, an Access-Reject message is sent to the
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<AuthBy UNIX> caches the password file and group file internally, and rereads the files when the modification time changes. If the Nocache parameter is set the password and group files will be reread for every authentication.

It is important to note that on its own, <AuthBy UNIX> does not implement check or reply items, and therefore can only be used for “Authenticate only” applications. However, you can use it in conjunction with another AuthBy module that does use check and reply items. For more information, see Section 7. Check and reply items on page 431. If you do this, you can also use the Group check item, which will check whether the user is a member of a group defined in the GroupFilename file.

Tip
You can use AddToReply to easily add standard reply items to all users authenticated by <AuthBy UNIX>. For more information see Section 3.13.20. AddToReply on page 94.

<AuthBy UNIX> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.38.1. Filename

Specifies the filename of the password file. Defaults to /etc/passwd. The file name can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19.

Tip
On systems with shadow password files, such as Solaris, Filename can name the shadow file. In order to support this, Radiator must have permission to read the shadow file (this usually means it must run as root).

# password file is in /usr/local/etc/local_passwd
Filename /usr/local/etc/local_passwd

3.38.2. Match

This parameter allows you to use flat files with different formats to the standard Unix password format. Match is a regular expression that is expected to match and extract the user name, password and (optional) primary group ID fields from each line in the password file. The default extracts the first two colon separated fields as user name and password, followed by a UID, followed by an (optional) primary group ID (i.e. standard Unix password file format).

# fields are separated by vertical bar |
Match ^([{}\|\s\|]{})\|\{\^[{}\|\s\|]}\}

Tip
The default Match expression is:

Match ^\{[^{]}\s]*\}\{[^{]}\s]*\}?:\{[^{]}\s]*\}?:\{[^{]}\s]*\}?
3.38.3. **GroupFilename**

Specifies the name of the group file. The group file is in standard Unix group file format. Used to check "Group=" check items when authentication is cascaded from another module. Defaults to /etc/group/.

```
# group file is in /usr/local/etc/local_group
GroupFilename /usr/local/etc/local_group
```

3.38.4. **Nocache**

Disables caching of the password and group files, and forces them to be reread for every Authentication. If not set, AuthBy UNIX will only reread the files when their modification time changes. Do not use this parameter unless you have to, because it can be very slow for any more than 1000 users or so.

```
# Do not cache so we can do some simple testing
# without restarting the server all the time
Nocache
```

3.39. **<AuthBy EXTERNAL>**

<AuthBy EXTERNAL> passes all requests to an external program, which is responsible for determining how to handle the request. It is implemented in AuthEXTERNAL.pm.

3.39.1. **Command**

This parameter specifies the command to run. The command can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19. There is no default, and a Command must be specified. For more information about interpreting stdin, stdout, and exit status, see Section 3.39.2. Interpreting command stdin, stdout, and exit status on page 169.

```
# Interface to an external system
Command /usr/local/bin/doReq %T
```

3.39.2. **Interpreting command stdin, stdout, and exit status**

When the external command is run, all the attributes in the request will be formatted and passed to its standard input (stdin), one per line, in the format:

```
<tab> Attribute-Name = attribute_value
```

Each line output by the command on stdout is interpreted as a list of comma separated attribute-value pairs in the format:

```
Attribute-Name = attribute_value
```

and are returned in the reply message (if any). Any output lines that cannot be interpreted in that form are put in a Reply-Message attribute and returned in the reply message (if any). (This last behaviour is for backwards compatibility only and will not be supported indefinitely).

The exit status of the external command determines what type of reply is to be sent in response to the request:

- 0 means reply with an acceptance. For Access-Requests, an Access-Accept will be sent. For Accounting-Requests, an Accounting-Response will be sent.
- 1 means reply with a rejection. For Access-Requests, an Access-Reject is sent. For Accounting-Requests, no response is sent.
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- 2 means do not send any reply. This will also make the Realm fall through to the next AuthBy module if you specified more than one for this Realm. For more information, see Section 3.37.1. AuthByPolicy on page 165.
- 3 means reply with an Access-Challenge for Access-Request. For Accounting-Requests, no response is sent.
- Any other value means that no reply is sent and no further action is taken.

/AuthBy EXTERNAL/ will wait for the external process to complete before handling more requests, so you should use this carefully, and avoid using long-running commands. If you cannot avoid long-running EXTERNAL commands, you can use the Fork parameter to force /AuthBy EXTERNAL/ to fork before calling the external command. This may improve performance.

/AuthBy EXTERNAL/ understands also the same parameters as /AuthBy xxxxxx/. For more information, see Section 3.31. /AuthBy xxxxxx/ on page 147.

3.39.3. DecryptPassword

This optional parameter makes AuthBy EXTERNAL decrypt the User-Password attribute before passing it to the external program. If you do not specify this, User-Password will be passed exactly as received in the request (i.e. encrypted by MD5 according to the RADIUS standard).

This is not able to decrypt CHAP or MSCHAP passwords.

```
# Pass plaintext passwords to the external program
DecryptPassword
```

3.39.4. ResultInOutput

If this optional parameter is set, AuthBy EXTERNAL will determine the type of the reply from the first line of the stdout output of the external program, rather than the exit code of the external program.

The following codes are recognised:

- ACCEPT
  Reply with an Access-Accept
- REJECT
  Reply with an Access-Reject
- IGNORE
  Do not reply
- CHALLENGE
  Reply with an Access-Challenge
- REJECT_IMMEDIATE
  Reply with an Access-Reject, and do not consider any other DEFAULT users in a chained Auth-Type request

3.40. <AuthBy SQL>

/AuthBy SQL/ authenticates users from an SQL database, and stores accounting records to an SQL database. It is implemented in AuthSQL.pm. /AuthBy SQL/ is very powerful and configurable, and it has many parameters in order to customise its behaviour. You need to have some familiarity with SQL and relational databases in order to configure and use /AuthBy SQL/.
<AuthBy SQL> uses the Perl DBI/DBD interface to connect to your database. You can therefore use <AuthBy SQL> with a large number of commercial and free SQL database systems. In order to use SQL, you will need to install your database software, install the matching Perl DBD module, and install the Perl DBI module before <AuthBy SQL> works.

When <AuthBy SQL> receives an Access-Request message, it tries to find a password and check and reply items for the user in a database table (you can change this behaviour with the AuthColumnDef parameter). Radiator constructs an SQL select statement from the AuthSelect parameter. By changing AuthSelect, you can control the table it looks in, and the names of the columns for the password, check and reply columns. If the user is found, all the check items are compared with the attributes in the request, including Expiration and other special check items. For more information about check and reply items, see Section 7. Check and reply items on page 431.

If all the check items are satisfied by the attributes in the request, <AuthBy SQL> replies with an Access-Accept message containing all the attributes in the reply items. If the user does not appear in the database, or if any check attribute does not match, an Access-Reject message is sent to the client.

If your AuthSelect statement does not generate a simple password, check items, and reply items as a result, you can configure Radiator how to interpret the columns in the result with the AuthColumnDef parameter. If you do not specify any AuthColumnDef parameters, Radiator assumes that AuthSelect returns password, check items, and reply items in that order.

When <AuthBy SQL> receives an Accounting-Request message, it can store any number of the attributes from the request in an SQL table. You can control the table it stores in, and the names of the columns where the attributes are stored, and the attribute that is stored there. To enable SQL accounting you must define AccountingTable and you must define at least one AcctColumnDef. If you do not do both of these <AuthBy SQL> acknowledges Accounting-Request message but will not store them anywhere. The example goodies/sql.cfg in the Radiator distribution shows a typical setup that will work with the table schemas in goodies/*Create.sql files.

Some example scripts for constructing database tables for various RDBMSs can be found in the goodies/*Create.sql files in the Radiator distribution. Regard these as a starting point for constructing large scalable user and accounting databases.

<AuthBy SQL> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

3.40.1. AuthSelect

This is an SQL select statement that will be used to find and fetch the password and possibly check items and reply items for the user who is attempting to log in. You can use the special formatting characters. %0 is replaced with the quoted and escaped user name. The first column returned is expected to be the password; the second is the check items (if any) and the third is the reply items (if any) (you can change this expectation with the AuthColumnDef parameter). Defaults to "select PASSWORD from SUBSCRIBERS where USERNAME= %0", which does not return any check or reply items. You can make arbitrarily complicated SQL statements so that you will only authenticate users for example whose account status is OK or who have not exceeded their download limit etc. For information about how check items and reply items are used, see Section 7. Check and reply items on page 431. If the password (or encrypted password) column for a user is NULL in the database, then any password will be accepted for that user.

The password column may be in any of the formats described in Section 7.1.1. User-Password, Password on page 432.

```bash
# Check user status is current. No reply items in DB
# Note: The entire statement must be on one line
```
AuthSelect select PW, CHECK from USERS where NAME=%0 and STATUS = 1

If AuthSelect is defined as an empty string, SQL will not attempt to authenticate at all.

If one or more AuthSelectParam parameters are specified, they will be used in order to replace any fields marked with a question mark in AuthSelect.

**Tip**
By default, many SQL servers do case-insensitive string comparison. This means that AuthBy SQL, AuthBy RADMIN etc. would match, for example mikem, MIKEM and MiKeM as being the same user. Some SQL databases allow you to force case-sensitive comparisons. For example, In the case of MySQL, the 'BINARY' keyword forces the following comparison to be case-sensitive. Therefore you could force case-sensitive user names in an AuthSQL for MySQL with something like:

AuthSelect select PASSWORD from SUBSCRIBERS where BINARY USERNAME=%0

**Tip**
You can improve the performance of AuthSelect queries executed by the SQL server with AuthSelectParam.

**Note**
In the event of a SQL timeout, Radiator will reconnect to the database and the AuthSelect query will be tried again. This means there may be up to 2 Timeout intervals before the entire AuthSelect query fails.

### 3.40.2. AuthSelectParam

This optional parameter specifies a bind variable to be used with AuthSelect. See Section 3.8.1. SQL bind variables on page 45 for information about how to use bind variables.

### 3.40.3. AuthColumnDef

This optional parameter allows you to change the way Radiator interprets the result of the AuthSelect statement. If you do not specify any AuthColumnDef parameters, Radiator assumes that the first column returned is the password; the second is the check items (if any) and the third is the reply items (if any). If you specify any AuthColumnDef parameters, Radiator uses the column definitions you provide.

AuthColumnDef ignores the returned columns if their value is one of the following:

- NULL
- Empty value
- Single NULL octet value

You can specify any number of AuthColumnDef parameters, one for each interesting field returned by AuthSelect. The general format is:

AuthColumnDef n, attributename, type[, formatted]

- n is the index of the field in the result of AuthSelect. 0 is the first field.
• `attributename` is the name of the attribute to be checked or replied. The value of the attribute is in the nth field of the result. The special `attributename"GENERIC"` indicates that it is a list of comma separated `attribute=value` pairs.

• `type` indicates whether it is a check or reply item. A type of "request" sets the named attribute in the incoming request, from where it can be retrieved later in the authentication process with special formatting characters.

• `formatted`, if this keyword is present, the value retrieved from the database is subject to special character processing before its value is used, and can therefore contain `%{something}` forms which are replaced at authentication time.

**Example**

The standard default AuthSelect statement is:

```plaintext
AuthSelect select PASSWORD from SUBSCRIBERS \ 
  where USERNAME=%0
```

This returns a single plain text password check item. The result can be interpreted with:

```plaintext
AuthColumnDef 0, User-Password, check
```

**Example**

Here is a more complicated AuthSelect statement:

```plaintext
AuthSelect select PASSWORD, CHECKATTR, REPLYATTR \ 
  from SUBSCRIBERS \ 
  where USERNAME=%0
```

The previous example returns 3 fields in the result. The first is a plain text password, the second is a string of check items like "Service-Type=Framed-User, Expiration="Feb 2 1999"", and the third field is a string of reply items like "Framed-Protocol=PPP,Framed-IP-Netmask = 255.255.255.0.....". The result can be interpreted with:

```plaintext
AuthColumnDef 0, User-Password, check
AuthColumnDef 1, GENERIC, check
AuthColumnDef 2, GENERIC, reply
```

**Note**

If your PASSWORD column contains a Unix encrypted password and you are using `AuthColumnDef`, you need to set it like this:

```plaintext
AuthColumnDef 0, Encrypted-Password, check
```

**Example**

Here is an example AuthSelect statement:

```plaintext
AuthSelect select SERVICE, PASSWORD, MAXTIME \ 
  from SUBSCRIBERS \ 
  where USERNAME=%0
```
This returns 3 fields in the result. The first is a Service-Type to check, the next is a plain text password and the last is the number of seconds to send back in Session-Timeout. The result can be interpreted with:

```
AuthColumnDef 0, Service-Type, check, formatted
AuthColumnDef 1, User-Password, check
AuthColumnDef 2, Session-Timeout, reply
```

In this example, column 0 is interpreted for special characters before being used as a check item for the Service-Type parameter.

**Example**

Here is an example of using NULL values for customising user authorisation:

```
AuthColumnDef 2, NAS-IP-Address, check
AuthColumnDef 1, Framed-IP-Address, reply
```

This allows you to restrict certain users so that they can only log in from a certain NAS. The unrestricted users have column 1 set to NULL. Likewise, users with static IP address have non-NULL value in column 2.

### 3.40.4. AccountingTable

This is the name of the table that will be used to store accounting records. Defaults to “ACCOUNTING”. If AccountingTable is defined to be an empty string, all accounting requests will be accepted and acknowledged, but no accounting data will be stored. You must also define at least one AcctColumnDef before accounting data will be stored.

The AccountingTable table name can contain special formatting characters: table names based on the current year and/or month might be useful, so you can rotate your accounting tables.

```
# store accounting records in RADUSAGEyyyymm table
AccountingTable RADUSAGE%Y%m
```

### 3.40.5. EncryptedPassword

This parameter should be set if and only if your AuthSelect statement will return a bare Unix encrypted password, and you are not using AuthColumnDef. Encrypted passwords cannot be used with CHAP or MSCHAP authentication. If the encrypted password column for a user is NULL in the database, then any password will be accepted for that user. If the encrypted password column for a user is set to the empty string (as opposed to NULL), then no password will be accepted for that user.

EncryptedPassword is a hint to Radiator about how to deal with passwords that have no explicit password type prefix. If EncryptedPassword is not set, bare passwords (i.e. without a prefix) are treated as plaintext passwords. If EncryptedPassword is set, they are treated as a Unix crypt password. If a password has a prefix, then the password will be interpreted according to that type of password, independent of the setting of EncryptedPassword. For more information, see Section 7.1.1. User-Password, Password on page 432.

**Note**

This parameter is ignored if you have defined your own AuthSelect column definitions with AuthColumnDef.

```
# unix Encrypted password are in CRYP TPW
AuthSelect select CRYP TPW from USERS where N = %0
```
3.40.6. HandleAcctStatusTypes

This optional parameter specifies a list of Acct-Status-Types that will be processed in Accounting requests. The value is a comma-separated list of valid Acct-Status-Type attribute values (see your dictionary for a full list) including, Start, Stop, Alive, Modem-Start, Modem-Stop, Cancel, Accounting-On, Accounting-Off etc.

If HandleAcctStatusTypes is specified and an Accounting request has an Acct-Status- Type not mentioned in HandleAcctStatusTypes, then the request will be ACCEPTed but not inserted or handled with AcctSQLStatement. The default is to handle all Acct-Status-Types.

```
# Only insert Start and Stop requests, ack everything else
HandleAcctStatusTypes Start,Stop
```

3.40.7. AccountingStartsOnly

If this parameter is defined, it forces AuthBy SQL to only log Accounting Start requests to the database. All other Accounting requests are accepted and acknowledged, but are not stored in the SQL database.

Note

This parameter is now deprecated and will not be supported in the future. Use Section 3.40.6. HandleAcctStatusTypes on page 175 instead.

Note

It does not make sense to set AccountingStartsOnly and AccountingStopsOnly.

3.40.8. AccountingAlivesOnly

If this parameter is defined, it forces AuthBy SQL to only log Accounting Alive requests to the database. All other Accounting requests are accepted and acknowledged, but are not stored in the SQL database.

Note

This parameter is now deprecated and will not be supported in the future. Use Section 3.40.6. HandleAcctStatusTypes on page 175 instead.

3.40.9. AccountingStopsOnly

If this parameter is defined, it forces AuthBy SQL to only log Accounting Stop requests to the database. All other Accounting requests are accepted and acknowledged, but are not stored in the SQL database.

Note

This parameter is now deprecated and will not be supported in the future. Use Section 3.40.6. HandleAcctStatusTypes on page 175 instead.
You may want to use this parameter if your accounting system does not use or need Accounting Start to do its billing.

```bash
# We only want Stops
AccountingStopsOnly
```

**Note**

It does not make sense to set AccountingStartsOnly and AccountingStopsOnly.

### 3.40.10. AcctColumnDef

AcctColumnDef is used to define which attributes in accounting requests are inserted into AccountingTable. It also specifies which column they are inserted into, and optionally the data type of that column. The general form is:

```
AcctColumnDef Column,Attribute[,Type][,Format]
```

- **Column** is the name of the SQL column where the data is inserted. **Attribute** is the name of the RADIUS attribute to store there. **Type** is an optional data type specifier, which specifies the data type of the SQL column. **Format** is an optional format string that can be used to format the value. Columns and their values are included in accounting SQL statements in alphabetical order by column name.

The following types are recognised:

- **integer**
  
  The insertion is done as an integer data type. RADIUS attributes that have VALUE names defined are inserted as their integer RADIUS value.

- **integer-date**
  
  The attribute value is converted from Unix seconds to an SQL datetime string using the date formatting characters. For more information, see Section 3.4. Date formatting on page 24. The Format field is used as the date format (if it is present), otherwise the standard DateFormat parameter for this AuthBy SQL is used (which defaults to the format 'Sep 3, 1995 13:37'). This is useful for inserting the Timestamp attribute as an SQL datetime type. The default is compatible with at least MySQL, Microsoft SQL and Sybase datetime columns. If it is not suitable for your database, consider defining your own DateFormat parameter for this AuthBy SQL.

- **formatted-date**
  
  This is now deprecated, and new installations should use integer-date instead. It has a much wider range of formatting and date options.

  The attribute is converted by Date::Format according to the format string. The Perl TimeDate package is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. It is most useful for SQL databases with unusual date formats, like Oracle. formatted-date is now only provided for historical reasons, and new installations should probably use integer-date in conjunction with DateFormat instead.

- **formatted**
  
  The attribute field is processed looking for the special characters described in Section 3.3. Special formatters on page 19. If the resulting string is empty it is not inserted. This is useful for inserting data from other places besides the current request, such as a GlobalVar you have defined elsewhere, or from a data item that the previous AuthBy put in the current reply packet. The resulting data is quoted. See literal below to generate unquoted data.
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- literal
  
  Similar to formatted, except that the resulting field is be quoted.

- inet_aton
  
  Converts a dotted quad IP address (such as 10.1.1.5) to a 32 bit unsigned integer.

- Anything else
  
  Any other type string causes the named RADIUS attribute to be inserted literally as a string. Quotes and other control characters are automatically escaped to suit your database.

You can use formatted-date to create date formats to suit your SQL database. This example inserts the Timestamp into an Oracle date type column called TIME_STAMP:

```
AcctColumnDef TIME_STAMP, Timestamp, formatted-date, to_date
   ('%e %m %Y %H:%M:%S', 'DD MM YYYY HH24:MI:SS')
```

The insert statement is this:

```sql
insert into ACCOUNTING(TIME_STAMP, .......) values
  (to_date('16 02 1999 16:40:02', 'DD MM YYYY HH24:MI:SS'), ....)
```

For types other than formatted-date and integer-date, the format field can be used to build custom values in your insert statement. This can be very useful to call SQL conversion functions on your data. If you specify a format, it is used as a sprintf-style format, where %s is replaced by your value.

If any named attribute is not present in the accounting request, nothing is inserted in the column for that value. The attribute does not appear in the insert statement at all, and the SQL server's default value (usually NULL) is used for that column. With some SQL servers, you can change the default value to be used when a column is not specified in an insert statement.

You can have 0 or more AcctColumnDef lines, one for each attribute you want to store in the accounting table. If there are no AcctColumnDef lines, then the accounting table is not updated.

The attribute Timestamp is always available for insertion, and is set to the time the packet was received, adjusted by Acct-Delay-Time (if present), as an integer number of seconds since midnight Jan 1, 1970 UTC. The Timestamp attribute is added by Radiator to all received Accounting requests, and is set to the current time according to the host on which the Radiator is running.

Here is an example column configuration:

```
AcctColumnDef USERNAME, User-Name
AcctColumnDef TIME_STAMP, Timestamp, integer
AcctColumnDef ACCTSTATUSYPE, Acct-Status-Type
AcctColumnDef ACCTDELAYTIME, Acct-Delay-Time, integer
AcctColumnDef ACCTINPUTOCT, Acct-Input-Octets, integer
AcctColumnDef ACCTOUTPUTOCT, Acct-Output-Octets, integer
AcctColumnDef ACCTSESSIONID, Acct-Session-Id
AcctColumnDef ACCTSESTIME, Acct-Session-Time, integer
AcctColumnDef ACCTTERMINATECAUSE, Acct_Terminate-Cause
AcctColumnDef NASIDENTIFIER, NAS-Identifier
AcctColumnDef NASPORT, NAS-Port, integer
```
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Note
If your accounting table inserts are not working, run Radiator at a trace level of 4, and you see each insert statement logged before it is executed. This helps you determine if your AcctColumnDef lines are correct.

Note
If there are multiple definitions for the same column with non-null values, the last one in the configuration file is used.

Note
SQL table and column names are generally case sensitive, and usually can consist only of letters, digits or the underscore character ‘_’.

Note
You can further customise the accounting insert query with AcctInsertQuery.

Note
The ‘formatted’ type is useful for inserting values set up in GlobalVars, or to get values from the current reply (possibly put there by a preceding AuthBy).

```
AcctColumnDef ACCOUNTTYPE,%{Reply:accounttype},formatted
AcctColumnDef SERVERNAME,%{GlobalVar:servername},formatted
```

Note
You can get SQL to calculate the start time of an accounting packet with something like:

```
AcctColumnDef START_TIME,%b-0%{Acct-Session-Time},literal
```

3.40.11. AuthSQLStatement

This parameter allows you to execute arbitrary SQL statements each time an authentication request is received, but before authentication is done.

You can have as many AuthSQLStatement parameters as you like (i.e. 0 or more). Each one will have its special formatting macros replaced at run time (the ones of the format %{attribute-name} are probably the most useful). %0 is replaced with the quoted and escaped user name. They are executed in the order they appear in the configuration file, before AuthSelect is run. They are run even if AuthSelect is empty.
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3.40.12. AcctSQLStatement

This parameter allows you to execute arbitrary SQL statements each time an accounting request is received. You might want to do it to handle processing in addition to the normal inserts defined by AcctColumnDef, or you might want to construct a much more complicated SQL statement than AcctColumnDef can handle. You only need this if the accounting definitions provided by AcctColumnDef are not powerful enough.

You can have as many AcctSQLStatement parameters as you like (i.e. 0 or more). Each one will have its special formatting macros replaced at run time (the ones of the format %{attribute-name} are probably the most useful). %0 is replaced with the quoted and escaped user name. They are executed in the order they appear in the configuration file.

```sql
AcctSQLStatement delete from ONLINE where SessionID='%(Quote:%{Acct-Session-Id})'
```

**Note**

By having multiple AuthBy SQL clauses, and by using AccountingStartsOnly and AccountingStopsOnly, in conjunction with AcctSQLStatement, you could implement a "who is online" table.

3.40.13. AcctInsertQuery

This optional parameter allows you to customise the exact form of the insert query used to insert accounting data. All date formatting characters are permitted. For more information, see Section 3.4. Date formatting on page 24. %0 is replaced with the value of the AccountingTable parameter. %1 is replaced with the comma separated list of column names to be inserted (derived from Acct-ColumnDef), and %2 is replaced by the data values to be inserted for each column in the same order as %1. The columns and values will be in alphabetical order by column name. The default is 'insert into %0 (%1) values (%2)'.

You can use this to use special features in your SQL server, such as this for MySQL:

```sql
# maybe update if this is a duplicate
AcctInsertQuery update or insert into %0 (%1) values (%2)
```

3.40.14. DateFormat

This optional parameter specifies the format to be used to format dates for insertion into the AccountingTable. All date formatting characters are permitted. For more information, see Section 3.4. Date formatting on page 24. Defaults to '%b %e, %Y %H:%M' (e.g. 'Sep 3, 1995 13:37').

```sql
# Include seconds in dates in a way that MS-SQL likes
DateFormat %b %e, %Y %H:%M:%S
```

3.40.15. AcctFailedLogFileName

The name of a file used to log failed Accounting-Request messages in the standard radius accounting log format. If the SQL database insert fails, the accounting message will be logged to the named file. For more information about file format, see Section 9.5. Accounting log file on page 460. If no AcctFailedLogFileName is defined, failed accounting messages will not be logged. The default is no logging. The file name can include special formatting characters as described in Section 3.3. Special formatters on page 19, which means that, for example, using the %c specifier, you can maintain separate accounting log files for each Client. The AcctFailedLogFileName file is always opened written and closed for each failed insertion, so you can safely rotate it at any time.
The user name that is recorded in the log file is the rewritten user name when RewriteUsername is enabled.

**Note**
You can change the logging format with AcctLogFileFormat.

**Note**
You may want to make the filename depend on the date, so you get one missed accounting file per day.

```bash
# Log all accounting to a single log file in LogDir
AcctFailedLogFileName %L/misseddetails
```

### 3.40.16. AcctLogFileFormat

This optional parameter is used to alter the format of the accounting log file from the standard radius format when AcctLogFileFormatHook is not defined. AcctLogFileFormat is a string containing special formatting characters. It specifies the format for each line to be printed to the accounting log file. A newline will be automatically appended. It is most useful if you use the `%{attribute}` style of formatting characters (to print the value of the attributes in the current packet).

```
AcctLogFileFormat %{Timestamp} %{Acct-Session-Id}\n%{User-Name}
```

### 3.40.17. AcctLogFileFormatHook

Specifies an optional Perl hook that will is used to alter the format of the failed accounting log file from the standard radius format when defined. The hook must return the formatted accounting record. A newline will be automatically appended. By default no hook is defined and AcctLogFileFormat or the default format is used. The hook parameter is the reference to the current request.

### 3.40.18. PostAuthSelectHook

This optional parameter allows you to define a Perl function that will be run during the authentication process. The hook will be called after the AuthSelect results have been received, and before Radiator has processed the attributes it is interested in.

The first argument passed to the hook is a handle to the current AuthBy SQL object. The second argument is the name of the user being authenticated. The third argument is a pointer to the current request. The fourth argument is a pointer to the User object being constructed to hold the check and reply items for the user being authenticated. The fifth argument ($_[4]) is a reference to the @row resulting from AuthSelect.

```perl
# Change the flag in the first field to 'Accept' or 'Reject'
PostAuthSelectHook sub{my($self,$name,$p,$user,$row)=@_;
  my $flag = $row->[0];
  $row->[0] = $flag ? 'Reject':'Accept';
  }
```

### 3.40.19. GroupMembershipQuery

This optional parameter defines an SQL query which will be used to determine whether a user is a member of a group in order to implement the Group check item. Special characters are supported. `%0` is replaced by the
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user name being checked. %1 is replaced by the group name being checked. You can use bound variables with GroupMembershipQueryParam. GroupMembershipQuery is expected to return a single row, where the first field is the name of the group the user belongs to.

3.40.20. GroupMembershipQueryParam

You can also use GroupMembershipQueryParam to provide bound variables for GroupMembershipQuery. %0 is replaced by the user name being checked. %1 is replaced by the group name being checked.

3.40.21. AcctTotalQuery

This optional parameter defines an SQL query which will be used to determine the total of all session times for a given user. Special characters are supported. %0 is replaced by the user name being checked. It is expected to return a single field containing the total session time in seconds.

It is used to get a count for the following check items:

- Max-All-Session

```
SELECT SUM(AcctSessionTime) FROM radacct WHERE UserName=%0
```

3.40.22. AcctTotalSinceQuery

This optional parameter defines an SQL query which will be used to determine the total of session times from a certain time until now for a given user. Special characters are supported. %0 is replaced by the user name being checked. %1 is replaced by the Unix epoch time in seconds in the start time of the query. It is expected to return a single field containing the total session time in seconds.

It is used to get a count for the following check items:

- Max-Hourly-Session
- Max-Daily-Session
- Max-Monthly-Session

3.40.23. AcctTotalOctetsSinceQuery

This optional parameter defines an SQL query which will be used to determine the total of octets from a certain time until now for a given user. Special characters are supported. %0 is replaced by the user name being checked. %1 is replaced by the Unix epoch time in seconds of the start time of the query. It is expected to return a single field containing the total octets.

It is used to get a count for the following check items:

- Max-Hourly-Octets
- Max-Daily-Octets
- Max-Monthly-Octets

3.40.24. AcctTotalOctetsQuery

This optional parameter defines an SQL query which will be used to determine the total of octets for a given user. Special characters are supported. %0 is replaced by the user name being checked. It is expected to return a single field containing the total octets.

It is used to get a count for the following check items:

- Max-All-Octets
3.40.25. AcctTotalGigawordsSinceQuery

This optional parameter defines an SQL query which will be used to determine the total of gigawords from a certain time until now for a given user. Special characters are supported. %0 is replaced by the user name being checked. %1 is replaced by the Unix epoch time in seconds of the start time of the query. It is expected to return a single field containing the total gigawords.

It is used to get a count for the following check items:

- Max-Hourly-Gigawords
- Max-Daily-Gigawords
- Max-Monthly-Gigawords

3.40.26. AcctTotalGigawordsQuery

This optional parameter defines an SQL query which will be used to determine the total of gigawords for a given user. Special characters are supported. %0 is replaced by the user name being checked. It is expected to return a single field containing the total gigawords.

It is used to get a count for the following check items:

- Max-All-Gigawords

3.40.27. NullPasswordMatchesAny

Normally, a NULL password in the SQL table matches any submitted password. If you disable this option, NULL passwords does not match any submitted password, causing every authentication request for that user to be rejected.

NullPasswordMatchesAny does not have any effect if one or more AuthColumnDefs are defined.

3.41. <AuthBy RADIUS>

<AuthBy RADIUS> forwards all authentication and accounting requests for this Realm to another (possibly remote) RADIUS server. This is called proxying. When the remote RADIUS server replies, the reply is forwarded back to the client that originally sent the request to the server.

This allows Radiator to act as a proxy RADIUS server, possibly running on the firewall of your organisation. You can also use it to set up roaming realms, or to make your RADIUS server act as a multiplexer for multiple realms. You can forward certain realms to other servers within your organisation in order to improve performance or redundancy.

By specifying multiple Host lines the requests can be forwarded to primary/secondary RADIUS server pairs. The normal behaviour is to try to forward the requests to the remote hosts in the order the hosts are listed in the configuration file. This means that it initially tries to forward a request to the first host listed (unless that host was marked as failed recently). If no reply is received from the first host (after Retries), it is marked as failed for FailureBackoffTime seconds, and the request is forwarded to the next Host in the list. This continues until a reply is received, or until all the hosts are tried. This way, if a primary remote server fails, the secondary takes over. After FailureBackoffTime seconds, the primary is tried again. To change this behaviour, choose other load balancing versions of <AuthBy RADIUS>. For more information, see Section 3.56. <AuthBy VOLUMEBALANCE>, <AuthBy LOADBALANCE>, <AuthBy HASHBALANCE>, <AuthBy EAPBALANCE> on page 230.
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**Attention**
By default, an `<AuthBy RADIUS>` clause is completed as soon as the request has been forwarded to the remote RADIUS server. In this case, `<AuthBy RADIUS>` returns IGNORE for AuthByPolicy, so take care when using sequences of AuthBy clauses that include `<AuthBy RADIUS>`. `<AuthBy RADIUS>` does not wait for a reply before moving on to other AuthBy clauses, or handling new requests. You can change this behaviour with one of these flag parameters: Asynchronous and Synchronous. Be cautious if you enable the Synchronous flag. It can have a significant impact on performance. If you need to continue processing the reply with another AuthBy clause, the correct way to do that is with a ReplyHook or Asynchronous flag that was added to Radiator 4.17.

**Tip**
If it is required to proxy RADIUS requests to a remote Radiator across an insecure or unreliable network such as the internet, consider using the RadSec protocol, and use `<AuthBy RADSEC>` instead of `<AuthBy RADIUS>`. RadSec provides encrypted, reliable transport of RADIUS requests to a remote Radiator. For more information, see Section 3.74. `<AuthBy RADSEC>` on page 272, Section 3.121. `<ServerRADSEC>` on page 382, and Section 16. RadSec (RFC 6614) on page 475.

**Tip**
Perform load balancing as well as simple proxying by using `<AuthBy ROUNDROBIN>`, `<AuthBy VOLUMEBALANCE>` or `<AuthBy LOADBALANCE>` instead of `<AuthBy RADIUS>`. For more information, see Section 3.56. `<AuthBy ROUNDROBIN>`, `<AuthBy VOLUMEBALANCE>`, `<AuthBy LOADBALANCE>`, `<AuthBy HASHBALANCE>`, `<AuthBy EAPBALANCE>` on page 230.

**Tip**
You can specify your remote RADIUS hosts either with Host parameters or `<Host xxxxxx>` clauses. For more information, see Section 3.41.2. Host on page 185 and Section 3.42. `<Host xxxxxxx>` within `<AuthBy RADIUS>` on page 199. The Host parameter is simpler but less flexible than the `<Host xxxxxxx>` clause. For ease of understanding, do not mix formats in the same `<AuthBy RADIUS>`.

**Tip**
Be cautious when using Fork with `<AuthBy RADIUS>`. It usually results in requests being sent to the remote host, but the replies not received.

**Example**
In case it is not obvious from the above, there are 2 ways of specifying which remote RADIUS hosts to proxy to. The simplest, but the least flexible, way is to use Host parameters, and have the same secrets, ports etc. for all hosts:

```plaintext
<AuthBy RADIUS>
  # Same secret and timeout for all hosts
  Secret xyzzy
```
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```
RetryTimeout 2
Host host1.bigco.com
Host host2.bigco.com
</AuthBy>
```

Example

The other way allows you to customise some parameters on a host-by-host basis by using Host clauses:

```
<AuthBy RADIUS>
  # Same secret for all hosts
  Secret xyzzy
  <Host host1.bigco.com>
    # But a custom Timeout for this one
    RetryTimeout 2
  </Host>
  <Host host2.bigco.com>
    # And custom ports for this one
    AuthPort 1001
    AcctPort 1002
  </Host>
</AuthBy>
```

<AuthBy RADIUS> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.41.1. Failure algorithm

AuthBy RADIUS implements a configurable algorithm to detect failed RADIUS hosts, and to temporarily disregard failed hosts. The algorithm uses the MaxFailedRequests, MaxFailedGraceTime and FailureBackoffTime parameters to customise the operation of the algorithm. It also uses KeepaliveTimeout and UseStatusServerForFailureDetect in order to use only Status-Server requests for failure detection, instead of any request.

AuthBy RADIUS initially assumes that each Host is not failed. After a request is sent to a RADIUS server, if no reply is received after the ReplyTimeout, it is reset up to Retries times. If there is still no reply, that request is deemed to have failed for that Host. AuthBy RADIUS keeps track of how many consecutive requests failed for each Host since the last time a reply was heard from that Host. If more than MaxFailedRequests consecutive requests are deemed to have failed within MaxFailedGraceTime seconds of that last reply heard from that Host, that Host is deemed to have failed.

When the Host is deemed to be failed, AuthBy RADIUS will not attempt to send any requests to it until FailureBackoffTime seconds have elapsed. It will also skip sending requests to that host, and will instead attempt to send to the next Host in its list of Hosts (if any).

The default values for these parameters are:

```
Retries 3
RetryTimeout 5
MaxFailedRequests 1
MaxFailedGraceTime 0
FailureBackoffTime 0
```

These values mean that by default AuthBy RADIUS will declare the Host failed after a 3 retries packet transmission failure, but that it will always try to transmit the next request to the Host. This means that AuthBy
RADIUS will always try to send every request to the first Host, and if nothing is heard from that Host within (Retries * Retry-Timeout) seconds, it will attempt to send to the next Host.

Tip
Judicious use of these parameters allows you to implement a RADIUS Host fallback policy, where if one RADIUS Host fails to respond to requests, then it will automatically temporarily fall back to the next RADIUS Host and so on.

3.41.2. Host

This parameter specifies the host names where the destination RADIUS server is running. It can be either a DNS name or an IP address. Multiple comma-separated host names can be specified in one Host parameter, or you can use multiple Host lines. Radiator tries up to Retries times to contact each host that you specify. If no response it heard it tries the next host in the list and so on until a reply is received or the list is exhausted. The Host name can contain special formatting characters, which are resolved at startup.

Tip
If the DNS name for any Host resolves to multiple IP addresses, Radiator forwards to those addresses in a round-robin fashion. DNS names are resolved at startup time.

```
# Send all requests for this realm to 203.63.154.2, if no reply
# try the secondary at 203.63.154.3, if no reply from that,
# try all the addresses that radiushosts.open.com.au resolves to
# in round-robin fashion.
Host 203.63.154.2,203.63.154.3
Host radiushosts.open.com.au
```

Tip
For greater flexibility, you can also specify the hosts with the <Host xxxxxxx> clause, which allows you to customise details for each host. For more information, see Section 3.42. <Host xxxxxxx> within <AuthBy RADIUS> on page 199.

```
# These are equivalent to the lines in the example above:
<Host 203.63.154.2>
    # Put host-specific values for Secret, ports,
    # retries etc. in here
</Host>
<Host 203.63.154.3>
</Host>
<Host radiushosts.open.com.au>
</Host>
```
**Tip**

In order to proxy to an IPv6 address, the first IPv6 address listed in LocalAddress is used as the source address. If LocalAddress does not contain any IPv6 address, then the default IPv6 source address for that host is used. A LocalAddress of '::' is equivalent to a locally allocated IPv6 address.

```xml
<AuthBy RADIUS>
  # send via IPv6. Packets will appear to come from
  # the default IPv6 source address for this host
  LocalAddress ::
  Host 2001:db8:100:f101::1
  Secret xxxxxx
  ....
</AuthBy>
```

**Tip**

IPv6 addresses are not required to be prefixed with 'ipv6:' with Radiator 4.13 or later.

### 3.41.3. Secret

The default value of the secret we share with the destination radius servers. Radiator acts like a RADIUS client when it forwards RADIUS request to another RADIUS server.

You must define a shared secret for each Host in AuthBy RADIUS, and it must match the secret configured into the destination RADIUS server. There is no default. The secret can be any number of ASCII characters. Any ASCII character except newline is permitted, but it might be easier if you restrict yourself to the printable characters. For a reasonable level of security, the Secret should be at least 16 characters, and a mixture of upper and lower case, digits and punctuation. You should not use just a single recognisable word. Can be overridden for an individual host inside its Host clause.

```xml
# This better agree with the server at
# eric.open.com.au or they wont understand us
<AuthBy RADIUS>
  Host eric.open.com.au
  Secret 666obaFGkmRNs666
</AuthBy>
```

**CAUTION**

Some NASs, notably Enterasys Smart Switch Routers support a maximum shared secret length of 16 characters.

### 3.41.4. AuthPort

Specifies the default UDP port on the destination Hosts to which Radiator will send authentication requests. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services (or its moral equivalent on your system). The default port is 1645. Note that the officially assigned port number for RADIUS accounting has been changed to 1812. AuthPort may contain special formatting characters. Can be overridden for an individual host inside its Host clause.
# Send authentication to port 1812 on the remote server
AuthPort 1812

## 3.41.5. AcctPort

Specifies the default UDP port on the destination Hosts to which Radiator will send accounting requests. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services (or its moral equivalent on your system). The default port is 1646. Note that the officially assigned port number for RADIUS accounting has been changed to 1813. AcctPort may contain special formatting characters. Can be overridden for an individual host inside its Host clause.

# Send accounting to port 1813 on the remote server
AcctPort 1813

## 3.41.6. OutPort

If this optional parameter is set, it forces a particular port number to be used for the forwarding port. Therefore if you have, for example:

OutPort 1001

Then all requests forwarded will appear to come from port 1001 on this Radiator host. This can be useful for implementing strict firewall rules. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services (or its moral equivalent on your system). The default is to use a port number determined by your operating system, which will typically be different every time you restart your Radiator. OutPort may contain special formatting characters. A typical use of special formatting characters is with GlobalVar and command line arguments.

---

**Tip**

Many operating systems require root or administrator privileges to use a socket with a port number less than 1024.

---

## 3.41.7. Retries

If Radiator does not get a reply from the RADIUS server within defined time, it retransmits the request up to this number of retries. The default value is 3, which means maximum of 4 transmissions. This can be overridden for an individual host inside its Host clause.

Here is an example of using **Retries**:

# It is a poor link, so lots of retries
Retries 10

## 3.41.8. RetryTimeout

Specifies the default number of seconds to wait for a reply before retransmitting. The default is 5 seconds, which is a common value for most RADIUS clients. If the destination RADIUS server is at the end of a distant or saturated link, you may want to set this to 10 or 20 seconds. Can be overridden for an individual host inside its Host clause.

# It is a poor link, wait 15 seconds before retransmission
RetryTimeout 15
3.41.9. KeepaliveTimeout

This optional integer specifies the maximum time in seconds that a RADIUS connection can be idle before a Status-Server request is sent. The default value is 0 and keepalives are not used.

3.41.10. KeepaliveNoreplyTimeout

This is an optional integer that specifies the waiting time, in seconds, for Status-Server request. If no reply is received within time KeepaliveNoreplyTimeout defines, the Status-Server request is marked as lost.

If this is not used, the used parameter value depends on the AuthBy you are using:

- <AuthBy RADSEC>: NoreplyTimeout value is used instead.
- <AuthBy RADIUS>: RetryTimeout value is used instead.

Usually it is recommendable to have a smaller value for KeepaliveNoreplyTimeout and larger value for NoreplyTimeout or RetryTimeout. The Status-Server receiver is on the next host and the reply comes quickly. To have a short waiting time for KeepaliveNoreplyTimeout, the possible failure situation is discovered quickly and request is rerouted to another server. The Access-Request or Accounting-Request receivers may be located on many hops away and it is possible that it take longer time to get the replies from them.

Here is an example of using both KeepaliveNoreplyTimeout and NoreplyTimeout in <AuthBy RADSEC>:

```
<AuthBy RADSEC>
  NoreplyTimeout 10
  KeepaliveNoreplyTimeout 3
</AuthBy>
```

To use this example with <AuthBy RADIUS>, you must use Retrytimeout instead of NoreplyTimeout.

3.41.11. KeepaliveRequestType

This string defines the type of RADIUS request that is sent as a keep-alive request. Any RADIUS request type is allowed. The default value is Status-Server.

Here is an example of using KeepaliveRequestType with AddToKeepaliveRequest:

```
# Send Access-Request as keepalive probe
KeepaliveRequestType Access-Request
AddToKeepaliveRequest User-Name=mikem,User-Password=fred
```

3.41.12. AddToKeepaliveRequest

This string adds attributes to the keep-alive request before sending it to Host. The value is a comma-separated list of attribute value pairs on one line, exactly as for any reply item. Special formatting characters are allowed, for more information, see Section 3.3. Special formatters on page 19.

Here is an example of using AddToKeepaliveRequest with KeepaliveRequestType:

```
# Send Access-Request as keepalive probe
KeepaliveRequestType Access-Request
AddToKeepaliveRequest User-Name=mikem,User-Password=fred
```
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3.41.13. UseStatusServerForFailureDetect

If this optional flag is enabled, use only Status-Server requests (if any) to determine that the target server is failed when there is no reply. If this is not enabled, use no-reply to any type of request. This parameter uses NoreplyTimeout, MaxFailedRequests, and MaxFailedGraceTime during failure detection. This is not enabled by default.

FailureBackoffTime has no effect when UseStatusServerForFailureDetect is enabled. Once a Host has been marked as failed, it remains marked as failed until a reply is received from it (typically in response to a subsequent Status-Server request).

If you enable this, ensure that KeepaliveTimeout is set to a sensible interval to balance between detecting failures early and loading the target server.

3.41.14. FailureBackoffTime

This optional parameter specifies for how long time a failed remote server is removed from the forwarding list and marked as failed. The number of retries is defined by MaxFailedRequests. If no reply is received when all retries are used, the host is marked as failed and no requests are sent to it. After FailureBackoffTime time has expired, the Host is again eligible for forwarding. The unit is seconds, and the default value is 0, which means that the host is always regarded as working.

**CAUTION**

With most types of load balancing modules, the default value means endless retransmission of each request until a reply is received.

3.41.15. MaxFailedRequests

This optional parameter specifies how many requests must fail to receive a reply before the remote radius server is marked as failed, and the FailureBackoffTime will be applied. The default is 1, which means that one ignored request will cause the Host to be marked as failed for FailureBackoffTime seconds.

3.41.16. MaxFailedGraceTime

This optional parameter specifies the time period in seconds over which MaxFailedRequests failures cause the target host to be assumed to be failed. The default value is 0. After a host is declared to be failed, no request are forwarded to it until FailureBackoffTime seconds have elapsed.

3.41.17. MaxTargetHosts

This parameter limits the number of different hosts a request is proxied to in the case of no reply. The default value is 0, which means there is no limit. If Radiator does not receive a reply from a host, it keeps trying until all hosts are exhausted.

3.41.18. StripFromRequest

Strips the named attributes from the request before forwarding it to any Host. The value is a comma separated list of attribute names. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. There is no default.

```bash
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port
```
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3.41.19. AddToRequest

Adds attributes to the request before forwarding to any Host. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```bash
# Append a Filter-ID and host name
AddToRequest Calling-Station-Id=1,Login-IP-Host=%h
```

3.41.20. AddToRequestIfNotExist

Adds attributes to the request before forwarding to any Host. Unlike AddToRequest, an attribute will only be added if it does not already exist in the request. Value is a list of comma separated attribute value pairs. You can use any of the special % formats in the attribute values. There is no default.

```bash
# Possibly add our default Operator-Name
AddToRequestIfNotExist Operator-Name=example.com
```

3.41.21. NoForwardAuthentication

Stops AuthBy RADIUS forwarding Authentication-Requests. They are ACCEPTED, but no further action is taken with them. This is different in meaning to IgnoreAuthentication, which IGNOREs them.

```bash
# Just ACCEPT Authentication-Requests, do not forward them
NoForwardAuthentication
```

3.41.22. NoForwardAccounting

Stops AuthBy RADIUS forwarding Accounting-Requests. They are ACCEPTED, but no further action is taken with them. This is different in meaning to IgnoreAccounting, which IGNOREs them.

```bash
# Just ACCEPT Accounting-Requests, do not forward them
NoForwardAccounting
```

3.41.23. LocalAddress

This optional parameter specifies the local address(es) to bind the proxy forwarding socket. This in turn specifies what the IP source address will be in forwarded requests. Defaults to BindAddress (which defaults to 0.0.0.0, i.e. the default source address). If no appropriate IPv4 or IPv6 address is found in LocalAddress, the default IPv4 or IPv6 source address for the host will be used. This parameter is usually only useful for multi-homed hosts. If you do not understand what this is for, do not set it: the default behaviour is fine for most situations. If BindAddress or LocalAddress are set to multiple comma separated addresses, only the first IPv4 or IPv6 address (as appropriate) will be used for outgoing IPv4 or IPv6 addresses.

**Tip**

IPv6 addresses are not required to be prefixed with 'ipv6:' with Radiator 4.13 or later.

```bash
# We are multi-homed, bind the proxy port so forwarded requests
# appear to come from 203.53.154.27
LocalAddress 203.53.154.27
```
### Tip
You can make forwarded IPv4 requests appear to come from one address, and IPv6 requests appear to come from a different address. In this example, requests will usually be forwarded to 2002:721:1500:1::a101, and will have a source address of 2001:720:1500:1::a100. If 2002:721:1500:1::a101 does not reply, then requests will be forwarded to 210.1.1.5 with a source address of 203.63.154.27.

<table>
<thead>
<tr>
<th>LocalAddress</th>
<th>203.63.154.27,2001:720:1500:1::a100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Host</td>
<td>2002:721:1500:1::a101</td>
</tr>
<tr>
<td>Host</td>
<td>210.1.1.5</td>
</tr>
</tbody>
</table>

### Note
AuthBy RADIUS will create and use a separate UDP network socket for each distinct source address used from the LocalAddress list.

### 3.41.24. ReplyHook

This optional parameter allows you to define a Perl function that will be called after a reply is received from the remote RADIUS server and before it is relayed back to the original client. The following arguments are passed in the following order:

- Reference to the reply received from the remote RADIUS server
- Reference to the reply packet being constructed for return to the NAS
- Reference to the original request from the NAS
- Reference to the request that was sent to the remote RADIUS server
- Reference to the Radius::Host structure for the remote host
- Reference to the redirected flag. If redirected is set by the hook, the ReplyHook has redirected the request to another AuthBy.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

The response type can be enforced when needed. For example, when the remote RADIUS server has rejected the request, the ReplyHook can do any local processing required for rejects and then change the response type to accept.

```perl
# Change RadiusResult in the 3rd argument, the original request
ReplyHook sub { @{$_[2]}->{RadiusResult} = $main::ACCEPT; }
```

ReplyHook Can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

```perl
# Fake a new attribute into the reply going back to the client
ReplyHook sub { @{$_[1]}->add_attr('test-attr', \ 'test-value');}
```
3.41.25. NoReplyHook

This optional parameter allows you to define a Perl function that will be called if no reply is received from any remote RADIUS server. A reference to the original request received from the NAS is passed as the first argument. A reference to the request that was forwarded to the remote RADIUS server is passed as the second argument. A reference to the reply packet being constructed for return to the NAS is passed as the third argument (note that the normal behaviour in case of no reply, is for no reply to be sent to the NAS).

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook will also be reported to the log file when your hook executes. Multiline hooks (i.e. with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore you should not use trailing comments in your hook.

NoReplyHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

```perl
# Call an AuthBy SQL to handle accounting that # failed to get to the remote server
NoReplyHook sub { Radius::AuthGeneric::find('SQL')
    ->handle_request($_[0], $_[2]);
}
```

Tip

See NoReplyReject on page 193 parameter in case you need to return a reject back to the NAS. Setting this parameter may be quicker than creating a hook to trigger a reject.

3.41.26. ForwardHook

This is a Perl hook that is called once for each request before the request is forwarded to a remote RADIUS or RadSec server. It allows you to modify the forwarded request without changing the current one. ForwardHook receives the following arguments:

- Current request
- Forwarded request

Here is an example of using ForwardHook:

```perl
ForwardHook sub { my $p = $_[0]; my $fp = $_[1];
    $fp->add_attr('OSC-AVPAIR', 'Added by ForwardHook');
}
```

3.41.27. ReplyTimeoutHook

This optional parameter allows you to define a Perl function that will be called if no reply is received from the currently tried remote RADIUS server. A reference to the original request received from the NAS is passed as the first argument. A reference to the request that was forwarded to the remote RADIUS server is passed as the second argument.

3.41.28. IgnoreReject

This optional parameter causes Radiator to ignore (i.e. not send back to the original NAS) any Access-Reject messages received from the remote RADIUS server. This is sometimes useful for authenticating from multiple RADIUS servers. However, you should note that if all the remote radius servers reject the request, then the NAS will receive no reply at all.
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3.41.29. NoReplyReject

This is an optional flag parameter. When this parameter is set, it forces `<AuthBy RADIUS>` and its subclasses to return with result REJECT to trigger an Access-Reject when a proxied request times out. This parameter is not set by default.

When `NoReplyReject` is enabled, the reject reason is set to 'Upstream timeout'.

```
# Trigger an Access-Reject back to the NAS
NoReplyReject
```

**Tip**

`NoReplyReject` allows rejecting timed out requests without hooks such as `NoReplyHook`. For more information, see Section 3.41.25. `NoReplyHook` on page 192

3.41.30. Synchronous

The default behaviour for `<AuthBy RADIUS>` is to return IGNORE as soon as the request has been forwarded to the remote RADIUS server. It will not wait for a reply before moving on to other AuthBy classes, or handling new requests. You can change this behaviour with the `Synchronous` flag, but make sure you understand what you are doing before enabling the `Synchronous` flag.

If you enable the `Synchronous` flag, Radiator will wait for either a reply, or a timeout from the remote radius server before processing any following AuthBy clauses, or before handling any further requests. This means that handling requests will stop until a reply is received or the reply times out (which might take 15 seconds or more, depending on the settings of your `RetryTimeout` and retries parameters). This can seriously affect the performance of your RADIUS server, especially if the remote radius server is slow, stopped, or at the end of a slow or unreliable link. You should therefore be very cautious about setting this flag, and you should understand the consequences of remote server failure. The performance impact of the `Synchronous` flag can be alleviated by use of the `Fork` parameter (see Section 3.31.1. `Fork` on page 147) at the cost of significant increase in memory requirements.

Nevertheless, `Synchronous` can be very handy if you wish, for example, to forward a request to remote server only if another server REJECTS the request. See the example below for sample configuration.

```
# Auth to server2 only if server 1 rejects. Caution:
# accounting will normally go to server1, unless it rejects
<Realm xxxxxx>
  AuthByPolicy ContinueWhileReject
  <AuthBy RADIUS>
    # Wait here until we get a reply or a timeout
    Synchronous
    Host server1
    Secret xxxxxx
  </AuthBy>
  <AuthBy RADIUS>
    Host server2
    Secret yyy
  </AuthBy>
</Realm>
```
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3.41.31. Asynchronous

The default behaviour for `<AuthBy RADIUS>` is to return IGNORE as soon as the request has been forwarded to the remote RADIUS server. It does not wait for a reply before moving on to other AuthBy classes, or handling new requests. You can change this behaviour with the `Asynchronous` flag.

When you enable the `Asynchronous` flag, `Handler` continues to evaluate its AuthBy policy after a reply or timeout from the remote proxy. Other requests are processed while the reply is pending. `Asynchronous` is supported by `<AuthBy RADIUS>` and its subclasses.

For more information about how proxied requests are waited for by Radiator, see Section 3.41. `<AuthBy RADIUS>` on page 182 and Section 3.41.30. Synchronous on page 193.

```
# Auth to server1 and continue to AuthBy FILE if server 1 accepts.
# Process other requests while the reply from server 1 is pending.
<Handler>
  AuthByPolicy ContinueWhileAccept
  <AuthBy RADIUS>
    # Evaluate the policy when we get a reply or a timeout
    Asynchronous
    Host server1
    Secret xxxxxx
  </AuthBy>
  <AuthBy FILE>
    Filename %D/users
  </AuthBy>
</Handler>
```

3.41.32. UseExtendedIds

This optional flag can be used to work around various problem that might arise with remote RADIUS servers in some circumstances.

In the standard RADIUS protocol, the packet identifier is only 8 bits (0 to 255), which means that a RADIUS server can only have 256 requests pending from a given client at any time. This flag forces AuthBy RADIUS to use a much larger range of identifiers (at least 32 bits) carried in the Proxy-State attribute, meaning that many more requests can be pending at a given time, and that replies from a remote RADIUS server are more accurately matched to their original requests.

One such problem is flooding of remote servers by large number of new requests occurring at the same time, such as after a power failure in a large part of the city, resulting in lots of requests being proxied all at the same time.

Another problem is in the case of some types of remote server which do not send their replies from the same port and address to which they were sent.

**Tip**

The correct operation of this parameter requires that the remote RADIUS server honours the Proxy-State attribute correctly by replying it back to the sender exactly as it was sent. Most modern RADIUS server (including Radiator) behave correctly in this respect.
3.41.33. UseOldAscendPasswords

**Attention**
Deprecated. See Section 3.41.32. UseExtendedIds on page 194 instead.

This optional parameter tells Radiator to encode all passwords sent by this AuthBy using the old style (non RFC compliant) method that Ascend used to use on some NASs. The symptom that might indicate a need for this parameter is that passwords longer than 16 characters are not decoded properly. Can be overridden for an individual host inside its Host clause.

3.41.34. ServerHasBrokenPortNumbers

**Attention**
Deprecated. See Section 3.41.32. UseExtendedIds on page 194 instead.

Some RADIUS servers (GoRemote (GRIC) on NT in particular) exhibit broken behaviour in that the reply does not come from the same UDP port that the request was sent to! This broken behaviour would normally cause Radiator to ignore replies from such broken servers. The optional ServerHasBrokenPortNumbers flag will permit interoperation with such broken servers. Can be overridden for an individual host inside its Host clause.

**CAUTION**
Enabling this for two remote servers at the same host will cause difficult to trace problems.

```
# We are proxying to a GRIC server on NT
ServerHasBrokenPortNumbers
```

3.41.35. ServerHasBrokenAddresses

Some RADIUS servers (some rare accounting proxies) exhibit broken behaviour in that the reply does not come from the same address that the request was sent to! This broken behaviour would normally cause Radiator to ignore replies from such broken servers. The optional ServerHasBrokenAddresses flag will permit interoperation with such broken servers. Can be overridden for an individual host inside its Host clause.

**WARNING**
Enabling this for two remote servers at the same host will cause difficult to trace problems.

```
ServerHasBrokenAddresses
```

3.41.36. CachePasswords

This parameter enables a user password cache in this AuthBy RADIUS. It allows proxying to be more robust when the remote server is not available. It can be very useful if the remote server is unreliable, or at the end of a
slow, saturated or unreliable link. The exact behaviour of when the password cache is consulted is controlled by
the CacheOnNoReply parameter.

---

**Tip**
Use of this parameter with a large user population can cause large amounts of memory use by the
Radiator process.

---

**Tip**
If Radiator is restarted, the password cache is lost.

---

**Note**
Matching of cached passwords can never succeed for CHAP or MS-CHAP authentication requests.

---

### 3.41.37. CacheOnNoReply

This flag controls when the password cache created by the CachePasswords parameter is consulted.

If CacheOnNoReply is set (the default), then the Access-Request will always be proxied to the remote RADIUS
server, and password cache will only be consulted if there is no reply from any of the remote RADIUS
servers. If no reply is received from any of the remote RADIUS servers, and If there is a cached reply that
matches the password and has not exceeded the CachePasswordExpiry time limit, then the request will be
accepted.

If CacheOnNoReply is not set, then the password cache will consulted before proxying. If there is a cached
reply that matches the password and has not exceeded the CachePasswordExpiry time limit, then the request
will be accepted immediately without being proxied to any remote RADIUS server.

---

### 3.41.38. IgnoreReplySignature

Deprecated. Normally, if a reply from a remote RADIUS server is received with a bad authenticator, the reply
will be logged and then ignored. This optional parameter tells AuthBy RADIUS to ignore incorrect signatures
in replies from remote RADIUS servers. Some RADIUS servers implement incorrect signature algorithms, and
this flag will prevent problems when interoperating with such servers. Can be overridden for an individual host
inside its Host clause.

---

**CAUTION**
Use of this flag can cause incorrect handling of replies in unusual circumstances.

You know you need this flag if you see an error like this, even when you are sure the shared secret for
the RADIUS server is correct.

"Bad authenticator received in reply .....

---
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3.41.39. IgnoreAccountingResponse

This optional flag causes AuthBy RADIUS to ignore replies to accounting requests, instead of forwarding them back to the originating host. This can be used in conjunction with the AccountingHandled flag in a Handler or Realm (see Section 3.30.6. AccountingHandled on page 135) to ensure that every proxied accounting request is replied to immediately, and the eventual reply from the remote RADIUS server is dropped.

3.41.40. AcctFailedLogFileName

The name of a file used to log failed Accounting-Request messages in the standard radius accounting log format. If no reply is ever received from any of the remote hosts, the accounting message is logged to the named file. For more information about log file format, see Section 9.5. Accounting log file on page 460. If no AcctFailedLogFileName is defined, failed accounting messages are not logged. The default is no logging. The file name can include special formatting characters as described in Section 3.3. Special formatters on page 19, which means that, for example, using the %c specifier, you can maintain separate accounting log files for each Client. The AcctFailedLogFileName file is always opened, written and closed for each failure, so you can safely rotate it at any time.

The user name that is recorded in the log file is the rewritten user name when RewriteUsername is enabled.

Tip
You can change the logging format with AcctLogFileFormat.

Tip
You may want to make the filename depend on the date, so you get one missed accounting file per day.

```bash
# Log all accounting to a single log file in LogDir
AcctFailedLogFileName %L/misseddetails
```

3.41.41. AcctLogFileFormat

This optional parameter is used to alter the format of the failed accounting log file from the standard radius format when AcctLogFileFormatHook is not defined. AcctLogFileFormat is a string containing special formatting characters. It specifies the format for each line to be printed to the accounting log file. A new line is automatically appended. It is most useful if you use the %{attribute} style of formatting characters (to print the value of the attributes in the current packet.

```bash
AcctLogFileFormat %{Timestamp} %{Acct-Session-Id}\n %{User-Name}
```

3.41.42. AcctLogFileFormatHook

This specifies an optional Perl hook that is used to alter the format of the failed accounting log file from the standard radius format when defined. The hook must return the formatted accounting record. A new line is automatically appended. By default no hook is defined and AcctLogFileFormat or the default format is used. The hook parameter is the reference to the current request.
3.41.43. AccountingStartsOnly

If this parameter is defined, it forces AuthBy RADIUS to only forward Accounting Start requests. All other Accounting requests are accepted and acknowledged, but are not forwarded.

Tip

It does not make sense to set AccountingStartsOnly and AccountingStopsOnly.

3.41.44. AccountingAlivesOnly

If this parameter is defined, it forces AuthBy RADIUS to only forward Accounting Alive requests. All other Accounting requests are accepted and acknowledged, but are not forwarded.

3.41.45. AccountingStopsOnly

If this parameter is defined, it forces AuthBy RADIUS to only forward Accounting Stop requests. All other Accounting requests are accepted and acknowledged, but are not forwarded.

You may want to use this parameter if your accounting system does not use or need Accounting Start to do its billing.

```
# We only want to forward Stops
AccountingStopsOnly
```

Tip

It does not make sense to set AccountingStartsOnly and AccountingStopsOnly.

3.41.46. ClearTextTunnelPassword

This optional parameter prevents Radiator decrypting and re-encrypting Tunnel-Password attributes in replies during proxying. This is provided in order to support older NASs that do not support encrypted Tunnel-Password.

3.41.47. AllowInRequest

This optional parameter specifies a list of attribute names that are permitted in forwarded requests. Attributes whose names do not appear in this list will be stripped from the request before forwarding.

```
# Strip everything except username and password
AllowInRequest User-Name,User-Password
```

3.41.48. DisableMTUDiscovery

If this optional parameter is set, it disables MTU discovery on platforms that support that behaviour (currently Linux only). This can be used to prevent discarding of certain large RADIUS packet fragments on supporting operating systems.

3.41.49. Gossip

The Gossip flag parameter enables this AuthBy to send and listen for notifications (aka. gossip) to/from other Radiator servers when any remote Radius server fails to reply. This is disabled by default.
See Section 3.134. `<GossipRedis>` on page 400 for more about the Gossip framework and `goodies/farmsize.cfg` for a configuration sample.

```yaml
# Use the configured Gossip implementation for notifications
Gossip
```

### 3.41.50. NoKeepaliveTimeoutForChildInstances

If this optional flag is enabled, only the first instance of this server farm will send Status-Server requests. Recommended when Gossip is used to distribute reachability information. This is not set by default.

### 3.41.51. GossipNoReply

If the `GossipNoReply` flag parameter is set, then a notification is sent when a remote Radius server fails to reply. Radiator server also increases a counter for failed requests when a notification is received. This is enabled by default.

### 3.41.52. GossipHostDown

If the `GossipHostDown` flag parameter is set, then a notification is sent when a remote Radius server is marked down. Radiator server also marks the remote Radius server down when a notification is received. This is enabled by default.

### 3.41.53. GossipHostUp

If the `GossipHostUp` flag parameter is set, then a notification will be send when a remote Radius server is marked up and alive again. Radiator server also marks the remote Radius server healthy when a notification is received. This is enabled by default.

### 3.42. `<Host xxxxxxx>` within `<AuthBy RADIUS>`

This clause can be used to specify the name and details of remote RADIUS servers inside `<AuthBy RADIUS>` and its subtypes. The `<Host xxxxxxx>` clause further allows you to customise details for individual hosts. `<AuthBy RADIUS>` permits one or more Host clauses.

In a Host clause header, the `xxxxxx` is the Host name or IP address of the remote RADIUS host to proxy to. The Host name can contain special formatting characters, which are resolved at startup.

```xml
<AuthBy RADIUS>
  <Host server1.test.com>
    Secret xyzzy
    AuthPort 1645
    AcctPort 1646
  </Host>
  <Host server2.test.com>
    Secret xyzzy
    AuthPort 1645
    AcctPort 1646
  </Host>
</AuthBy>
```

The following parameters can be used within a Host clause. They have the same meaning and default values as the parameter of the same name in the enclosing `<AuthBy RADIUS>`:

- Secret on page 186
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- AuthPort on page 186
- AcctPort on page 187
- Retries on page 187
- RetryTimeout on page 187
- UseOldAscendPasswords on page 195
- UseExtendedIds on page 194
- ServerHasBrokenPortNumbers on page 195
- ServerHasBrokenAddresses on page 195
- IgnoreReplySignature on page 196
- FailureBackoffTime on page 189
- MaxFailedRequests on page 189
- MaxFailedGraceTime on page 189
- LocalAddress on page 190
- OutPort on page 187

3.42.1. BogoMips

<AuthBy LOADBALANCE> and <AuthBy VOLUMEBALANCE> use BogoMips to determine which target RADIUS server to use. The default value is 1. If set to 0, this Host is not used for forwarding by <AuthBy RADIUS> or any of its sub-types.

3.43. <AuthBy RADMIN>

<AuthBy RADMIN> provides authentication and accounting using the RAdmin User Administration package from Open System Consultants website [http://www.open.com.au/radmin/]. RAdmin is a complete web-based package that allows you to maintain your RADIUS user and accounting details in an SQL database. You can add, change and delete users, examine connection history, control simultaneous login, get reports on modem usage and many other functions. The combination of Radiator and RAdmin provides a complete solution to your RADIUS user administration requirements.

**Tip**

RAdmin is not a billing or invoicing system.

During authentication, Radiator checks the password in the RAdmin “RADUSERS” table. Accounting details are added to the RADUSAGE table.

There is an example Radiator configuration file for RAdmin in goodies/radmin.cfg.

<AuthBy RADMIN> understands also the same parameters as <AuthBy SQL>. For more information, see Section 3.40. <AuthBy SQL> on page 170.

3.43.1. AuthSelect

This SQL query is used to select details of users who are attempting to log in. %0 is replaced by the quoted and (possibly rewritten) User-Name. Other special formatting characters may be used.
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Defaults to

```sql
select PASS_WORD, STATICADDRESS, TIMELEFT, MAXLOGINS, \nSERVICENAME, BADLOGINS, VALIDFROM, VALIDTO from RADUSERS \nwhere USERNAME=%0
```

Tip

You can force AuthBy RADMIN to honour additional fields in your AuthSelect statement by using AuthColumnDef. For example, you might add 3 new columns to your RADUSERS table and wish to use them as reply items. You could do that something like this:

```sql
# Honour FRAMED_NETMASK,FRAMED_FILTER_ID,MAXIDLETIME too
AuthSelect select PASS_WORD,STATICADDRESS,TIMELEFT,\nMAXLOGINS,SERVICENAME, BADLOGINS, VALIDFROM, \nVALIDTO, FRAMED_NETMASK,FRAMED_FILTER_ID,MAXIDLETIME \nfrom RADUSERS where USERNAME=%0
AuthColumnDef 0,Framed-IP-Netmask,reply
AuthColumnDef 1,Filter-Id,reply
AuthColumnDef 2,Idle-Timeout,reply
```

Note that the numbering of AuthColumnDef 0 starts with the field following the first 8 minimum and required fields.

3.43.2. LogQuery

This optional parameter allows you to control the SQL query that is used to insert log messages into the database.

The default is:

```sql
insert into RADMESSAGES (TIME_STAMP, TYPE, MESSAGE) 
values (%t, %0, %1)
```

Where `%t` is translated as a special character to the current time, `%0` is converted to the message priority (in integer in the range 0 to 4 inclusive), and `%1` is converted to the log message, quoted and escaped. MESSAGE will be truncated to MaxMessageLength characters prior to insertion.

3.43.3. MaxMessageLength

The optional parameter sets the maximum length of message that will be inserted by LogQuery. All messages longer than MaxMessageLength characters will be truncated to MaxMessageLength. Defaults to 200, which is the default size of the MESSAGE column in the RADMIN.RADMESSAGES table.

3.43.4. UserAttrQuery

This optional parameter allows you to control the query used to get user-specific RADIUS check and reply items. `%0` is replaced by the (possibly rewritten) User-Name. Other special formatting characters may be used.

Defaults to

```sql
select ATTR_ID, VENDOR_ID, IVALUE, SVALUE, ITEM_TYPE \nfrom RADCONFIG where NAME=%0 order by ITEM_TYPE
```
3.43.5. ServiceAttrQuery

This optional parameter allows you to control the query used to get service-specific RADIUS check and reply items. %0 is replaced by the Service Profile name from the SERVICENAME column in the user’s database record. Other special formatting characters may be used. ServiceAttrQuery will be run after UserAttrQuery if ServiceAttrQuery is non-empty, and if a non-empty servicename was found in the 5th field returned from AuthSelect.

Defaults to

```
select ATTR_ID, VENDOR_ID, IVALUE, SVALUE, ITEM_TYPE  
from RADSTCONFIG where NAME=%0 order by ITEM_TYPE
```

3.43.6. AttrQueryParam

This optional parameter enables the use of bound variables (where supported by the SQL server) and query caching in the UserAttrQuery and ServiceAttrQuery strings. If you specify one or more AttrQueryParam parameters, they will be used in order to replace parameters named with a question mark (“?”) in the UserAttrQuery and Service-AttrQuery queries, and the query will be cached for future reuse by the SQL server. %0 is replaced by the appropriate user name or service name. For more information, see Section 3.8.1. SQL bind variables on page 45.

3.43.7. IncrementBadloginsQuery

This optional parameter specifies the SQL query to issue if AuthBy RADMIN detects a bad password. It is intended to increment a count of the number of bad logins, which can then be checked during authentication. %0 is replaced with the name of the user being authenticated. Other special formatting characters may be used.

Defaults to:

```
update RADUSERS set BADLOGINS=BADLOGINS+1 where USERNAME=%0
```

3.43.8. ClearBadloginsQuery

This optional parameter specifies the SQL query to issue if AuthBy RADMIN detects a good password. It is intended to clear a count of the number of bad logins, which can then be checked during authentication. %0 is replaced with the name of the user being authenticated. Other special formatting characters may be used.

Defaults to:

```
update RADUSERS set BADLOGINS=0 where USERNAME=%0
```

3.43.9. MaxBadLogins

AuthBy RADMIN compares the bad login count in the RAdmin database with Max-BadLogins. If it is exceeded, it is assumed that password guessing has been attempted and the user will be disabled until their bad login count is reset. Defaults to 5. If set to 0, the bad login count is ignored.

3.44. <AuthBy EMERALD>

/AuthBy EMERALD/ provides authentication and accounting using the popular Emerald ISP billing package from IEA website [http://www.iea-software.com/]. The combination of Radiator and Emerald provides a very powerful and easy to use ISP billing and user management system. You will be able to add users to Emerald, and have them able to log in immediately. Changing their password takes effect immediately, and all user logins are available as soon as they are completed: no need to import accounting files.
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Tip
Users of Emerald version 4 should use the `<AuthBy EMERALD4>`, following the instructions provided by IEA.

Tip
This AuthBy method will also work for Platypus when it has its optional RadiusNT compatibility package installed.

Emerald uses Microsoft SQL for its user database, so in order to make Radiator work with Emerald on Unix, you will usually need to install an ODBC driver, plus the Perl DBD-ODBC module. Alternatively, you can use the DBD-Sybase module and the Sybase client libraries. More details on connectivity between Unix and MS-SQL on NT can be found in the Radiator FAQ.

During authentication, Radiator checks the password in the Emerald “masteraccounts” and “subaccounts” tables. It also checks the expiry dates, extensions and time left. It also gathers radius reply attributes from the RadConfigs and RadATConfigs tables. The RadATConfigs table (which contains per-account-type radius reply items) is only consulted if there are no per-user reply items for the user in the RadConfigs table (but you can change this behaviour with AddATDefaults. For more information, see Section 3.44.2. AddATDefaults on page 204.

Tip
By default, AuthBy EMERALD takes no notice of the LoginLimit from the Emerald database. If you wish to honour it to limit the maximum number of simultaneous logins for a user, add this to your Radiator configuration:

```
# use the LoginLimit from the emerald database
AuthSelect, sa.LoginLimit
AuthColumnDef 0, Simultaneous-Use, check
```

`<AuthBy EMERALD>` does not use the RADIUS client configuration and secrets entered into the Emerald “Radius Config”. You still need to configure a `<Client>` clause in Radiator for each NAS you are going to use.

`<AuthBy EMERALD>` will connect to the Emerald database as the user you specify in the DBUsername parameter. You will probably have to create such a login in your database, and make sure they are a member of the Emerald database group.

During accounting, Radiator logs call details from each Accounting request to the Emerald “Calls” table.

There is an example Radiator configuration file for Emerald in `goodies/emerald.cfg`. You should use this as the starting point for configuring Radiator to work with Emerald.

`<AuthBy EMERALD>` understands also the same parameters as `<AuthBy SQL>`. For more information, see Section 3.40. `<AuthBy SQL>` on page 170.

3.44.1. TimeBanking

If this optional parameter is set, it will enable Time Banking, which can be used to limit the longest possible user session for the user to a pre-paid limit. If TimeBanking is enabled and if the “subaccounts.timeleft” column
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for the user is not NULL, then Radiator will use it to generate a Session-Timeout reply attribute. This has the effect of limiting the user session to the number of minutes specified in the subaccounts.timeleft column.

3.44.2. AddATDefaults

If this optional parameter is defined, then the account-type-specific RADIUS reply items will be used unless there was a user-specific reply item. This allows you to use the account-specific reply items as defaults.

3.45. <AuthBy EMERALD4>

<AuthBy EMERALD4> authenticates users from the Emerald version 4 database from IEA website [http://www.iea-software.com/]. It also stores accounting and logs to the Emerald 4 SQL database.

Tip
There is a sample Radiator configuration file for Emerald 4 in goodies/emerald4.cfg in your Radiator distribution.

<AuthBy EMERALD4> understands also the same parameters as <AuthBy SQL>. For more information, see Section 3.40. <AuthBy SQL> on page 170.

3.45.1. AuthSelect

AuthSelect This optional parameter from AuthBy SQL is pre-configured or Emerald 4 and need not be altered. Defaults to

```
AuthSelect exec RadGetUser %0, NULL
```

3.45.2. ConcurrencyControl

This optional flag controls whether to apply Simultaneous-Use limits to each user. Defaults to false.

3.45.3. TimeBanking

This optional flag control whether Time Banking limits are to be enforced. Defaults to false.

3.45.4. HonourServers

This optional flag controls whether this module will use the Rodopi Servers list as an additional source of Radius Client addresses. ClientQuery is used to fetch the client list. Defaults to false.

3.45.5. HonourServerPortAccess

This optional flag controls whether this module will enforce time-based access limits for certain NAS ports. PortAccessQuery is used to fetch details of port restrictions. Defaults to false.

3.45.6. HonourDNISGroups

This optional flag controls whether this module will enforce limits on Called-Station-Id. DNISGroupQuery is used to fetch details of permitted groups. Defaults to false.

3.45.7. HonourRoamServers

This optional flag Controls whether RoamQuery will be used to get roaming restrictions. Defaults to false.
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3.45.8. DNISGroupQuery

SQL query used to fetch DNIS Groups. This parameter is preconfigured for Emerald 4, and should not need to be changed. Defaults to:

```
DNISGroupQuery select dn.DNISNumber from AccountTypes a, DNISNumbers dn where a.AccountType="%0" and a.DNISGroupID=dn.DNISGroupID and dn.DNISNumber="%1"
```

3.45.9. PortAccessQuery

SQL query used to fetch permitted ports. This parameter is preconfigured for Emerald 4, and should not need to be changed. Defaults to:

```
PortAccessQuery select sa.StartTime, sa.StopTime, sa.MaxSessionLength from Servers s, ServerAccess sa, AccountTypes at where s.IPAddress="%{Client:Name}" and s.ServerID = sa.ServerID and (sa.Port=%0 or sa.Port=9214328) and sa.AccountTypeID=at.AccountTypeID and at.AccountType="%1" order by sa.Port
```

3.45.10. RadUserQuery

SQL query used to fetch user attributes. This parameter is preconfigured for Emerald 4, and should not need to be changed. Defaults to:

```
RadUserQuery exec RadGetConfigs %0
```

3.45.11. ClientQuery

SQL query used to fetch RADIUS client details. This parameter is preconfigured for Emerald 4, and should not need to be changed. Defaults to:

```
ClientQuery select IPAddress, Secret, Community, ServerID from Servers
```

3.45.12. RoamQuery

SQL query used to fetch roaming restrictions. This parameter is preconfigured for Emerald 4, and should not need to be changed. Defaults to:

```
RoamQuery exec RadRoamCache
```

3.46. <AuthBy PLATYPUS>

<AuthBy PLATYPUS> provides authentication and accounting using the popular Platypus ISP billing package from Platypus website [http://www.ispbilling.com/]. The combination of Radiator and Platypus provides a very powerful and easy to use ISP billing and user management system. You are able to add users to Platypus, and have them able to log in immediately. Deactivating a Platypus account or changing their password takes effect immediately, and all user logins are available as soon as they are completed: no need to import accounting files.
<AuthBy PLATYPUS> supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

<AuthBy PLATYPUS> uses Microsoft SQL for its user database, so in order to make Radiator work with Platypus on Unix, you usually need to install an ODBC driver, plus the Perl DBD-ODBC module.

During authentication, Radiator checks the password in the Platypus customer table. It also checks the “Block User” state. If it is set to Y or G, Radiator checks the Platypus Time Left field, and will reject the login if the time left is negative. Otherwise, it accepts the login, and set Session-Timeout in the reply to the number of seconds of login time left. This allows you to prevent users overspending the prepaid time.

During accounting, Radiator logs call details from each Accounting Stop request to the Platypus radiusdat table.

There is an example Radiator configuration file for Platypus in goodies/platypus.cfg. Use this as the starting point for configuring Radiator to work with Platypus.

Tip

Tucows has an optional package that makes Platypus compatible with RadiusNT, an NT-only radius server. With this package installed, Platypus lets you set up per-user and per-service RADIUS reply attributes using Platypus editing screens in the menu Maintenance->RadiusNT Setup. Radiator can also work with this, but you must use <AuthBy EMERALD> instead of <AuthBy PLATYPUS>, and configure it as if for Emerald. For more information, see Section 3.44. <AuthBy EMERALD> on page 202.

3.46.1. AccountingTable

This optional parameter specifies the name of the Platypus table to insert Accounting Stop requests into. It defaults to "radiusdat" which is the usual name for that table in Platypus. You will normally not want to change it. If you change it to the empty string, Radiator will not store any Accounting requests to Platypus at all.

```plaintext
# do not store any accounting data to platypus
AccountingTable
BasicSelect
AuthSelect
```

3.46.2. AcctColumnDef

By default, AuthBy PLATYPUS only logs a few attributes to AccountingTable: user name, call start time, call end time and session ID. You can log additional attributes from Accounting Stop requests with AcctColumnDef in the same was as AuthBy SQL. For more information about syntax, see Section 3.40.10. AcctColumnDef on page 176. Add the appropriate new columns to your AccountingTable before you can log to them.

```plaintext
# Log some extra data from each Stop
AcctColumnDef NASIDENTIFIER,NAS-Identifier
AcctColumnDef ACCTTERMINATECAUSE,Acct-Terminate-Cause
```

3.46.3. BasicSelect

AuthBy PLATYPUS works slightly differently to AuthBy SQL when it comes to how the user attribute selection query is assembled.

BasicSelect specifies the SQL query used to fetch user attributes from the Platypus database. It is expected to return the following attributes in this order:
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- password
- active
- timeleft
- blockuser
- guarantor
- possibly other attributes as selected by AuthSelect

%0 is replaced with the contents of AuthSelect, which is expected to be a list of additional columns to select from the database. For more information, see Section 3.46.4. AuthSelect on page 207.

%1 is replaced with the user name.

The default will work with the standard Platypus database and need not be changed:

```
BasicSelect select password, active, timeleft, blockuser, \\
guarantor %0 from customer where username=%1
```

3.46.4. AuthSelect

This optional parameter specifies additional SQL columns to fetch with BasicSelect.

You can optionally fetch your own additional columns from the user database when you fetch the password in a similar way to AuthSQL. In this example, you define an additional column in the customer table called maxsessions, which (if not NULL) will be used to set Simultaneous-Use for the user. AuthSelect is the SQL required to select additional columns from customer, so the comma is required.

```
AuthSelect ,maxsessions
AuthColumnDef 0,Simultaneous-Use,check
```

3.47. <AuthBy RODOPI>

<AuthBy RODOPI> provides authentication and accounting using the popular Rodopi ISP billing package. It is available on Rodopi website [http://www.rodopi.com/]. The combination of Radiator and Rodopi provides a very powerful and easy to use ISP billing and user management system. You will be able to add users to Rodopi, and they will be able to log in immediately. Changing their password takes effect immediately, and all user logins details are available as soon as they are completed: no need to import accounting files.

Rodopi uses Microsoft SQL Server for its user database, so in order to make Radiator work with Rodopi on Windows, you will usually need to install an ODBC driver, plus the Perl DBD-ODBC module. On Unix, you will need to install DBD-Sybase and the Sybase client library to allow Radiator to connect to Microsoft SQL Server.

During authentication, Radiator checks the password in the Rodopi “Logsins” table. It also gathers radius check and reply attributes from the RadiusUsers table.

<AuthBy RODOPI> will connect to the Rodopi database as the user you specify in the DBUsername parameter. The default user name that Rodopi installs is “Rodopi”, with password “rodopi”.

During accounting, Radiator logs call details from each Accounting request to the Rodopi “UsageOnlineHours” table.

<AuthBy RODOPI> automatically handles Cisco VOIP authentication and Accounting with the Rodopi 5.4 or later Cisco VOIP support. RADIUS requests that contain the cisco-h323-conf-id attribute are handled with the VOIP stored procedures. All other requests are handled with the non-VOIP procedures.
There is an example Radiator configuration file for Rodopi in `goodies/rodopi.cfg`. You should use this as the starting point for configuring Radiator to work with Rodopi.

`<AuthBy RODOPI>` understands exactly the same parameters as `<AuthBy SQL>`. For more information, see Section 3.40. `<AuthBy SQL>` on page 170.

```plaintext
<Realm DEFAULT>
  <AuthBy RODOPI>
    DBSource    dbi:ODBC:Rodopi
    DBUsername  Rodopi
    DBAuth      rodopi
  </AuthBy>
</Realm>
```

### 3.47.1. AuthSelect

Similar in meaning to AuthSelect in AuthBy SQL. For more information, see Section 3.40.1. AuthSelect on page 171. Defaults to:

```plaintext
eexec Interface_VircomUsers %0
```

where `%0` is replaced with the User-Name.

### 3.47.2. AcctSQLStatement

This optional parameter defines the SQL query that will be used to insert accounting details into the Rodopi database. Defaults to:

```plaintext
%0, '%1', %2, %3, %4, %5, %6, %7, %8, %9,
%10, %11, %12, %13, %14, %15, %16, %17, %18, %19,
%20
```

- `%0` is replaced with Acct-Session-Id
- `%1` with SQL formatted Timestamp
- `%2` with User-Name
- `%3` with Nas-IP-Address
- `%4` with Nas-Port
- `%5` with Service-Type
- `%6` with Framed-Protocol
- `%7` with Framed-IP-Address
- `%8` with Calling-Station-Id
- `%9` with Nas-Identifier
- `%10` with Acct-Status-Type
- `%11` with Acct-Delay-Time
- `%12` with Acct-Input-Octets
- `%13` with Acct-Output-Octets
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- %14 with Acct-Session-Time
- %15 with Acct-Input-Packets
- %16 with Acct-Output-Packets
- %17 with Acct-Terminate-Cause
- %18 with Nas-Port-Type
- %19 with Connect-Info
- %20 with Called-Station-Id

Unlike other AuthBy SQL clauses, if you define AcctSQLStatement in your AuthBy RODOPI configuration file, it will replace the default AcctSQLStatement, rather than add another AcctSQLStatement.

3.47.3. CiscoVoip

This optional parameter tells AuthBy RODOPI to handle Cisco VOIP requests using the VOIP procedures specified by VoipAuthSelect and VoipAcctSQLStatement parameters. Defaults to 1, meaning that Cisco VOIP requests will be handled. If this parameter is set to 0, Cisco VOIP requests will be handled using the AuthSelect and AcctSQLStatement parameters.

```bash
# Do not handle Cisco VOIP specially
CiscoVoip 0
```

3.47.4. VoipAuthSelect

This optional parameter specifies the SQL query which will be used to authenticate VOIP Access-Requests. May contain special characters. If CiscoVoip is enabled, then any Access-Request containing a the 'cisco-h323-conf-id' attribute will be authenticated with VoipAuthSelect. The default is:

```sql
exec Interface_VircomUsers2 %0, %1, %2, %3, %4, %5
```

Where %0 is replaced with the User-Name, %1 is replaced with Calling-Station-Id, %2 is replaced with Called-Station-Id, %3 is replaced with NAS-IP-Address, %4 is replaced with cisco-h323-conf-id and %5 is replaced with Service-Type.

3.47.5. VoipAcctSQLStatement

VoipAcctSQLStatement This optional parameter defines the SQL query that will be used to insert VOIP accounting details into the Rodopi database. May contain special characters. If CiscoVoip is enabled, then any Accounting-Request containing a the 'cisco-h323-conf-id' attribute will be authenticated with VoipAcctSQLStatement. Defaults to:

```sql
exec Interface_VircomDetails2
%0, '%1', %2, %3, %4, %5, %6, %7, %8, %9,
%10, %11, %12, %13, %14, %15, %16, %17, %18, %19,
%20, %21, %22, %23, %24, %25, %26, %27, %28, %29, %30, %31, %32
```

Arguments %0 to %20 inclusive are replaced the same was as specified in AcctSQLStatement. For more information, see Section 3.47.2. AcctSQLStatement on page 208.

- %21 is replaced by cisco-h323-gw-id
- %22 is replaced by cisco-h323-conf-id
- %23 is replaced by cisco-h323-call-origin
• %24 is replaced by cisco-h323-calltype
• %25 is replaced by cisco-h323-setup-time
• %26 is replaced by cisco-h323-connect-time
• %27 is replaced by cisco-h323-disconnect-time
• %28 is replaced by cisco-h323-voice-quality
• %29 is replaced by cisco-h323-disconnect-cause
• %30 is replaced by cisco-h323-remote-address
• %31 is replaced by cisco-h323-ivr-out
• %32 is replaced by cisco-h323-call-treatment

3.48. <AuthBy LDAP2>

/AuthBy LDAP2/ module authenticates by issuing requests to an LDAP server. When the LDAP server replies, Radiator fetches a number of attributes and looks in them for the password, check items and reply items in order to authenticate the user. It does not log (but does reply to) accounting requests. You need to have a basic understanding of LDAP servers and databases in order to configure <AuthBy LDAP2>.

When an <AuthBy LDAP2> module receives its first authentication request, it attempts to connect to the LDAP server specified by Host. Optionally you can authenticate Radiator as a valid user of the LDAP server by specifying AuthDN and AuthPassword. This is not the same thing as authenticating a user. It happens before authenticating a user, and proves that this radiusd is allowed to talk to the LDAP database.

The <AuthBy LDAP2> module tries then to fetch some attributes for the user. Specify the base DN to start looking in, and the attribute name with which to filter. Also specify the attributes that contain the password, and (optionally) the names of the attributes containing an encrypted password, RADIUS check items and RADIUS reply items. This scheme allows you to work with almost any LDAP schema. All you have to do is identify the right LDAP attribute names.

If all the check items are satisfied by the attributes in the request, the <AuthBy LDAP2> module replies with an Access-Accept message containing all the attributes in the reply items attribute (if any). If the user does not appear in the LDAP database, or if any check attribute does not match, an Access-Reject message is sent to the client.

At present, <AuthBy LDAP2> modules do synchronous connections and searches. This can mean significant delays if your LDAP server is reached by a slow network connection, or your LDAP server is slow. In this case, consider putting the <AuthBy LDAP2> realm in a sub-server, and having your main Radiator forward requests for that realm to the RADIUS sub-server.

This clause supports all the common LDAP configuration parameters. For more information about the LDAP configuration parameters, see Section 3.9. LDAP configuration on page 50.

/AuthBy LDAP2/ understands also the same parameters as <AuthBy xxxxx>. For more information, see Section 3.31. <AuthBy xxxxx> on page 147.

3.48.1. Using <AuthBy LDAP2> with Microsoft Active Directory

When using <AuthBy LDAP2> together with Microsoft Active Directory (AD), you may need to try the following:

• Use ServerChecksPassword when the user must be authenticated. AD does not provide password to LDAP. In this case, do not use HoldserverConnection. For more information, see Section 3.48.10. ServerChecksPassword on page 215.
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- Leave BaseDN empty if you use Global Catalog. For more information, see Global Catalog and LDAP Searches [https://technet.microsoft.com/en-us/library/cc978012.aspx].

- Global Catalog contains all users but not necessarily all the attributes. Use port 3268 for LDAP and port 3269 for LDAPS to access to Global Catalog.

- Use AttrsWithBaseScope if you need to get a constructed attribute, such as tokenGroups, for a certain user. For more information, see Section 3.48.8. AttrsWithBaseScope on page 214.

### 3.48.2. BaseDN

This is the base DN, where searches are made. It is used in similar way as with all LDAP modules. For more information, see Section 3.9.1. BaseDN on page 50.

Special formatting characters are permitted. When using <AuthBy LDAP2>, %0 is replaced by UsernameAttr and %1 by the user name.

**Tip**

On some LDAP servers, you can get a significant performance increase by narrowing the search to the exact entry you are interested in. With AuthBy LDAP2 default settings, this example restricts the search to `uid=username,ou=foo,o=bar,c=au`:

<table>
<thead>
<tr>
<th>BaseDN</th>
<th>%0=%1,ou=foo,o=bar,c=au</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope</td>
<td>base</td>
</tr>
</tbody>
</table>

### 3.48.3. SearchFilter

This is the LDAP filter to use when searching for the user. It is used in similar way as with all LDAP modules. For more information, see Section 3.9.2. SearchFilter on page 51.

Usually, the search filter that is used to find a matching user name is

```
(uid=name)
```

`uid` is the name of the LDAP attribute defined by the UsernameAttr parameter, and `name` is the name of the user currently being authenticated. For advanced applications, you can completely alter the search filter that Radiator uses by using the optional SearchFilter parameter. It allows you to use arbitrarily complicated LDAP search filters to select or exclude users based on attributes other than their user name. Special formatting characters are permitted, %0 is replaced by UsernameAttr and %1 by the user name. For example, this SearchFilter matches only users with the appropriate setting of their ‘current’ attribute:

```
SearchFilter (&(current=1)(uid=%1))
```

In SearchFilter, you can use any special formatting character. For backwards compatibility, Perl variables used to be interpolated, but this has been removed. The default setting for SearchFilter is `{%0=%1}`, which matches the user name against the LDAP attribute defined by the UsernameAttr parameter (usually uid). Therefore, the default search string is `{uid=name}`.

### 3.48.4. EncryptedPasswordAttr

This is the optional name of the LDAP attribute that contains a Unix crypt(3) encrypted password for the user. If you specify EncryptedPasswordAttr, it will be used instead of PasswordAttr, and PasswordAttr will not be fetched. You must specify either PasswordAttr or EncryptedPasswordAttr. There is no default.
Tip
If your passwords are in the form `{crypt}1xMKc0GIVUNbE`,
{SHA}0DPiKuNIrrVmD8IUCuw1hQxNg2c= or {SSHA}0DPiKuNIrrVmD8IUCuw1hQxNg2c=
you should be using PasswordAttr, not EncryptedPasswordAttr. Only use EncryptedPasswordAttr if the your
password are plain old Unix crypt format, like: `1xMKc0GIVUNbE`.

```bash
# Get the encrypted password from cryptpw
EncryptedPasswordAttr cryptpw
```

### 3.48.5. PasswordAttr

This is the name of the LDAP attribute that contains the password for the user. The password may be in any of
the formats supported by User-Password. For more information, see Section 7.1.1. User-Password, Password
on page 432. Most LDAP servers will only have a plaintext password if they are secured in another way, and
probably not even then. You must specify either PasswordAttr or EncryptedPasswordAttr. There is no default.

Note
OpenLDAP's userPassword is (a) encrypted and (b) only retrievable via an appropriately authenticated
binding to the slapd.

```bash
# Plaintext passwords. Gasp
PasswordAttr passwd
```

Tip
If there is no password to be checked (e.g. Wireless MAC Addresses) you should specify PasswordAttr
without a value, otherwise you will get a warning log message.

CAUTION
The value of currently configured PasswordAttr is printed as **obscured** when the attributes received
from the LDAP server are logged. If the PasswordAttr is not present, nothing is logged for it. That is,
only the value is obscured not the information about the presence of the attribute in the reply. To debug
the password, use the Debug configuration parameter and see the console output. Another option is to
configure “PasswordLogFileName” for the enclosing Handler. For more information, see Section 9.6.
Password log file on page 460.

### 3.48.6. UsernameAttr

This is the name of the LDAP attribute that is required to match the user name in the authentication request
(possibly after user name rewriting by RewriteUsername). Defaults to “uid”. The LDAP search filter is
constructed from UsernameAttr and the name of the user in the Access-Request like this: “(UsernameAttr =
user name)” For example, if you UsernameAttr is “uid”, and user “mikem” tries to log in, Radiator will use the
LDAP filter “(uid=mikem)” . This behaviour can be customised with the Search-Filter parameter.

```bash
# Use the uid attribute to match usernames
```
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### 3.48.7. AuthAttrDef

This optional parameter allows you to specify LDAP attributes to use as general check and reply items during authentication. AuthAttrDef is more general and useful than CheckAttr and ReplyAttr, and should be used in preference to them.

Using AuthAttrDef you can specify multiple LDAP attributes and tell Radiator to use them as check or reply items during authentication.

You can specify any number of AuthAttrDef parameters, one for each check or reply attribute in your LDAP database. The general format is:

```
AuthAttrDef ldapattributename[, radiusattributename, type[, formatted]]
```

- `ldapattributename` is the name of the LDAP attribute to be used as the check or reply item. If it is multi-valued, and this is a check item, then Radiator will permit a match with any one of the values.

- `radiusattributename` is the name of the RADIUS attribute that will be used as the check or reply item. The special `radiusattributename` "GENERIC" indicates that it is a list of comma separated attribute=value pairs, similar to ReplyAttr or CheckAttr.

- `type` indicates whether it is a check or reply item. It consists of the word “check” or the word “reply”. If type is “request” the value is saved in the current request, from where it can be later collected with a special formatting macro like: `%{attributename}`.

- `formatted` indicates that the LDAP attributes are to be subject to special character processing before being used.

**Tip**

The `radiusattributename` and `type` fields are optional. If they are not specified, then the `ldapattributename` attribute will be fetched from LDAP, but the fetched value of that attribute will not be used. This can be helpful for some types of LDAP query.

#### Example

Fetch the LDAP attribute called `calledstationid`, and use it as a check item against the RADIUS Called-Station-Id

```
AuthAttrDef calledstationid,Called-Station-Id,check
```

Check the RADIUS Service-Type matches the LDAP attribute called `servicetype`, and return the LDAP attribute called address as a static IP address (after special character replacements):

```
AuthAttrDef servicetype,Service-Type,check
AuthAttrDef address,Framed-IP-Address,reply,formatted
```

#### Example

During LDAP authentication, save 2 LDAP attributes into the current request:

```
# Put poolhint attribute into the request:
```

```
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AuthAttrDef radiusUserPoolHint, X-userPoolHint, request
# Put Group Name attribute into the Request:
AuthAttrDef radiusSimultaneousUseGroupName, X-GroupName, request

Then use those attributes in a later AuthBy FILE:

<table>
<thead>
<tr>
<th>User</th>
<th>Group</th>
<th>PoolHint</th>
</tr>
</thead>
<tbody>
<tr>
<td>fred</td>
<td>%{X-GroupName}</td>
<td>%{X-userPoolHint}</td>
</tr>
</tbody>
</table>

**Example**

Check items handle multi-valued LDAP attributes in a special way: by permitting a match with any one of the multiple values. For example, suppose you had callingstation LDAP attribute that could be multi-valued, and into which you put all the numbers the user was permitted to call from (as a separate value for each number), then you would use:

AuthAttrDef callingstation, Calling-Station-Id, check

### 3.48.8. AttrsWithBaseScope

Tells Radiator to search first for the user DN then do a search with scope base to fetch the attributes. Required, for example, to get access to Windows AD constructed attributes, such as tokenGroups, which are only returned when the search scope is set to base. Defaults to off.

### 3.48.9. PostSearchHook

This optional parameter allows you to define a Perl function that is run during the authentication process. The hook is called after the LDAP search results have been received, and after Radiator has processed the attributes it is interested in. Hook authors can use LDAP library routines to extract other attributes and process them in any way. PostSearchHook is called once for each LDAP result, as governed by MaxRecords parameter. See Section 3.48.13. MaxRecords on page 216.

*PostSearchHook* has the following arguments:

- Handle to the current AuthBy object
- User name
- Pointer to the current request
- Pointer to the User object being constructed to hold the check and reply items for the user being authenticated
- Search result entry
- Pointer to the reply packet currently being constructed

Here is an example of *PostSearchHook*:

```perl
# this example for LDAP2 gets an additional attribute, multiplies it by 60 and uses it for Session-Timeout
# as a reply attribute for the user
PostSearchHook sub {my $attr = $_[4]->get('someldapattr');
    $_[3]->get_reply->add_attr('Session-Timeout',
        $attr * 60);}
```
Tip
In order to get any attributes you may want to access in the PostSearchHook, you also need to add this to the `<AuthBy LDAP>` clause:

```plaintext
AuthAttrDef someldapattr
```

*someldapattr* is the name of the LDAP attribute you are going to access in the PostSearchHook.

### 3.48.10. ServerChecksPassword

Normally, Radiator fetches the user’s password attribute from the LDAP server using the *PasswordAttr* parameter and checks the password internally. This optional parameter causes the LDAP server to check the password instead. This is useful with LDAP servers that implement proprietary encryption algorithms in their passwords, or do not provide access to password attribute. For example, Microsoft Active Directory does not provide read access to password information over LDAP.

When ServerChecksPassword is specified, the password checking is performed using an LDAP bind operation.

Here is an example of using ServerChecksPassword:

```plaintext
# We are using Active Directory
ServerChecksPassword
```

**CAUTION**

ServerChecksPassword is compatible with PAP, EAP-TTLS/PAP, and other authentication methods that provide a plain text password. ServerChecksPassword does not work with CHAP, MSCHAP, and most EAP methods since these do not provide a password Radiator can use with an LDAP bind operation.

**Note**

In some cases, using ServerChecksPassword with HoldServerConnection may cause failure situations. This is due to some LDAP servers’ behaviour when the password check fails but the connection is not closed. A failure situation may also occur when the password check succeeds but the user is not allowed to perform searches in the server. If your users experience unexpected authentication failures, try testing your system without using these 2 parameters together.

### 3.48.11. UnbindAfterServerChecksPassword

This optional parameter works around problems with some LDAP servers. Normally, when ServerChecksPassword is set, after Radiator checks a users password the LDAP connection is not unbound. This can cause problems with some LDAP servers (notably Oracle ID and Novell eDirectory), where they unexpectedly cause the following LDAP query to fail with LDAP_INAPPROPRIATE_AUTH. Setting this flag causes an unbind after each ServerChecksPassword bind.
3.48.12. AuthCheckDN

This optional parameter allows you to specify an alternate DN to use to check a user's password, instead of the one returned by the search result. Special formatting characters are permitted, and %0 is replaced by the DN returned by the search.

Note
This is an advanced parameter. Most installations will not need to use it. Available in AuthBy LDAP2 only.

3.48.13. MaxRecords

This optional parameter specifies the maximum number of matching LDAP records to use for check and reply items. Default is 1 to be backwards compatible with earlier versions of AuthBy LDAP2. Only the first match (if any) is used for ServerChecksPassword. This parameter can be used to extract additional check and reply items from LDAP records that define user roles.


This optional parameter can be used with the Novell eDirectory LDAP server to fetch the user's Universal Password and use it to authenticate the user. The eDirectory Universal Password is a single password for each user that can be used to authenticate a range of Unix and Windows services. Normally it is not possible to fetch the users password from eDirectory, but GetNovellUP uses a special Novell API to fetch the users plaintext password.

GetNovellUP will fetch the password if ServerChecksPassword is not set, and if PasswordAttr and EncryptedPasswordAttr are either not set or are not present in the user's LDAP record.

Passwords retrieved with GetNovellUP are in plaintext and are compatible with PAP, CHAP, MSCHAP, MSCHAPV2, TLS, TTLS-*, PEAP-MSCHAPV2, EAP-MD5 etc.

The eDirectory server must be configured correctly before it will supply Universal Passwords to Radiator. The following conditions must be met.

- eDirectory Password Policy must be created and assigned to the group, organisational unit or organisation that holds the users to be authenticated.
- Password Policy must have Universal Passwords enabled.
- Password Policy must have ‘Allow password retrieval by admin’ enabled.

See goodies/edirectory.txt for more details about how to install and configure eDirectory so that Radiator can use GetNovellUP successfully.

3.48.15. GroupSearchFilter

For advanced applications, you can specify a search filter that Radiator will use to find which user groups a user belongs to by using the optional GroupSearchFilter parameter. It allows you to use arbitrarily complicated LDAP search filters to find the names of user groups the user belongs to. Special formatting characters are permitted, and %0 is replaced by UsernameAttr and %1 by the user name.

3.48.16. GroupNameCN

When GroupSearchFilter is specified and Radiator looks for the user groups the user is a member of, this parameter specifies the name of the Group name attribute in the LDAP records. Defaults to "cn".
3.48.17. GroupBaseDN

When GroupSearchFilter is specified and Radiator looks for the user groups the user is a member of, this parameter specifies an alternate LDAP base DN for the group search. Defaults to the value of BaseDN.

3.48.18. CheckAttr

This is the optional name of the LDAP attribute that contains the RADIUS check items for the user. During authentication, all the check items in this LDAP attribute (if specified) will be matched against the RADIUS attributes in the authentication request in the same was as for AuthBy FILE and AuthBy SQL, including Expiration in the format “Dec 08 1998”. Defaults to undefined. For more information, see Section 7.1. Check items on page 432.

**Tip**

If there are multiple instances of the LDAP attribute for the user, they are concatenated together with commas. This means that you can have each RADIUS check attribute in its own LDAP attribute for easy reading and maintenance.

**Tip**

AuthAttrDef is a more general and easy to use method of defining check and reply items. Support for CheckAttr will be discontinued sometime in the future.

```sh
# Check the radius items in checkitems
CheckAttr checkitems
```

3.48.19. ReplyAttr

This is the optional name of the LDAP attribute that contains the RADIUS reply items for the user. If the user authenticates successfully, all the RADIUS attributes named in this LDAP attribute will be returned to the user in the Access-Accept message. Defaults to undefined. For more information, see Section 7.2. Reply items on page 449.

**Tip**

If there are multiple instances of the LDAP attribute for the user, they are concatenated together with commas. This means that you can have each RADIUS reply attribute in its own LDAP attribute for easy reading and maintenance.

**Tip**

AuthAttrDef is a more general and easy to use method of defining check and reply items. Support for ReplyAttr will be discontinued sometime in the future.

```sh
# Reply with all the items in replyitems
ReplyAttr replyitems
```
3.49. **<AuthBy SYSTEM>**

<AuthBy SYSTEM> provides authentication with your getpwnam, getgrgid, and getgrnam system calls. On most Unix hosts, that means authentication from the same user database that normal user logins occur from, whether that be `/etc/passwd`, NIS, YP, NIS+, or the like. It is implemented in `AuthSYSTEM.pm`. This allows you to hide whether its password files, NIS+, PAM or whatever else might be installed on your system. It is not supported on Windows, or on systems with shadow password files unless Radiator runs with root or other permissions that allow it to access them.

<AuthBy SYSTEM> honours the Group and GroupList check item. These check items can match the numeric or symbolic group number of the primary or any secondary group.

<AuthBy SYSTEM> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

### 3.49.1. UseGetspnam and UseGetspnamf

These parameters are deprecated and will be removed from the future Radiator versions.

3.50. **<AuthBy TACACSPLUS>**

<AuthBy TACACSPLUS> provides authentication via a TacacsPlus server. It supports authentication only, not accounting or authorisation. It requires the `Authen::TacacsPlus` module. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. Use at least version `TacacsPlus-0.15.tar.gz`. Earlier versions do not work properly. Version 0.15 supports PAP authentication only. Later versions support both PAP and CHAP.

<AuthBy TACACSPLUS> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

### 3.50.1. Host

This optional parameter specifies the name of the host where the TacacsPlus server is running. It can be a DNS name or an IP address. Defaults to ‘localhost’.

```
Host oscar.open.com.au
```

### 3.50.2. Key

This mandatory parameter specifies the encryption key to be used to encrypt the connection to the TacacsPlus server. You must specify this. There is no default. It must match the key specified in the TacacsPlus server configuration file.

```
# There is a line saying key = mytacacskey in my tac_plus config file
Key mytacacskey
```

### 3.50.3. Port

This optional parameter specifies the TCP port to be used to connect to the TacacsPlus server. It can be a service name as specified in `/etc/services` or an integer port number. Defaults to ‘tacacs’ (TCP port 49). You should not need to change this unless your TacacsPlus server is listening on a non-standard port.
### 3.50.4. Timeout

This optional parameter specifies the number of seconds timeout. Defaults to 15. You would only need to change this under unusual circumstances.

### 3.50.5. AuthType

This optional parameter allows you to force the type of authentication to be used in the Tacacs+ request sent to the Tacacs+ server. Options are ‘PAP’ and ‘ASCII’. The default is to choose PAP if the version of Authen::TacacsPlus is 0.16 or greater, otherwise ASCII.

```bash
# Force ASCII auth regardless of the version of
# Authen::TacacsPlus installed
AuthType ASCII
```

### 3.51. <AuthBy NISPLUS>

<AuthBy NISPLUS> provides authentication via your NIS+ database. It is implemented in AuthNISPLUS.pm. It looks for user information in an NIS+ table, and uses that information as check and reply items for the user. It does not log (but does reply to) accounting requests. You will need to have a basic understanding of NIS+ databases in order to configure <AuthBy NISPLUS>. <AuthBy NISPLUS> requires the NISPlus Perl module. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

When <AuthBy NISPLUS> receives its first authentication request, it attempts to connect to the NIS+ table defined by the Table parameter. <AuthBy NISPLUS> will then try to fetch some fields for the user from the table. You can specify the query to use to locate the user in the NIS+ table with the Query parameter. You also specify the NIS+ field that contains the password, and (optionally) the names of fields containing an encrypted password, RADIUS check items and RADIUS reply items. This scheme allows you to work with almost any NIS+ table definition, however the defaults are set up so you can authenticate from a standard NIS+ passwd table without having to add any special definitions.

If all the check items are satisfied by the request, <AuthBy NISPLUS> will reply with an Access-Accept message containing all the attributes in the reply items (if any). If the user does not appear in the NIS+ Table, or if any check item does not match, an Access-Reject message is sent to the client.

<AuthBy NISPLUS> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

#### 3.51.1. Table

This optional parameter defines the name of the NIS+ table to search in. It defaults to `passwd.org_dir` which is the name of the standard password table in NIS+. You would not normally need to change this. You could define your own NIS+ table with your own table structure to authenticate from, and define the name of the table with the Table parameter. You might occasionally want to specify a table for a specific domain with Table:

```bash
# Use the mydomain.com password table
Table passwd.org_dir.mydomain.com
```

#### 3.51.2. Query

This optional parameter specifies how users are to be located in the NIS+ table. It is a list of field=value pairs. You can use any of the special characters. For more information, see Section 3.3. Special formatters on page 19. In addition, you can use %0 for the user name. The default is [name=%0], which will find the user name in a standard NIS+ passwd table. You would only need to define this if you define your own NIS+ table to authenticate from.
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# Use cname and type in our own special table
Query [cname=%n,type=LOCAL]

## 3.5.1.3. EncryptedPasswordField

This optional parameter specifies the name of the field in the NIS+ table that contains the encrypted password for the user. It defaults to `passwd`, which is the name of the password field in the standard NIS+ passwd table. Radiator will use this field as the source of the encrypted password with which to check authentication requests.

If you define any AuthFieldDef parameters, EncryptedPasswordField will be ignored completely, and you will have to define every check and reply item (including the encrypted password) with an AuthFieldDef entry.

# Our special table has the password in pw
EncryptedPasswordField pw

## 3.5.1.4. AuthFieldDef

This optional parameter allows you to specify precisely how the fields in the NIS+ table are to be interpreted. If any AuthFieldDef parameters are specified, EncryptedPasswordField will be completely ignored, and you will have to define every check and reply item (including the encrypted password) with an AuthFieldDef entry.

You can specify as many AuthFieldDef parameters as you like, one for each check and reply item in the NIS+ table.

You can specify any number of AuthFieldDef parameters, one for each interesting field in the NIS+ table. The general format is:

```
AuthFieldDef fieldname,attributename,type
```

- `fieldname` is the field in the NIS+ table that contains the value to check or reply. If `fieldname` is not present in the NIS+ table, or is empty for the user, it will not be used.
- `attributename` is the name of the radius attribute to be checked or replied. The special `attributename` ‘GENERIC’ indicates that it is a list of comma separated attribute= value pairs, not just a single attribute
- `type` indicates whether it is a check or reply item

### Example

The standard NIS+ passwd table contains user name and encrypted password. You can interface to such a table by having an empty AuthBy NISPLUS clause:

```
<AuthBy NISPLUS>
</AuthBy>
```

Just for illustration purposes, that is exactly equivalent to the following:

```
<AuthBy NISPLUS>
    Table passwd.org_dir
    Query [name=%n]
    AuthFieldDef passwd,Encrypted-Password,check
</AuthBy>
```
### Example

You might define a special NIS+ table something like this: the table called “users” contains user names in the “uname” column, encrypted password in the “pw” column, and an optional IP address to use in the “address” column:

```xml
<AuthBy NISPLUS>
  Table users.org_dir
  Query [uname=%n]
  AuthFieldDef pw,Encrypted-Password,check
  AuthFieldDef address,Framed-IP-Address,reply
</AuthBy>
```

### 3.52. <AuthBy PAM>

<AuthBy PAM> provides authentication via any method supported by PAM (Pluggable Authentication Modules) on your host. It is implemented in AuthPAM.pm. It requires that PAM be installed and configured on your host, and it also requires the Perl module Authen-PAM-0.04 or later. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

<AuthBy PAM> asks PAM to authenticate the user using the PAM service specified with the Service parameter (defaults to “login”).

AuthBy PAM has not been tested on Windows platforms.

#### Tip

Make sure PAM is configured on your host before building and testing the Authen-PAM Perl module, otherwise “make test” will report errors. This will usually require configuring `/etc/pam.conf`, or perhaps `/etc/pam.d/login` for the login service. For example, on our RedHat 5.2 Linux, we found that we had to remove the pam_securetty from our `/etc/pam.d/login` file to enable testing from other than a secure TTY. Consult your system documentation for details on configuring PAM.

<AuthBy PAM> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

#### 3.52.1. Service

This optional parameter specifies the PAM service to be used to authenticate the user name. If not specified, it defaults to “login”.

```perl
# We want to use the PAM "ppp" service to authenticate our users
Service ppp
```

#### 3.52.2. UsePamEnv

This optional parameter allow you to get UID, GID etc. if your PAM supports it, and your Authen::PAM was compiled with -DHAVE_PAM_ENV_FUNCTIONS. This can be useful with PAM authenticators which can supply UID, GID or other values of the user.

If this parameter is set, AuthBy PAM will gather PAM Environment strings and use them to set RADIUS reply attributes according to the following table:
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**Table 9. How PAM Environment strings are converted to RADIUS reply attributes**

<table>
<thead>
<tr>
<th>PAM Env string</th>
<th>RADIUS reply attribute</th>
</tr>
</thead>
<tbody>
<tr>
<td>UID</td>
<td>OSC-Uid</td>
</tr>
<tr>
<td>GID</td>
<td>OSC-Gid</td>
</tr>
<tr>
<td>HOME</td>
<td>OSC-Home</td>
</tr>
<tr>
<td>SHELL</td>
<td>OSC-Shell</td>
</tr>
</tbody>
</table>

#### 3.52.3. PasswordPrompt

This optional parameter allows you to specify the prompt string which PAM uses to ask for a password. Defaults to ‘password’. You may need to change this if your PAM module asks for data with a different prompt, such as ‘Code’.

#### 3.53. <AuthBy ADSI>

<AuthBy ADSI> authenticates from Windows Active Directory, which is the user information database on Windows 2000 and later servers. It uses ADSI (Active Directory Service Interface) to get user information from any Active Directory service provider available to your Windows server. It is only available on Windows 2000 and later server platforms. It is implemented in AuthADSI.pm.

ADSI is a unified interface to Windows user information that was introduced in Windows 2000. Active Directory can access user information from a range of provider types:
- NT Primary or Secondary domain controller (WinNT:)
- Active Directory LDAP database (LDAP:)
- Novell Directory Services (NDS:)

You can configure AuthBy ADSI to use any of these service providers.

For more information, see Active Directory Service Interfaces website [https://msdn.microsoft.com/en-us/library/aa772170(v=vs.85).aspx].

During authentication, <AuthBy ADSI> check and honours AccountDisabled, IsAccount-Locked and LoginHours for the user being authenticated. It also checks the users password (by attempting to change it). Because Active Directory does not make the plaintext password available, <AuthBy ADSI> only supports PAP, not CHAP or MSCHAP authentication.

<AuthBy ADSI> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

#### 3.53.1. BindString

BindString is the string that defines what ADSI object will be bound in order to get user details. You can bind to any Active Directory provider supported on your Radiator host, but WinNT or LDAP will be the usual choices. BindString must specify which provider to use and how to match the user. Use %0 to specify the user name to match.

WinNT means to use an NT 4.0 primary or backup domain controller, e.g. `WinNT:MyDomain/%0`, User means to match Users in the Windows NT domain called MyDomain. If the domain is omitted, the “best” domain controller in the default domain will be used.

Other acceptable variants are:
- `BindString WinNT://%0,User`
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- **BindString WinNT://domain/%0,User**
- **BindString WinNT://domain/controller/%0,User**

**LDAP** means to use an LDAP server, including Microsoft Exchange and Windows 2000 Active Directory e.g. `LDAP://ldapsvr/cn=%n,cn=Users,dc=yourdomain,dc=com` means to match a user with the given common name (cn), in the AD domain yourdomain.com. If ldapsvr is omitted, the default AD server will be used.

Other acceptable variants are:

- **BindString LDAP://cn=%0.......**
- **BindString LDAP://controller/cn=%0.......**
- **BindString LDAP://msexchangeserver.bigco.com/cn=%0.......**
- **BindString LDAP://msexchangeserver:390/cn=%0.......**

**NDS** means use Novell Directory Services. e.g. `NDS://MarsTree/O=MARS/OU=MARTIANS/CN=%0`

The default is `WinNT://%0,User` which means a user with the given user name in the default domain.

```bash
# Get users from the OSC domain in NT
BindString WinNT://OSC/%0,User
# Get user details from the Users folder in Active Directory
# for the AD domain open.com.au
BindString LDAP://cn=%0,cn=Users,dc=open,dc=com,dc=au
```

### 3.5.3.2. AuthUser

This parameter defines how to construct the Active Directory user name to be authenticated by Active Directory. You can choose whether to use standard NTLM user names or AD Distinguished Names. This is a different concept to BindString, which specifies what AD object to get account details from.

The default is `%0`, which will try to authenticate the user name sent by the NAS (after RewriteUsernames have been applied).

This example will authenticate the user from an AD user record in the `csx users` Organizational Unit, and get account details from the same AD record. Unlike NTLM user names, it will even work for user names with spaces in them. Note that you need to specify AuthFlags of 0 in order to use an Active Directory DN in AuthUser.

```bash
BindString LDAP://cn=%0,ou=csx users,dc=open,dc=com,dc=au
AuthUser cn=%0,ou=csx users,dc=open,dc=com,dc=au
AuthFlags 0
```

### 3.5.3.3. AuthFlags

This optional parameter specifies flags to be passed to OpenDSObject. The default is 1, which means NTLM secure authentication. For more information, see AuthFlags website [https://msdn.microsoft.com/en-us/library/ms524513(v=vs.90).aspx]. You need to specify 0 to use an Active Directory DN in AuthUser.

### 3.5.3.4. AuthAttrDef

This optional parameter allows you to use additional ADSI user information as RADIUS check or reply items. This is most useful when you define new user attributes in your Active Directory schema. It is beyond the scope of this document to describe how to add new attributes to an Active Directory schema.

The general format is
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**AuthAttrDef adsiname,radiusattr,type**

- *adsiname* is the name of an attribute in your Active Directory User schema. The value of that attribute will be fetched using ADSI during authentication.

- *radiusattr* is the name of the RADIUS attribute that the adsiname will be converted to. check or reply item. The special radiusattr ‘GENERIC’ indicates that it is a list of comma separated attribute=value pairs, similar to ReplyAttr or CheckAttr.

- *type* specifies whether to use the value as a check or reply item. type may be check, reply or request. If type is “request” the value is saved in the current request, from where it can be later collected with a special formatting macro like: %{attributename}.

For example,

**AuthAttrDef address,Framed-IP-Address,reply**

would get an attribute called ‘address’ from the ADSI user record, and put it into Framed-IP-Address attribute in the RADIUS reply. If address was not defined in your schema, or there was no value defined for the user being authenticated, then Framed-IPAddress would not be set in the reply.

Multi-valued AD attributes can be used as check items, which results in Radiator passing the authentication if one of the multi-valued items matches. For example if you have this in your AuthBy ADSI:

**AuthAttrDef otherHomePhone,Calling-Station-Id,check**

and multiple entries in Home, ‘Other….’ tab of the Telephones tab. Then Radiator will let the user log in if they call from any one of the Other Home Phone numbers.

### 3.5.3.5. GroupBindString

This optional parameter is used to generate an ADSI group identifier when checking group membership through a Group= check item. Defaults to ‘WinNT://%0,Group’ (i.e. the named group in the default domain). Special characters can be used, and %0 is replaced with the name of the group being checked, and %1 with the name of the user whose group membership is being checked.

### 3.5.3.6. GroupUserBindString

This optional parameter is used to generate an ADSI user name identifier when checking group membership through a Group= check item. Defaults to ‘WinNT://%1’ (i.e. the named user). Special characters can be used, and %0 is replaced with the name of the group being checked, and %1 with the name of the user whose group membership is being checked.

This example checks whether an NT user in the OSC domain is in an NT Group in the OSC domain:

**GroupBindString WinNT://OSC/%0,Group**

**GroupUserBindString WinNT://OSC/%1**

This example checks whether the active directory user identified by GroupUserBindString is in the group defined by GroupBindString.

**GroupBindString LDAP://cn=%0,dc=open,dc=com,dc=au**

**GroupUserBindString LDAP://cn=%1,cn=Users,dc=open,dc=com,dc=au**
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**Tip**
With AD, do not confuse Organizational Unit with group membership. They are different ideas. A user can be in one OU, but be a member of multiple groups. Use GroupBindString, GroupUserBindString and the Group= check item to check for AD group members.

3.53.7. CheckGroupServer

This optional parameter, in conjunction with CheckGroup, allows you to set a Class reply attribute that depends on which NT group the user is a member of. CheckGroupServer is the name of an NT domain controller that contains group information.

```xml
<AuthBy ADSI>
  CheckGroupServer brbaaa01
  CheckGroup USVPN,ou=tcgic
  CheckGroup UKVPN,ou=tcgic
  ....
</AuthBy>
```

3.53.8. CheckGroup

This optional parameter, in conjunction with CheckGroupServer, allows you to set a Class reply attribute that depends on which NT group the user is a member of. Recall that if you set the Class in an access reply, then subsequent accounting requests sent by the NAS for that session will contain exactly the same Class attribute. This is useful for remembering which accounting group or rate to charge the user.

CheckGroup is a comma-separated pair of names. The first is an NT group name, the second is an arbitrary string. During authentication, if the user is a member of the NT group, then the Class attribute in the reply will be set to the arbitrary string. The first match found will be used.

For example:

```xml
<AuthBy ADSI>
  CheckGroupServer romeo
  CheckGroup USVPN,premium
  CheckGroup UKVPN,standard
  ....
</AuthBy>
```

In this example, if a user is a member of the NT group USVPN, then the reply will contain Class=premium. If they are in UKVPN group, then the reply will contain Class=standard. If they are in neither group, then no Class will be set in the reply.

3.54. `<AuthBy PORTLIMITCHECK>`

`<AuthBy PORTLIMITCHECK>` can apply usage limits for arbitrary groups of users. It is implemented in AuthPORTLIMITCHECK.pm. It requires that you have a `<SessionDatabase SQL>` defined in your Radiator configuration.

This module allows you to specify for example that up to 20 ports can be used by a customer with a certain DNIS, or 10 ports in one POP and 20 ports in another. Users can be grouped by any attribute stored in your SQL Session Database.

Furthermore, you can arrange to set the Class attribute for the session depending on bands of port usage. This could allow you to charge different amounts for the first 10 and the second 10 ports, for example, or to have a
premium price for excessive port occupancy. (The Class attribute set this way will be sent back by the NAS in all accounting requests for that session. You could then use the value of the Class attribute to tell your billing system how much to charge for the session. The ability to actually charge differently depends on the functions of your billing system.)

This module must be used in conjunction with some other module that actually performs the authentication of the user. PORTLIMITCHECK should be considered as a pre-check to make sure that the login would be within the port occupancy limits you have specified.

<AuthBy PORTLIMITCHECK> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

### 3.54.1. CountQuery

This parameter specifies an SQL query that will be used to count the users currently online according to the SQL Session Database. Defaults to "select COUNT(*) from RADONLINE where DNIS='\{Called-Station-Id\}". AuthBy PORTLIMITCHECK will compare the results of this query with SessionLimit in order to determine whether the user will be permitted to log in at all.

#### Tip

You must have a <SessionDatabase SQL> configured into Radiator. The Session Database must be configured to save the columns that you plan to use to group users in your CountQuery. So, if you are using the default CountQuery, your SQL Session Database must be configured to save the Called-Station-Id attribute to the DNIS column, with something like:

```xml
<SessionDatabase SQL>
    <AddQuery>insert into RADONLINE (USERNAME, NASIDENTIFIER, NASPORT, ACCTSESSIONID, TIME_STAMP, FRAMEDIPADDRESS, NASPORTTYPE, SERVICETYPE, DNIS) 
        values (%0, '%N', %{NAS-Port}, '%{Acct-Session-Id}', %{Timestamp}, '%{Framed-IP-Address}', '%{NAS-Port-Type}', '%{Service-Type}', '%{Called-Station-Id}')</AddQuery>
</SessionDatabase>
```

### 3.54.2. SessionLimit

This parameter specifies the absolute upper limit to the number of current logins permitted to this group of users. Defaults to 0. For example if SessionLimit is set to 10, then up to 10 concurrent sessions are permitted. If an 11th user attempts to log in through this AuthBy, they will be rejected. If LimitQuery is defined, and if it successfully gets an integer from the database, then the result of the query will be used instead of SessionLimit. SessionLimit may contain special formatting characters.

```xml
    # They have paid for 20 ports
    SessionLimit20
```

### 3.54.3. ClassForSessionLimit

This optional parameter allows you to set up different charging bands for different levels of port occupancy in this group of users. You can have one or more ClassForSessionLimit lines. If the current level of port usage is below a ClassForSessionLimit, then the class name will be applied as a Class attribute to that session. Your
NAS will then tag all accounting records for that session with the Class attribute. If your billing system records and uses the Class attribute in accounting records, then you could use this to charge differently for different levels of port occupancy.

```bash
# The first 2 users will be tagged with a Class of "normal"
# the next 2 with "overflow". No more than 4 concurrent users
# permitted
SessionLimit 4
ClassForSessionLimit normal,2
ClassForSessionLimit overflow,4
```

### 3.54.4. LimitQuery

This optional parameter can be used to override the fixed session limit defined by SessionLimit. LimitQuery is an SQL query that is expected to return an integer that will be used as the limit instead of SessionLimit. If LimitQuery fails to execute, or if it does not return any rows, then SessionLimit will be used as the limit instead.

```sql
LimitQuery select maxsessions from customers where dnis=%{Called-Station-Id}
```

### 3.54.5. IgnoreErrors

This optional parameter causes AuthBy PORTLIMITCHECK to IGNORE rather than REJECT if the SQL query or SQL connection fails. It can be useful for recovering from or working around SQL server failures.

### 3.55. <AuthBy DYNADDRESS>

/AuthBy DYNADDRESS/ is used to dynamically allocate IP address information in conjunction with <AddressAllocator xxxxxx> clauses. It is implemented in AuthDYNADDRESS.pm. At present, there are three Address Allocation engines provided:

- AddressAllocator SQL can allocate IPv4 addresses and IPv6 prefixes out of an SQL database. For more information, see Section 3.115. <AddressAllocator SQL> on page 350.

- AddressAllocator DHCP can allocate addresses from a DHCP server. For more information, see Section 3.116. <AddressAllocator DHCP> on page 356.

- AddressAllocator DHCPv6 can allocate addresses and prefixes from a DHCPv6 server. For more information, see Section 3.117. <AddressAllocator DHCPv6> on page 359.

IP address and prefix allocation is usually the responsibility of your NAS, and most organisations have allocation done by their NASs. There are sometimes special requirements that mean allocation must be done by a central authority, and /AuthBy DYNADDRESS/ allows you to make your RADIUS server the address allocator.

When using /AuthBy DYNADDRESS/, the usual arrangement is to make /AuthBy DYNADDRESS/ the last AuthBy clause in a <Handler>. Some previous AuthBy clauses are responsible for authenticating the password of the user. Only if the authentication succeeds is /AuthBy DYNADDRESS/ run and an address allocated.

It is common practice to maintain multiple IP address pools, with each pool used for a different class of users, perhaps with different access controls. The features of /AuthBy DYNADDRESS/ allow you to control which pools to allocate from, and also how to translate the allocated information into RADIUS reply attributes.

See goodies/addressallocator* in the Radiator distribution for configuration samples for different allocation engines.

/AuthBy DYNADDRESS/ understands also the same parameters as /AuthBy xxxxxx/. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.
3.55.1. AddressAllocator

This is the Identifier of an `<AddressAllocator xxxxxx>`. It specifies which Address Allocation engine will be used to allocate the addresses. It must match the Identifier parameter of an `<AddressAllocator xxxxxx>` clause. Special formatting characters are permitted. The named AddressAllocator will be used to allocate and deallocate addresses of all users authenticated through this AuthBy.

```
<AddressAllocator SQL>
    Identifier SQLAllocator
    DBSource ....
    ..... 
</AddressAllocator>
<Handler>
    AuthByPolicy ContinueWhileAccept
    # This does the authentication
    <AuthBy FILE>
        Filename xxxxxx
    </AuthBy>
    # If authentication succeeds, this allocates an
    # address, using the AddressAllocator above
    <AuthBy DYNADDRESS>
        AddressAllocator SQLAllocator
    </AuthBy>
</Handler>
```

**Note**

This parameter used to be called Allocator. This word is still supported but deprecated. Support will be removed some time in the future.

3.55.2. PoolHint

This optional parameter specifies how the pool hint is derived. A pool hint is generally used by an AddressAllocator to determine which pool to allocate an address from. The value of the pool hint will therefore depend on what type of Address Allocator you are using, and usually which pools are available.

The default PoolHint (and the most common requirement) is ‘%{Reply:PoolHint}’, which means the pool hint is an attribute called ‘PoolHint’ in the current reply. Presumably the PoolHint will have been set in the reply by some previous AuthBy clause. This is easy to do for example in an AuthBy FILE, by adding the pool hint attribute to the users file:

```
user1       Password=x
            PoolHint=pool1
user2       Password=y
            PoolHint=pool2
```

The PoolHint attribute will then be used by the Address Allocator to indicate which pool to allocate from. The exact way the pool hint is used depends on the type of Address Allocator you are using, so refer to the documentation for the Address Allocator.
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Tip

If the pool hint resolves to an empty string, a DEBUG message will be issued, no address will be allocated, but the request will be ACCEPTED. This allows you to arrange for only some users to get an address allocated (and the NAS will allocate addresses for the others).

3.55.3. MapAttribute

This optional parameter allows you to specify how the results of the address allocation are to be placed in the reply.

If the yiaddr attribute (usually Framed-IP-Address) is already set in the reply, then AuthBy DYNADDRESS will not allocate an address, and will just ACCEPT the request. This means that if a user record has a fixed IP address in it, then AuthBy DYNADDRESS will not allocate an address for that user.

The above also applies to IPv6 iaaddr and iaprefix. However, if there is additional configuration information, such as DNS server addresses, the allocator may still make a query to fetch this information. For example, DHCPv6 allocator can send a stateless Information-request.

Each MapAttribute specifies the name of the allocation variable, and the name of the RADIUS attribute in which to place it (if it is not set already). The following allocation variables are normally available for IPv4 allocation. Some AddressAllocator clauses may not provide all of these or may also make others available.

- yiaddr, usually the allocated IP address in dotted quad format (e.g. 1.2.3.4)
- subnetmask, usually the IP Subnet Mask in dotted quad format (e.g. 255.255.255.255)
- dnsserver, usually the address of the DNS server to use in dotted quad format (e.g. 1.2.3.4) Only one DNS server address is currently permitted and supported for IPv4

The default behaviour is to place the allocated IPv4 address in Framed-IP-Address, and the IPv4 subnetmask in Framed-IP-Netmask. This is equivalent to:

```
MapAttribute yiaddr, Framed-IP-Address
MapAttribute subnetmask, Framed-IP-Netmask
```

There are no default MapAttribute parameters for IPv6 information. For DHCPv6 allocator, the name of the allocation variables must be the case insensitive name of the desired DHCPv6 option. For example, the following requests and maps OPTION_IAADDR and OPTION_DNS_SERVERS. Multiple DNS servers are mapped to multiple instances of DNS-Server-IPv6-Address

```
MapAttribute iaaddr, Framed-IPv6-Address
MapAttribute dns_servers, DNS-Server-IPv6-Address
```

For more information about the details of the available allocation variables, see Section 3.117. <AddressAllocator DHCPv6> on page 359 and Section 3.115. <AddressAllocator SQL> on page 350.

3.55.4. MapResultHook

MapResultHook allows modifying the allocation results after they have been received, and before Radiator has processed the MapAttribute definitions.

This example complies with how some vendors require uplink addresses as host routes with a /128 prefix for the requesting routers.

```
MapAttribute iaprefix, Delegated-IPv6-Prefix
MapAttribute iaaddr, Framed-IPv6-Prefix
```
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MapResultHook sub { my $result = $_[0];
   $result->{iaaddr} .= "/128" if $result->{iaaddr}; }

3.55.5. RunWhenMissing

This optional flag parameter controls if confirm and deallocate operations are run even if the address, as defined by MapAttribute yiaddr, is missing from the accounting requests that have Acct-Status-Type set to Start, Alive or Stop. The default value is enabled and confirm, and deallocate are always run.

# If Framed-IP-Address is missing from the request do nothing
MapAttribute yiaddr, Framed-IP-Address
RunIfMissing false

Tip
When IPv4 and IPv6 allocators are chained, yiaddr is typically not set for one of the allocators. In this case, set RunWhenMissing to off.

3.56. <AuthBy ROUNDROBIN>, <AuthBy VOLUMEBALANCE>, <AuthBy LOADBALANCE>, <AuthBy HASHBALANCE>, <AuthBy EAPBALANCE>

These authentication methods are sub-types of <AuthBy RADIUS> but they also do load distribution and balancing. They allow you to proxy RADIUS requests to any number of remote RADIUS servers and to distribute the RADIUS load amongst those servers. Further, if any remote server fails to reply to a proxied request, the remote server is marked as unavailable until the FailureBackOffTime expires. During that period, no requests are proxied to that remote RADIUS server.

These authentication methods understand all the same parameters as <AuthBy RADIUS>. For more information, see Section 3.41. <AuthBy RADIUS> on page 182. The only difference between them and <AuthBy RADIUS> is the algorithm for choosing which remote host to proxy to and how the received and dropped responses provide feedback for the host selection algorithm.

Note
See an example config file showing how to use various load balancing modules in goodies/proxyalgorithm.cfg in the Radiator distribution.

3.56.1. <AuthBy ROUNDROBIN>

<AuthBy ROUNDROBIN> distributes RADIUS requests to the servers. The first incoming RADIUS request is proxied to the first server listed, the next to the second listed and so on, until the list is exhausted. Then it starts again at the top of the list. If at any time a proxied request does not receive a reply from a remote server, that server is marked as unavailable until FailureBackOffTime seconds has elapsed. Meanwhile that request is retransmitted to the next host due to be used.

The result of this algorithm is to distribute the load equally amongst all the currently operational remote RADIUS servers.

<AuthBy ROUNDROBIN> supports the same parameters as Section 3.41. <AuthBy RADIUS> on page 182.
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3.56.2. <AuthBy VOLUMEBALANCE>

When using `<AuthBy VOLUMEBALANCE>`, the incoming RADIUS requests are distributed between all the listed hosts according to the relative values of their BogoMips attributes. BogoMips is a relative measure of the processing power of that host. A Host with a BogoMips rating of 2 receives twice as many requests as one with the default BogoMips rating of 1. If at any time a proxied request does not receive a reply from a remote server, that server is marked as unavailable until `FailureBackoffTime` seconds has elapsed. Meanwhile, that request is retransmitted to the next host due to be used.

The result of this algorithm is to distribute the load amongst all the currently operational remote RADIUS servers, according to the relative values of their BogoMips values. For more information about configuring the BogoMips parameter, see Section 3.42.1. BogoMips on page 200.

`<AuthBy VOLUMEBALANCE>` supports the same parameters as Section 3.41. `<AuthBy RADIUS>` on page 182.

3.56.3. <AuthBy LOADBALANCE>

When using `<AuthBy LOADBALANCE>`, the incoming RADIUS requests are distributed between all the listed hosts according to the relative values of their BogoMips attributes and the time the remote server takes to process requests. BogoMips is intended to be a relative measure of the processing power of that host. A Host with a BogoMips rating of 2 receives twice as many requests as the one with the default BogoMips rating of 1. Every request that is proxied and receives a reply has its turnaround time, which is measured in microseconds. A sliding average response time over the last 10 request is calculated. Requests are proxied to the server that is currently responding fastest. If at any time a proxied request does not receive a reply from a remote server, that server is marked as unavailable until `FailureBackoffTime` seconds has elapsed. Meanwhile, that request is retransmitted to the next host due to be used.

The result of this algorithm is to distribute the load until the BogoMips-weighted response time is the same for all servers. This allows the load balancing to adapt to the changes in the available processing capacity of a remote host.

For more information about configuring the BogoMips parameter, see Section 3.42.1. BogoMips on page 200.

Example

In this example, Radiator running by itself on a host distributes RADIUS requests to 3 remote servers. The second host has twice the processing power of the others, and therefore gets twice as many requests as the other 2.

```
....
# Proxy all requests to remote hosts inside our network:
<Handler>
    <AuthBy VOLUMEBALANCE>
        # If a host fails, do not send to it again
        # for 100 seconds
        FailureBackoffTime 100
        # Default values for all hosts. You can change
        # them for a single host in a Host clause
        Secret mysecret
        RetryTimeout 1
        Retries 1
        # Hosts to send to are listed below
        <Host 203.63.154.2>
    </Host>
</Handler>
```
3. Configuring Radiator

<Host 203.63.154.3>
BogoMips 2
</Host>
# This host has non-standard ports
<Host 203.63.154.4>
AuthPort 1647
AcctPort 1648
</Host>
</AuthBy>
</Handler>

3.56.4. <AuthBy HASHBALANCE>

/AuthBy HASHBALANCE/ distributes RADIUS requests among a set of RADIUS servers so that multiple related requests from the same user go to the same server unless that server fails. This prevents the requests being distributed among multiple servers, which is prone to problems with authentication methods that use multiple messages, such as EAP.

When using /AuthBy HASHBALANCE/, a hash number is calculated for each incoming request. That hash number is based on number of attributes in the incoming request. It is used to select which host to use. If the selected Host is unavailable, then the next one on the Host list is used in sequence until the Host list is exhausted. This results in a random distribution of requests among the available server, and the same server handles all the requests related to a single user.

/AuthBy HASHBALANCE/ supports the same parameters as Section 3.41. <AuthBy RADIUS> on page 182.

The HashAttributes parameter specifies which attributes in the incoming request is used to select the server. The default value is shown below. It is suitable for most use cases.

HashAttributes %{Request:Calling-Station-Id}:%n

3.56.5. <AuthBy EAPBALANCE>

/AuthBy EAPBALANCE/ is similar to /AuthBy HASHBALANCE/ in the aspect that it is intended to ensure all EAP requests relating to a single session always go to the same target RADIUS server. It uses the RADIUS State attribute to track EAP sessions, and therefore relies on all the RADIUS clients supporting the State attribute similarly. The target server for the first EAP request in a session is chosen in the same was as /AuthBy HASHBALANCE/. If you are unsure, try /AuthBy HASHBALANCE/ with new configurations first.

/AuthBy EAPBALANCE/ is useful in installations where all RADIUS clients are known to support the RADIUS State attribute similarly. This usually covers the network managed by a single organisation, but is likely to not work with Eduroam or other roaming services where remote or intermediate proxies may add, change, or remove the State attribute. With these services, /AuthBy HASHBALANCE/ with the default HashAttributes setting should ensure correct operation.

CAUTION

When EAPBALANCE is used in a ServerFarm architecture to proxy requests to a set of back end RADIUS servers, the duplicate detection in the back end servers can be defeated by changes to requests made by the server farm. It is therefore essential that all the backend servers in such an architecture have the UseContentsForDuplicateDetection flag set in the receiving Client clauses.
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Note
See an example config file showing how to use EAPBALANCE in goodies/eapbalance.cfg in the Radiator distribution.

<AuthBy EAPBALANCE> supports the same parameters as Section 3.41. <AuthBy RADIUS> on page 182.

3.57. <AuthBy OPIE>

This clause allows authentication from OPIE (One time Passwords In Everything), a one-time password system based on S/Key, and written by Craig Metz. AuthBy OPIE requires opie-2.4 or better and Authen::OPIE 1.0. Both are part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. OPIE is only supported in Unix platforms. It can be used with PAP, but not CHAP or MS-CHAP. It can also be used with EAP-One-Time-Passwords and EAP-Generic-Token-Card authentication in 802.1X wired and wireless networks.

OPIE is a one-time password system that prompts an intending user with a Challenge. The user enters the challenge into a password calculator program which then tells them the one-time password to use. A one-time password is 6 short words, separated by spaces. A one-time password can only be used successfully once. Next time you log in, you will be prompted with a different challenge and a different password will be required. Opie can also generate lists of one-time passwords that can be used in sequence without prompts.

<AuthBy OPIE> interfaces directly to OPIE using the OPIE Perl module. If you attempt to log in with an empty password, <AuthBy OPIE> will issue an Access-Challenge, with the Reply-Message containing the OPIE Challenge that must be entered into the password calculator. The user can then use the Response from the calculator as the password for the next attempt.

CAUTION
Not all PPP clients will show the user the contents of the Reply-Message. If that is the case with your users, they will not be able to see the challenge, and hence will not be able to log in with OPIE.

Tip
On Windows, in order to do interactive login, and so the end user can see the OPIE challenge and enter the response, enable ‘Show terminal window’ for the dial-up connection.

When using <AuthBy OPIE>, Radiator must usually be run as root, so it can get access to the OPIE password database, typically in /etc/opiekeys.

<AuthBy OPIE> understands the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

<Realm DEFAULT>
   <AuthBy OPIE>
      DefaultReply Service-Type=Framed-User,\n      Framed-Protocol=PPP
   </AuthBy>
</Realm>
3. Configuring Radiator

3.58. <AuthBy LDAPRADIUS>

This clause proxies requests to one or more target RADIUS servers. The target host is determined by a lookup in an LDAP database. This allows the easy management of large numbers of downstream radius servers, such as in a wholesale ISP. It inherits from both LDAP and <AuthBy RADIUS>.

<AuthBy LDAPRADIUS> runs the SearchFilter query to determine the details of the target RADIUS server until either an acknowledgment is received from the target or Num-Hosts is exceeded. This permits fallback RADIUS servers to be configured.

SearchFilter can be configured to select the target RADIUS server based on any attribute in the incoming request. The default is the user's Realm, but other possibilities, such as Called-Station-Id may be more useful for your organisation.

Tip

There is a sample LDAP schema for OpenLDAP in goodies/radiator-ldap.schema in your Radiator distribution. This schema is compatible with the default behaviour of SearchFilter and HostAttrDef allowing the selection of a target host primary based on Realm.

Tip

If SearchFilter fails to find any matching LDAP records, <AuthBy LDAPRADIUS> attempts to proxy according any <Host xxxxxx> clauses contained within the <AuthBy LDAPRADIUS> clause. For more information, see Section 3.42. <Host xxxxxx> within <AuthBy RADIUS> on page 199. This permits unknown realms to be proxied to a catchall target server, such as GoRemote (GRIC) and IPASS.

<AuthBy LDAPRADIUS> understands also the same parameters as <AuthBy LDAP2>. For more information, see Section 3.48. <AuthBy LDAP2> on page 210.

3.58.1. BaseDN

This is the base DN, where searches are made. It is used in similar way as with all LDAP modules. For more information, see Section 3.9.1. BaseDN on page 50.

Special formatting characters are permitted. %0 is replaced by the host counter. It is an integer that starts at 1 and counts the searches made for a given request. %1 is replaced by the realm of the user name in the current request.

3.58.2. SearchFilter

This parameter specifies the LDAP search filter that is used to find the LDAP records containing remote RADIUS server data. The default value is (oscRadiusTarget=%1), which is compatible with the example schema provided in goodies/radiator-ldap.schema, and selects a record where oscRadiusTarget matches the user's realm.

SearchFilter can contain any of the special characters. For more information, see Section 3.3. Special formatters on page 19. %0 is replaced by the host counter. It is an integer that starts at 1 and counts the searches made for a given request. %1 is replaced by the realm of the user name in the current request. Use %0 to select a different record each time HostSelect is run for a given record, allowing you to choose, for example, primary or secondary server.
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3.58.3. NumHosts

This parameter defines the maximum number of times that SearchFilter will be called for a given request. If NumHosts is exceeded for a given request, the proxying of the request fails. Defaults to 1. The current count is available as %0 in SearchFilter and HostAttrDef.

3.58.4. HostAttrDef

This optional parameter specifies which parameters to get from an LDAP record and how they are to be used to set the parameters of the Radiator Host clause for proxying. Format is

```
HostAttrDef ldapattrname,hostparamname
```

where `ldapattrname` is the name of the LDAP attribute to fetch and `hostparamname` is the name of the Radiator Host clause parameter it will be used to set. For more information about the available `hostparamname`, see Section 3.42. `<Host xxxxxx>` within `<AuthBy RADIUS>` on page 199. If `hostparamname` is ‘failurePolicy’ it will be used to specify how AuthBy LDAPRADIUS will reply to the originating NAS if no reply is heard from any remote server for this request. The following values are supported:

- 0 ACCEPT
- 1 REJECT
- 2 IGNORE
- 3 CHALLENGE
- 4 REJECT_IMMEDIATE

The default behaviour if no reply is heard from any remote server is to not reply to the NAS. This will usually cause the NAS to re-send the request to its secondary RADIUS server.

In HostAttrDef, the `ldapattrname` may contain special characters, and %0 is replaced by hostCounter, an integer which starts at 1 and increases by one each time a search is made for a given request. You can use that mechanism to fetch different LDAP attributes for the primary, secondary etc. RADIUS servers.

If no HostAttrDef lines are specified, defaults to the equivalent of the following, which is compatible the sample OpenLDAP schema in `goodies/radiator-ldap.schema`. Note that not all LDAP parameters are required to be present. The minimum set required are Host and Secret. Host can be an IPv4 or IPv6 address.

```
HostAttrDef oscRadiusHost,Host
HostAttrDef oscRadiusSecret,Secret
HostAttrDef oscRadiusAuthPort,AuthPort
HostAttrDef oscRadiusAcctPort,AcctPort
HostAttrDef oscRadiusRetries,Retries
HostAttrDef oscRadiusRetryTimeout,RetryTimeout
HostAttrDef oscRadiusUseOldAscendPasswords,UseOldAscendPasswords
HostAttrDef oscRadiusServerHasBrokenPortNumbers,ServerHasBrokenPortNumbers
HostAttrDef oscRadiusServerHasBrokenAddresses,ServerHasBrokenAddresses
HostAttrDef oscRadiusIgnoreReplySignature,IgnoreReplySignature
HostAttrDef oscRadiusFailurePolicy,failurePolicy
```

3.59. `<AuthBy SQLRADIUS>`

This clause proxies requests to a target RADIUS server. The target host is determined by a table lookup in an SQL database. This allows the easy management of large numbers of downstream RADIUS servers, such as in a wholesale ISP. It inherits from both common SQL module and `<AuthBy RADIUS>`.
<AuthBy SQLRADIUS> runs the HostSelect query to determine the details of the target RADIUS server until either an acknowledgment is received from the target or Num-Hosts is exceeded. This permits fallback radius servers to be configured.

HostSelect can be configured to select the target RADIUS server based on any attribute in the incoming request. The default is the user’s Realm, but other possibilities, such as Called-Station-Id may be more useful for your organisation.

**Tip**
There are example SQL table definitions in the goodies/*.sql scripts. These tables work with the default HostSelect allowing the selection of a target host primary and secondary based on Realm.

**Tip**
If HostSelect fails to select any rows, <AuthBy SQLRADIUS> attempts to proxy according any <Host xxxxxx> clauses contained within the <AuthBy SQLRADIUS> clause. For more information, see Section 3.42. <Host xxxxxx> within <AuthBy RADIUS> on page 199. This permits unknown realms to be proxied to a catchall target server.

<AuthBy SQLRADIUS> understands the same parameters as <AuthBy RADIUS>. For more information, see Section 3.41. <AuthBy RADIUS> on page 182. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

### 3.59.1. HostSelect

This parameter defines the SQL statement that is run to determine the details of the target RADIUS server. It is run for each request that is handled by the AuthBy. If no reply is received by the target RADIUS server for a given request, it is rerun to find a secondary server, and so on until either HostSelect returns no more rows, or the number of times exceeds NumHosts.

If HostSelect returns no rows, and if <AuthBy SQLRADIUS> contains <Host xxxxxx> clauses, then the request is proxied according to the <Host> clauses in order, the same as with <AuthBy RADIUS>. This is a useful catchall for unknown realms, and could be used to proxy to a GoRemote (GRIC) server or similar.

HostSelect is expected to return at least the target host name/address and the shared secret in that order. Optionally, you can also fetch a number of other columns to control the proxying process, including RetryCount, target ports and such. The columns fetched by HostSelect are used to determine the following <AuthBy RADIUS> Host parameters in this order. Any column that is NULL is ignored.

- Target host name or IP address
- Secret
- AuthPort
- AcctPort
- Retries
- RetryTimeout
- UseOldAscendPasswords
- ServerHasBrokenPortNumbers
• ServerHasBrokenAddresses

• IgnoreReplySignature

• Failure policy
  This is an integer in the range 0 to 4 inclusive that indicates what sort of reply to send to the NAS in the event that proxying fails. You can use this to determine how to handle the failure of a downstream RADIUS server. The integers mean the following replies:
  – 0: ACCEPT
  – 1: REJECT
  – 2: IGNORE
  – 3: CHALLENGE

• FailureBackoffTime

• MaxFailedRequests

• MaxFailedGraceTime

For more information about how these attributes are used to control proxying, see Section 3.42. <Host xxxxxx> within <AuthBy RADIUS> on page 199.

HostSelect can contain any of the special characters. For more information, see Section 3.3. Special formatters on page 19. Also, %0 is replaced by the current host counter for this request. The counter starts with the value of StartHost which defaults to 1. You can therefore use %0 to select a different column each time HostSelect is run. %1 is replaced with SQL quoted realm.

The default value is:

```sql
HostSelect select HOST%0, SECRET, AUTHPORT, ACCTPORT, RETRIES, RETRYTIMEOUT, USEOLDASCENDPASSWORDS, \ SERVERHASBROKENPORTNUMBERS, SERVERHASBROKENADDRESSES, \ IGNOREREPLYSIGNATURE, FAILUREPOLICY from RADSQLRADIUS \ where TARGETNAME=%1
```

The default value works with the example tables supplied in goodies/*.sql. Note that this allows for up to 2 target hosts per Realm, primary and secondary, and that the Realm to match goes in the TARGETNAME column.

---

**Note**
Details about failure history, backoff times and such are cached within Radiator memory, not in the SQL database.

---

**Example**

If you have a simple SQL table with one target host per Realm, <AuthBy SQLRADIUS> contains:

```sql
HostSelect select HOST%0, SECRET, AUTHPORT, ACCTPORT, RETRIES, \ RETRYTIMEOUT, USEOLDASCENDPASSWORDS, \ SERVERHASBROKENPORTNUMBERS, SERVERHASBROKENADDRESSES, \ IGNOREREPLYSIGNATURE, FAILUREPOLICY from RADSQLRADIUS where TARGETNAME=?
HostSelectParam %1
NumHosts 1
```
Example

If you want to choose the target RADIUS server based on Called-Station-Id and Realm, and multiple Called-Station-Ids can map to the same target RADIUS servers, and if the target has a primary and a secondary RADIUS server, you can use the example RADIUSRADIUS and RADIUSRADIUSINDIRECT tables, plus an <AuthBy SQLRADIUS> containing:

```sql
HostSelect select R.HOST%0, R.SECRET, R.AUTHPORT, \
R.ACCTPORT, R.RETRIES, R.RETRYTIMEOUT, \ 
R.USEOLDASCENDPASSWORDS, R.SERVERHASBROKENPORTNUMBERS, \ 
R.SERVERHASBROKENADDRESSES, R.IGNOREREPLYSIGNATURE, \ 
R.FAILUREPOLICY from RADSQLRADIUS R, RADSQLRADIUSINDIRECT I \ 
where I.SOURCENAME=? and I.TARGETNAME=R.TARGETNAME 
HostSelectParam %{Called-Station-Id} 
NumHosts 2
```

3.59.2. HostSelectParam

This optional parameter specifies a bind variable to be used with HostSelect. %1 is replaced with unquoted realm. For more information, see Section 3.8.1. SQL bind variables on page 45.

Here is an example of using HostSelectParam:

```sql
# Use bound parameters to improve performance in SQL 
HostSelect select HOST%0, SECRET, AUTHPORT, ACCTPORT, RETRIES,\ 
RETRYTIMEOUT, USEOLDASCENDPASSWORDS, \ 
SERVERHASBROKENPORTNUMBERS, SERVERHASBROKENADDRESSES, \ 
IGNOREREPLYSIGNATURE, FAILUREPOLICY from RADSQLRADIUS where TARGETNAME=? 
HostSelectParam %1 
NumHosts 1
```

3.59.3. NumHosts

This parameter defines the maximum number of times that HostSelect will be called for as given request. If NumHosts is exceeded for a given request, the proxying of the request fails. Defaults to 2. The current counter is available as %0 in HostSelect.

3.59.4. StartHost

StartHost sets the initial host number. Defaults to 1.

3.59.5. HostColumnDef

This optional parameter allows you to specify an alternate mapping between the fields returned by HostSelect and the parameters used to define the Host. If HostColumnDef is not specified, the mapping is the default as described in Section 3.59.1. HostSelect on page 236.

The format of HostColumnDef is:

```
HostColumnDef n,paramspec
```

Where \( n \) is the column number of the fields as returned by HostSelect (starting at 0), and paramspec may be one of the following:

- Host
- FailurePolicy
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- any valid Host parameter as described in the Host clause. For more information, see Section 3.42. `<Host xxxxxxx>` within `<AuthBy RADIUS>` on page 199. Also `StripFromRequest`, `RewriteUsername`, and `AddToRequest` are usable.

In the following example, `HostSelect` returns five fields. The first defines the Host name or address, the second is the shared secret for that host, the third is the maximum retry count, and the fourth is the failure policy. The last is a comma-separated list of reply items that is added to the reply.

```sql
HostSelect select HOST%0, SECRET, RETRIES, FAILUREPOLICY, ADDTOREQUEST \
    from RADSQLRADIUS where TARGETNAME=?
HostSelectParam %1
HostColumnDef 0, Host
HostColumnDef 1, Secret
HostColumnDef 2, Retries
HostColumnDef 3, failurePolicy
HostColumnDef 4, AddToRequest
```

**Tip**

If a Host has `FailurePolicy` defined, and `NoReplyHook` is defined, then `NoReplyHook` is run before the automatic replies are sent.

### 3.60. `<AuthBy INTERNAL>`

This clause allows you permanently pre-define how to reply to a request, depending only on the type of request. You can specify whether to ACCEPT, REJECT, IGNORE or CHALLENGE each type of request. The default behaviour is to IGNORE all requests.

The following result codes are recognised. They are not case sensitive, and may be embedded within a longer string:

- ACCEPT
- REJECT
- IGNORE
- CHALLENGE

This clause can be useful in a number of cases:

- As a fallback at the end of an AuthBy chain, so that if all your authentication methods are failing due to internal problems, you can let all users on, irrespective of password.

- As a trap for certain types of requests, either in a distinct handler, or at the beginning of a chain of AuthBy clauses.

**Tip**

The RADIUS protocol does not define an accounting reject message. For accounting requests, REJECT and CHALLENGE are the same as IGNORE.

This example clause will ACCEPT all Access Requests, ACCEPT Accounting Starts and Stops, and REJECT everything else:
<AuthBy INTERNAL> also supports a number of hooks. You can define a Perl hook to handle some or all requests. Requests that are not handled by a hook will be handled according to the result code defined for that type of request. Hooks are passed information about the request, and the hook is expected to return one of:

- $main::ACCEPT
- $main::REJECT
- $main::IGNORE
- $main::CHALLENGE
- $main::REJECT_IMMEDIATE

to indicate the result of the request. All hooks in <AuthBy INTERNAL> are passed the same arguments in this order:

- Reference to the current request, $p
- Reference to the partly formed reply packet for $p
- Array (possibly zero length) of additional check items. This can safely be ignored in most circumstances.

Tip

<AuthBy INTERNAL> cannot be used to authenticate any EAP-TLS, TTLS or PEAP protocols directly, but it can be used in conjunction with AuthBy FILE to achieve the same thing:

```
<AuthBy INTERNAL>
    Identifier myinternal
    ......
</AuthBy>
<Realm DEFAULT>
    <AuthBy FILE>
        Filename %D/users
        EAPType TLS
        ......
    </AuthBy>
</Realm>
```

and in the users file:

```
DEFAULT Auth-Type=myinternal
```

This has the effect of using <AuthBy FILE> to do the EAP authentication handling, certificates etc., and the <AuthBy INTERNAL> to just authenticate the user name.

<AuthBy INTERNAL> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

### 3.60.1. DefaultResult

Specifies how to reply to any request for which there is no more specific result. The default is to IGNORE.
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```plaintext
# Accept everything not otherwise specified
DefaultResult ACCEPT
```

### 3.60.2. AuthResult

Specifies how to reply to all Access Requests. There is no default.

### 3.60.3. AcctResult

Specifies how to reply to all Accounting Requests for which there is no more specific parameter. There is no default.

### 3.60.4. AcctStartResult

Specifies how to reply to all Accounting Start Requests. There is no default.

### 3.60.5. AcctStopResult

Specifies how to reply to all Accounting Stop Requests. There is no default.

### 3.60.6. AcctAliveResult

Specifies how to reply to all Accounting Alive Requests. There is no default.

### 3.60.7. RequestHook

This optional parameter allows you to define a Perl program that will handle all requests passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see [Section 3.60. <AuthBy INTERNAL>](#) on page 239.

### 3.60.8. AuthHook

This optional parameter allows you to define a Perl program that will handle all Access-Request requests passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see [Section 3.60. <AuthBy INTERNAL>](#) on page 239.

### 3.60.9. AcctHook

This optional parameter allows you to define a Perl program that will handle all Accounting-Request requests passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see [Section 3.60. <AuthBy INTERNAL>](#) on page 239.

### 3.60.10. AcctStartHook

This optional parameter allows you to define a Perl program that will handle all Accounting-Request requests with an Acct-Type of Start passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see [Section 3.60. <AuthBy INTERNAL>](#) on page 239.

### 3.60.11. AcctStopHook

This optional parameter allows you to define a Perl program that will handle all Accounting-Request requests with an Acct-Type of Stop passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see [Section 3.60. <AuthBy INTERNAL>](#) on page 239.
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3.60.12. AcctAliveHook

This optional parameter allows you to define a Perl program that will handle all Accounting-Request requests with an Acct-Type of Alive passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see Section 3.60. <AuthBy INTERNAL> on page 239.

3.60.13. AcctOtherHook

This optional parameter allows you to define a Perl program that will handle all Accounting-Request requests with an Acct-Type other than Start, Stop and Alive passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see Section 3.60. <AuthBy INTERNAL> on page 239.

3.60.14. OtherHook

This optional parameter allows you to define a Perl program that will handle all requests other than Access-Request and Accounting-Request passed to this AuthBy INTERNAL. For more information about the arguments and the required return value, see Section 3.60. <AuthBy INTERNAL> on page 239.

3.61. <AuthBy POP3>

This clause authenticates from a POP3 server, according to RFC1939. It requires the Mail::POP3Client Perl module version 2.9 or better. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. It supports both plaintext and APOP authentication in the POP server. There is an example configuration file in goodies/pop3.cfg. <AuthBy POP3> was mostly contributed by Karl Gaissmaier.

<AuthBy POP3> can support SSL or non-SSL connections to the POP3 server. Use of SSL connections requires IO::Socket::SSL from CPAN and OpenSSL. For more information about CPAN, see Section 2.1.2. CPAN on page 3.

<AuthBy POP3> only supports PAP authentication in incoming RADIUS requests. CHAP and MS-CHAP are not supported, since the plaintext password is not available within Radiator.

<AuthBy POP3> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.61.1. Host

This parameter specifies the host name of the POP server. Defaults to ‘pop3’.

Host your.pop.server.com

3.61.2. Port

This optional parameter specifies the port number to contact on the POP server. Defaults to 110, the standard pop3 port.

Port 9000

3.61.3. LocalAddr

This optional parameter allows you to specify what local internet address (an optionally port) to bind to. Format is ‘xxx.xxx.xxx.xxx[:xx]’.

LocalAddr 203.63.154.2
3.61.4. AuthMode

This optional parameter specifies what types of POP authentication to permit.

- PASS means use plaintext passwords
- APOP means use APAP (MD5 encrypted) passwords
- BEST means use APOP if possible, else PASS

Defaults to BEST.

AuthMode APOP

3.61.5. Timeout

This optional parameter specifies a timeout in seconds. If the connection to the POP server is not complete within this time, the authentication will fail with REJECT. Defaults to 10 seconds.

Timeout 2

3.61.6. Debug

If this optional parameter is set, Mail::POP3Client prints details of its transactions to stdout.

3.61.7. SSLVerify

This optional parameter specifies what sort of SSL server verification that AuthBy POP3 will demand from the POP3 server. The options are ‘none’, ‘optional’ or ‘require’. Defaults to IO::Socket::SSL default.

SSLVerify require

3.61.8. SSLCAFile

Use this option to locate the file containing the certificates of the trusted certificate authorities. Thus, you can verify that the server certificate has been signed by a reputable certificate authority. Special characters are permitted.

Here is an example of using SSLCAFile:

SSLCAFile %D/certificates/demoCA/cacert.pem

3.61.9. SSLCAPath

You can define a directory containing several trusted certificates as separate files as well as an index of the certificates. To use that directory for validation purposes, use this parameter to specify the directory. There is no need to set both SSLCAFile and SSLCAPath. Special characters are permitted.

Here is an example of using SSLCAPath:

SSLCAPath %D/cadirectory

3.61.10. SSLCAClientCert

This optional parameter specifies the location of the SSL client certificate that this LDAP connection uses to verify itself with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.
Here is an example of using \texttt{SSLCAClientCert}:

\texttt{SSLCAClientCert} %D/certificates/cert-clt.pem

### 3.61.11. SSLCAClientKey

This optional parameter specifies the location of the SSL private key that this connection uses to communicate with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.

It is common for the SSL client private key to be in the same file as the client certificate. In that case, both \texttt{SSLCAClientCert} and \texttt{SSLCAClientKey} refer to the same file.

If \texttt{SSLCAClientKey} contains a private key in encrypted format, you need to specify the decryption password in \texttt{SSLCAClientKeyPassword}.

Here is an example of using \texttt{SSLCAClientKey}:

\texttt{SSLCAClientKey} %D/certificates/cert-clt.pem

### 3.61.12. SSLCAClientKeyPassword

If the SSLCAClientKey contains an encrypted private key, then you must specify the decryption password with this parameter. If a key is required, you will generally have been given the password by whoever provided the private key and certificate.

\texttt{SSLCAClientKeyPassword} whatever

### 3.62. \texttt{<AuthBy IMAP>}

This clause authenticates from an IMAP server. It requires the Mail::IMAPClient Perl module version 2.2.5 or better. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. There is an example configuration file in \texttt{goodies/imap.cfg}. \texttt{<AuthBy IMAP>} was mostly contributed by Karl Gaissmaier.

\texttt{<AuthBy IMAP>} can support SSL or non-SSL connections to the IMAP server. Use of SSL connections requires IO::Socket::SSL from CPAN and OpenSSL. For more information about CPAN, see Section 2.1.2. CPAN on page 3.

\texttt{<AuthBy IMAP>} only supports PAP authentication in incoming RADIUS requests. CHAP and MS-CHAP are not supported, since the plaintext password is not available within Radiator.

\texttt{<AuthBy IMAP>} understands also the same parameters as \texttt{<AuthBy xxxxxx>}. For more information, see Section 3.31. \texttt{<AuthBy xxxxxx>} on page 147.

#### 3.62.1. Host

This parameter specifies the host name of the IMAP server.

\texttt{Host} your.imap.server.com

#### 3.62.2. Port

This optional parameter specifies the port number to contact on the IMAP server. Defaults to 143, the standard imap port.

\texttt{Port} 9000
3.62.3. LocalAddr

Local host bind address.

3.62.4. Timeout

This optional parameter specifies a timeout in seconds. If the connection to the IMAP server is not complete within this time, the authentication will fail with REJECT. Defaults to 10 seconds.

| Timeout 2 |

3.62.5. Debug

If this optional parameter is set, Mail::IMAPClient prints details of its transactions to stdout.

3.62.6. SSLVerify

This optional parameter specifies what sort of SSL server verification that AuthBy IMAP will demand from the IMAP server. The options are ‘none’, ‘optional’ or ‘require’. Defaults to IO::Socket::SSL default.

| SSLVerify require |

3.62.7. SSLCAFile

Use this option to locate the file containing the certificates of the trusted certificate authorities. Thus, you can verify that the server certificate has been signed by a reputable certificate authority. Special characters are permitted.

Here is an example of using SSLCAFile:

SSLCAFile %D/certificates/demoCA/cacert.pem

3.62.8. SSLCAPath

You can define a directory containing several trusted certificates as separate files as well as an index of the certificates. To use that directory for validation purposes, use this parameter to specify the directory. There is no need to set both SSLCAFile and SSLCAPath. Special characters are permitted.

Here is an example of using SSLCAPath:

SSLCAPath %D/cadirectory

3.62.9. SSLCAClientCert

This optional parameter specifies the location of the SSL client certificate that this LDAP connection uses to verify itself with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.

Here is an example of using SSLCAClientCert:

SSLCAClientCert %D/certificates/cert-clt.pem

3.62.10. SSLCAClientKey

This optional parameter specifies the location of the SSL private key that this connection uses to communicate with the server. If SSL client verification is not required, then this option does not need to be specified. Special characters are permitted.
It is common for the SSL client private key to be in the same file as the client certificate. In that case, both SSLCAClientCert and SSLCAClientKey refer to the same file.

If SSLCAClientKey contains a private key in encrypted format, you need to specify the decryption password in SSLCAClientKeyPassword.

Here is an example of using SSLCAClientKey:

SSLCAClientKey %D/certificates/cert-clt.pem

### 3.62.11. SSLCAClientKeyPassword

If the SSLCAClientKey contains an encrypted private key, then you must specify the decryption password with this parameter. If a key is required, you will generally have been given the password by whoever provided the private key and certificate.

SSLCAClientKeyPassword whatever

### 3.63. <AuthBy LSA>

This module provides authentication against user passwords in any Windows Active Directory or NT Domain Controller, by using the Windows LSA (Local Security Authority). Since it accesses LSA directly, it can authenticate dial-up or wireless passwords with PAP, CHAP, MSCHAP, MSCHAPv2, LEAP, and PEAP.

<AuthBy LSA> is only available on Windows 7/8/8.1/10 and Server 2008/2012/2016/2019, home editions are not supported. It requires the Win32-Lsa Perl module from Open System Consultants.

To install the Win32-Lsa Perl module for ActivePerl or Strawberry Perl from the Radiator distribution's ppm directory:

```bash
ppm install Win32-Lsa.ppd
```

To use <AuthBy LSA>, Radiator must be run on Windows as a user that has the ‘Act as part of the operating system's security policy (SE_TCB_PRIVILEGE) enabled. This is not possible with Home editions.

**Tip**

Users can only be authenticated with <AuthBy LSA> if they have the ‘Access this computer from the network’ security policy enabled (this is the normal configuration for Windows Domains). <AuthBy LSA> honours the Logon Hours, Workstation Restrictions and ‘Account is Disabled’ flags in user accounts.

**Tip**

CHAP passwords can only be authenticated if the user has the ‘Store password using reversible encryption’ option enabled in their Windows Account. CHAP challenge must also be 16 octets long. This is the default for the most CHAP implementations.
3. Configuring Radiator

**Tip**
See `goodies/lsa.cfg` and `goodies/lsa_eap_peap.cfg` for examples on how to configure Radiator to authenticate PAP, CHAP, MSCHAP, MSCHAPV2, LEAP and PEAP against Windows user passwords.

---

**Tip**
If you are running Radiator on Unix or Linux, and wish to authenticate to Windows Active Directory or to a Windows Domain Controller. For more information, see Section 3.77. `<AuthBy NTLM>` on page 284.

### 3.63.1. Domain
This optional parameter specifies which Windows domain will be used to authenticate passwords, regardless of whether the user supplies a domain when they log in. It can be the name of any valid domain in your network. The default is to authenticate against local accounts on the machine that Radiator is running on. Special characters are permitted.

```
Domain OPEN
```

### 3.63.2. DefaultDomain
This optional parameter specifies the Windows Domain to use if the user does not specify a domain in their username. Special characters are supported. Can be an Active directory domain or a Windows NT domain controller domain name. Empty string (the default) means the local machine.

```
DefaultDomain OPEN
```

### 3.63.3. Workstation
This optional parameter specifies a workstation name that will be used to check against workstation logon restrictions in the users account. If the user has any workstation restrictions specified in their account, this is the workstation name that will be used to check the restriction. Defaults to an empty string, which means that LSA will not check any workstation logon restrictions.

```
Workstation WLAN
```

### 3.63.4. ProcessName
This optional parameter specifies a process name for LSA internal logging. Defaults to ‘Radiator’.

### 3.63.5. Origin
This optional parameter specifies a request origin name for LSA internal logging. Defaults to ‘Radiator’.

### 3.63.6. Source
This optional parameter specifies a source name for LSA internal logging. Defaults to ‘Radiator’.
3.63.7. LSARewriteHook

This optional parameter allows you to define a Perl function to rewrite the username that is passed to LSA. Username passed to LSA API is changed to whatever is returned by this function. The username in request is not changed. This may be needed, for example, with Wi-Fi roaming where roaming username cannot be directly used with Windows authentication because of local naming conflicts with roaming requirements.

The following parameters are passed to LSARewriteHook:

- $$_[0]$: $p, the current Radius::Radius request object
- $$_[1]$: $user, the current username to pass to LSA

Here are some examples:

```perl
# We use file instead of inline code
LSARewriteHook file: "%D/lsa-rewrite-hook.pl"

# Use inline code to change our global roaming realm to windows domain
LSARewriteHook sub { my ($user) = $_[1];
    $user =~ s/example.com/z/org.local/;
    return $user; }
```

3.63.8. Group

This optional parameter allows you to specify that each user must be the member of at least one of the named Windows Global or Local groups. More than one required group can be specified, one per Group line. Requires Win32::NetAdmin (which is installed by default with ActivePerl but may require separate installation with Strawberry Perl). If no Group parameters are specified, then Group checks will not be performed.

```perl
# Each user must be in Administrators and/or Domain Users
Group Administrators
Group Domain Users
```

3.63.9. DomainController

This optional parameter is used only if one or more Group check parameters are set. It specifies the name of the Windows Domain Controller that will be used to check each users Group membership. If no Group parameters are specified, DomainController will not be used. Defaults to empty string, meaning the default controller of the host where this instance of Radiator is running.

3.64. <AuthBy SOAP>

This module handles authentication and accounting by sending it to a remote RADIUS server over TCP using the SOAP protocol. Each RADIUS request is transformed into a SOAP request, which is sent by HTTP or HTTPS to a remote SOAP server. The Remote SOAP server can be any implementation, but example SOAP server code is provided with Radiator.

AuthBy SOAP can be useful in order to tunnel RADIUS requests through ports 80 or 443 in a firewall, where UDP port 1645 is not permitted through the firewall. It can also be used to improve reliability in some environments by using TCP rather than UDP. And RADIUS security can be improved by using HTTPS as the transport protocol, which will encrypt all the contents of the RADIUS request. Requires the SOAP::Lite Perl module and its prerequisites.

AuthBy SOAP uses a simple SOAP interface. An example Web Service Description Language file (goodies/soaprequest.wsdl) is provided for people wishing to implement their own SOAP RADIUS client.
3. Configuring Radiator

Included with Radiator is a sample SOAP server CGI script and a SOAP handler module. The file goodies/soapradius.cgi receives SOAP radius requests as sent by AuthBy SOAP and invokes Radius::SOAPRequest::radius(), which is provided by Radius/SOAPRequest.pm. SOAPRequest transforms incoming SOAP requests into standard RADIUS requests and sends them to a RADIUS server. The RADIUS reply is sent back to AuthBy SOAP as the SOAP reply. In order to install the SOAP server, you will need to edit SOAPRequest.pm and specify the location of your RADIUS dictionary, and the address and port of the destination RADIUS server. The address defaults to localhost: 1647. You must also install soapradius.cgi in a suitable location in your web server's CGI directory. You may also need to edit soapradius.cgi if your Radiator per modules are not installed in the usual place.

Tip
See goodies/soap.cfg for an example configuration file.

3.64.1. Endpoint

With this parameter, you can specify any number of SOAP proxy points. AuthBy SOAP will try to contact each one in turn until the SOAP call succeeds in getting a reply. Defaults to http://localhost/cgi-bin/soapradius.cgi.

**Endpoint** https://your.server.com/cgi-bin/soapradius.cgi

3.64.2. URI

This parameter specifies the SOAP URI that AuthBy SOAP will try to run. This is not a URL. It is used by the server to deduce the right SOAP module to load. You should not need to change this. Defaults to http://www.open.com.au/Radius/SOAPRequest.

3.64.3. SOAPTrace

This enables some or all of the SOAP::Lite internal tracing. Allowable values are

- transport
- dispatch
- result
- parameters
- headers
- objects
- method
- fault
- freeform
- trace
- debug
- all

or any combination. Defaults to no tracing. Tracing is printed to STDOUT.

**SOAPTrace all**
### 3.64.4. Timeout

With this optional parameter, you can control how long to wait for the SOAP reply from the SOAP server. Time is in seconds. Defaults to 3 seconds.

### 3.65. <AuthBy OTP>

This module is extensible and customisable to support a range of One-Time-Password (OTP) schemes, including automatic password generation and sending of passwords through a back-channel such as SMS. AuthBy OPT is suitable for authenticating 802.1X Wired and Wireless access with custom one-time password and token card authentication systems.

The default behaviour of AuthBy OTP demonstrates how it can be used and tested, but it is not suitable for use in a production environment: it tells the user the correct password in the challenge. In almost all cases, you will need to develop at least your own ChallengeHook, and possibly a VerifyHook to work with your local system.

In the most common use of AuthBy OTP, it will be configured to generate a random password (according to a configurable password pattern) and then send it to the user by SMS or some other channel. AuthBy OTP will then challenge the user to enter the correct password (after they have received it through the SMS system or whatever). In order to achieve this, you must configure at least the *ChallengeHook* to call some external program that will deliver the password to the user.

AuthBy OTP works with EAP-OTP (One-Time-Password), EAP-GTC (Generic-Token-Card) as well as standard RADIUS PPP dialup. Caution: most PPP clients and modems do not handle OTP challenges very well. AuthBy OTP supports PPP dial-up in the following way: if the user attempts to log in with an empty (zero length) password, the ChallengeHook will be called and the challenge will be sent back to the PPP client. This may result in a message for the user, but often does not, depending on the PPP client on the users computer.

**Tip**

See `goodies/otp.cfg` for an example configuration file.

**Tip**

You can test AuthBy OTP with the following radpwtst commands:

```bash
# Conventional RADIUS PPP
radpwtst -noacct -interactive -password ''
# EAP-OTP authentication
radpwtst -noacct -eapotp
# EAP-GTC auth (with EAPType set to Generic-Token):
radpwtst -noacct -eapgtc
```

**Tip**

One-time password system works with PPP dial-up as well as EAP-OTP and EAP-GTC using the well known OPIE one-time password system. For more information, see Section 3.57. *<AuthBy OPIE>* on page 233.
3.65.1. ChallengeHook

ChallengeHook is a fragment of Perl code that is expected to generate a OTP (if necessary) save the OTP (in $context is sometimes convenient) and send the OTP to the user by a back channel (if necessary). It should return a challenge string that will be presented to the user by the client, informing them of how to get or generate their password.

It is passed the following arguments:

- Reference to the current AuthBy module object
- User name
- Current RADIUS request packet
- User context that will be available later in VerifyHook. It can be used to store information such as the correct password until later in the authentication process.

The default ChallengeHook generates a random password according to PasswordPattern, saves it in the context and returns a challenge message telling the user what the correct password is. The default ChallengeHook must not be used in a production environment.

This example shows how to generate a random password and pass it to an external program which must deliver it to the user through some back channel like SMS. The example just echoes it to stdout. You can see that the generate_password() function can be used to generate a random password that conforms to PasswordPattern. The password is stored in the context so it can be checked later in the VerifyHook.

```
ChallengeHook sub {my ($self, $user, $p, $context) = @_;
    $context->{otp_password} = $self->generate_password();
    system('/bin/echo', "in sample ChallengeHook for", 
        $user, " password is", $context->{otp_password});
    return "Your OTP password has been printed by Radiator on STDOUT";}
```

3.65.2. VerifyHook

VerifyHook is a fragment of Perl code that is expected to validate a OTP and return 1 on success. You will need to specify your own VerifyHook if you require an external program to verify the correct OTP.

VerifyHook is passed the following arguments:

- Reference to the current AuthBy module object
- User name
- Submitted OTP password in plaintext
- Current RADIUS request packet
- Same user context that was passed to ChallengeHook for this user when the challenge was generated.
  $context->{otp_password} will generally contain the correct plaintext password for this user.

The default VerifyHook compares the submitted password to $context->{otp_password}.

This example VerifyHook only accepts the password 'xyzzy':

```
VerifyHook sub {my ($self,$user,$submitted_pw,$p,$context)=@_;
    return $context->{otp_password} eq 'xyzzy';}
```
3.65.3. PasswordPattern

This optional parameter specifies a character pattern that will be used to generate random passwords by `generate_password()` and the default ChallengeHook.

- a
  Lowercase alphanumeric (abcdefghijklmnopqrstuvwxyz0123456789)
- A
  Uppercase alphanumeric (ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789)
- c
  lowercase consonant (bcdghijklmnpqrstvwxyz)
- C
  uppercase consonant (BCDFGHJKLMNPQRSTVWXYZ)
- v
  lowercase vowel (aeiou)
- V
  uppercase vowel (AEIOU)
- 9
  numeric (0123456789)
- anything else is used literally

The default is cvcvvcv99 which produces passwords like:

vosuyic04
rezeqek86
jocupon50

3.65.4. ContextTimeout

This optional parameter specifies how long (in seconds) the context passed to ChallengeHook for a user will be kept. It defaults to 120 seconds, which is expected to be enough time for most users to receive and enter their correct OTP. You should not need to change this.

3.66. <AuthBy RSAMOBILE>

This module permits authentication from an RSA Mobile server. RSA Mobile is a token authentication system from RSA Security. During authentication, the user provides a password, then the RSA Mobile server sends a one-time password by SMS, pager etc. When the correct one-time password is entered, then the authentication succeeds.

Tip

AuthBy RSAMOBILE is deprecated when used with RSA Authentication Manager 7.1 and later. If you have AM 7.1 or later you should use <AuthBy RSAAM>, since it is more capable and more portable.
The <AuthBy RSAMOBILE> module is compatible with Radius-PAP, EAP-Generic-Token-Card and EAP-PEAP-Generic-Token-Card authentication. It requires SOAP::Lite. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

There is an example configuration file in goodies/eap_gtc_rsamobile.cfg in the Radiator distribution showing how to configure Radiator to authenticate EAP-GTC using RSA Mobile.

---

**CAUTION**

On some platforms and networks, the performance of the SOAP protocol used by RSA Mobile can be poor. You should test <AuthBy RSAMOBILE> in your particular situation to confirm that it will meet your authentication volume requirements before deploying it in production.

---

### 3.66.1. Endpoint

This optional parameter specifies how to create the endpoint of the SOAP connection to the RSA Mobile server. Special characters are permitted. %0 is replaced by the value of the Protocol parameter (for more information, see Section 3.66.2. Protocol on page 253) and %1 is replaced by the value of the Host parameter (for more information, see Section 3.66.3. Host on page 253). The default is `%0://%1/axis/services/AuthenticationAPI`. You should not normally need to change this.

### 3.66.2. Protocol

This optional parameter specifies the protocol that will be used to contact the RSA Mobile server. It is used as %0 in the Endpoint parameter. The default is ‘http’. You should not normally need to change this.

### 3.66.3. Host

This parameter specifies the address and port number of the RSA Mobile server. It is used as %1 in the Endpoint parameter. The default is ‘localhost:7001’. You will usually have to change this to the address and port number of your RSA Mobile server. 7001 is the usual port number for RSA Mobile.

### 3.66.4. URI

This optional parameter specifies the SOAP URI that will be accessed in the RSA Mobile server. The default is ‘http://rsa.com/csf/clientservice/authenticationapi/AuthenticationAPI’. You should not normally need to change this. Note that this is not the address of a web resource and it is not accessed by Radiator during authentication.

### 3.66.5. Policy

This optional parameter specifies the authentication policy that is to be requested. The RSA Mobile server can be configured to permit password or RSA SecurID authentication as well as RSA Mobile authentication. The permitted options are:

- *System Policy: Password Only
- *System Policy: RSA Mobile Only
- *System Policy: RSA SecurID Only
- *System Policy: RSA SecurID OR Password

The default is ‘*System Policy: RSA Mobile Only’.

This example changes the requested policy to password only:
3.66. Resource

This optional parameter specifies an alternate resource for the RSA Mobile server to use to authenticate each user. The default is an empty string. See your RSA Mobile administrator for information about what resources are available. You should not normally need to set this parameter.

3.66.7. Lang

This optional parameter permits an alternate language to be specified for the RSA Mobile server to use for the password prompts to be sent to the user. The default is empty string. See your RSA Mobile administrator for information about what Lang options are available. You should not normally need to set this parameter.

3.66.8. Country

This optional parameter permits an alternate language to be specified for the RSA Mobile server to use for the password prompts to be sent to the user. The default is empty string. See your RSA Mobile administrator for information about what Lang options are available. You should not normally need to set this parameter.

3.66.9. SessionUsername

This parameter specifies a user name that will be used to contact the RSA Mobile HTTP server. The default is ‘authapiuser’, which is the same as the default that is installed on the RSA Mobile HTTP server. You will almost certainly have to set this to suit the configuration of your RSA Mobile server. See your RSA Mobile administrator for information about what the RSA Mobile Server HTTP access password and user name is.

3.66.10. SessionPassword

This parameter specifies the password that will be used to contact the RSA Mobile HTTP server. The default is ‘changeit’, which is the same as the default that is installed on the RSA Mobile HTTP server. You will almost certainly have to set this to suit the configuration of your RSA Mobile server. See your RSA Mobile administrator for information about what the RSA Mobile Server HTTP access password and user name is.

3.66.11. SessionRealm

This optional parameter specifies the HTTP Realm that the SessionUsername and SessionPassword will be used for. The default is ‘weblogic’, which matches the RSA Mobile Server SOAP implementation. You should not normally need to set this parameter.

3.66.12. Timeout

This optional parameter specifies the timeout in seconds that will be used during authentication requests sent by Radiator to the RSA Mobile server. The default is 20 seconds.

3.66.13. SOAPTrace

This optional parameter enables low level protocol tracing in the SOAP::Lite module. Setting it to 1 will cause details of each incoming and outgoing SOAP request to be printed on STDOUT.

3.67. <AuthBy RSAAM>

This module provides authentication via RSA Authentication Manager AM 7.1 and later. AM 7.1 provides more features than the ACE server and RSA Mobile servers it replaces. <AuthBy RSAAM> supports more features.
than either <AuthBy ACE> or <AuthBy RSAMOBILE>. Therefore <AuthBy RSAAM> may be your preferred module for use with AM 7.1 or later.

AM 7.1 supports traditional SecurID two-factor token cards, as well as static passwords. It also supports OnDemand tokencodes, where a random tokencode is sent to the user via email or SMS. It also supports authentication through a series of user-configurable security questions. All these authentication methods are supported by AuthBy RSAAM.

AuthBy RSAAM can authenticate the following protocols against AM. Note that CHAP, MSCHAPV1, MSCHAPV2 and EAP-MSCHAPV2 cannot be authenticated against AM.

- PAP
- TTLS-PAP
- EAP-GTC
- EAP-OTP
- PEAP-GTC

AuthBy RSAAM works on all platforms supported by Radiator, including Windows, Linux, Solaris, Unix etc. AuthBy RSAAM connects the AM server by SSL and SOAP, and therefore required the following Perl modules from CPAN:

- SOAP::Lite and its prerequisites
- Either Crypt::SSLeay or IO::Socket::SSL
- Net::SSLeay

For more information, see Section 2.1.2. CPAN on page 3.

**Tip**

Sample configuration files are provided in the goodies directory of your distribution in rsaam.cfg and eap_peap_gtc_rsaam.cfg.

**Tip**

RSA AM is not able to specify the preferred authentication policy to use for each user. Therefore, if you need to use different authentication policies for different groups of user, you will need an <AuthBy RSAAM> clause for each policy, and then direct requests to the appropriate clause using one of the many methods supported by Radiator.

**Tip**

AuthBy RSAAM returns IGNORE if it unable to communicate with its configured AM server. This means you can chain several AuthBy RSAAM clauses together using AuthByPolicy ContinueWhileIgnore to implement failover from one AM server to another in the event of AM server unavailability.
3. Configuring Radiator

Tip
In some circumstances, The Radiator connection to RSA AM may fail with an error message in the RSA Weblogic server like:

```
Received fatal alert: bad_record_mac at sun.reflect.NativeConstructorAccessorImpl.newInstance0
```

This can be fixed by adding these lines to the weblogic server start file:

- `Dhttps.protocols=SSLv3,TLSv1`
- `Dsun.security.ssl.allowLegacyHelloMessages=true`
- `Dsun.security.ssl.allowUnsafeRenegotiation=true`

Configuring Authentication Manager for AuthBy RSAAM

In order to configure Authentication Manager to work with AuthBy RSAAM:

1. Install RSA AM 7.1 on your platform of choice, or Install 8.0 virtual appliance
2. Install Radiator on your platform of choice. It may be the same as the AM 7.1 host, or a different one in case of AM 8.0.
3. Install SOAP::Lite and its prerequisites on the Radiator host.
4. Starting with one of the sample RSAAM configuration files, configure Radiator.
5. Get the user name and password required for AuthBy RSAAM to connect to AM. These commands will print out the user name and password that AM automatically generates during installation.
   
   Do this on AM7.1 or earlier:

   ```
cd "C:\Program Files\RSA Security\RSA Authentication Manager\Utils rsautil
   manage-secrets -m <MASTERPWD> -a list
   ```

   Do this on AM 8.0:

   ```
cd /opt/rsa/am/utils
   ./rsautil manage-secrets --action list
   ```

   This will print out the user name and password required for Radiator to connect to AM 7.1 or 8.0. Enter the user name and password as SessionUsername and Session-Password in your Radiator configuration file.
6. Select which authentication method you will use to authenticate all your users. Set Policy in your Radiator configuration file.
7. Set Host in your Radiator configuration file to the FQDN (fully qualified domain name) and port number of your AM host. For example

   ```
   Host boodgie.open.com.au:7002
   ```
8. Add and configure a test user to AM. If required allocate a token to the user.
9. Start Radiator and test with a command like:

   ```
radpwtst -noacct -user username -password password -interactive -timeout 60
   ```
3. Configuring Radiator

3.67.1. Host

This parameter specifies the address and port number of the RSA AM server. It is used as %1 in the Endpoint parameter. The default is "localhost:7002". You will have to change this to the hostname/address and port number of your RSA AM server, since by default AM does not listen on localhost. 7002 is the usual port number for RSA AM.

3.67.2. Endpoint

This optional parameter specifies how to create the endpoint of the SOAP connection to the RSA AM server. Special characters are permitted. %0 is replaced by the value of the Protocol parameter (for more information, see Section 3.67.3. Protocol on page 257) and %1 is replaced by the value of the Host parameter (for more information, see Section 3.67.1. Host on page 257). The default is %0://%1/ims-ws/services/CommandServer.

You should not normally need to change this from the default.

3.67.3. Protocol

This optional parameter specifies the protocol that will be used to contact the RSA AM server. It is used as %0 in the Endpoint parameter. The default is "https". You should not normally need to change this.

3.67.4. URI

This optional parameter specifies the SOAP URI that will be accessed in the RSA AM server. The default is "http://webservice.rsa.com/". You should not normally need to change this. Note that this is not the address of a web resource and it is not accessed by Radiator during authentication.

3.67.5. Policy

This optional parameter specifies the authentication policy that is to be used. Defaults to RSA_Password.

Options are:

- SecurID_Native
  - Traditional SecurID two-factor token cards. User enters their PIN followed by the tokencode currently showing on their token card.

- OnDemand
  - User enters their PIN. AM sends a temporary tokencode to the user by email or SMS, according to however AM is configured. User then enters the tokencode they receive.

- RSA_Password
  - Static password stored in the RSA internal database.

- LDAP_Password
  - Static password stored in an LDAP database.

- Security_Questions
  - User is asked a series of security questions, and enters answers that they have previously configured using the RSA Self-Service Console.

- SecurID_Proxy
3.67.6. SessionUsername

User name used to authenticate the SSL connection to AM. Created automatically by AM during installation. For more information, see Section 3.67.1. Host on page 257.

3.67.7. SessionPassword

Password used to authenticate the SSL connection to AM. Created automatically by AM during installation. For more information, see Section 3.67.1. Host on page 257.

3.67.8. ChallengeHasPrompt

Add RADIUS Prompt attribute to Access-Challenge messages. Prompt value is based on responses received from RSA AM. Default is not to add Prompt in Access-Challenges. Prompt attribute is a hint to the client software to echo or not echo sensitive user input such as PINs or security question answers.

3.67.9. SessionRealm

Tip
This is now an obsolete parameter.

Previously, the realm name used to authenticate the SSL connection to AM.

3.67.10. Timeout

This optional parameter specifies the timeout in seconds that will be used during authentication requests sent by Radiator to the RSA AM server. The default is 20 seconds.

3.67.11. SOAPTrace

This optional parameter enables low level protocol tracing in the SOAP::Lite module. Setting it to "debug" will cause details of each incoming and outgoing SOAP request to be printed on STDOUT.

3.67.12. Message

This optional parameter enables customisation of various user messages generated by this module. The key for each message is the RSA AM message, and the value is the string you want the user to see.

3.67.13. SSLVerify

May be used to control how the Server's certificate will be verified. May be one of "none" or "require".

3.67.14. SSLCAFile

Use this option to locate the file containing the certificates of the trusted certificate authorities. Thus, you can verify that the server certificate has been signed by a reputable certificate authority. Special characters are permitted.

Here is an example of using SSLCAFile:

SSLCAFile %D/certificates/demoCA/cacert.pem
3. Configuring Radiator

3.67.15. SSLCAPath

You can define a directory containing several trusted certificates as separate files as well as an index of the certificates. To use that directory for validation purposes, use this parameter to specify the directory. There is no need to set both \texttt{SSLCAFile} and \texttt{SSLCAPath}. Special characters are permitted.

Here is an example of using \texttt{SSLCAPath}:

\begin{verbatim}
SSLCAPath %D/cadirectory
\end{verbatim}

3.67.16. SSLVerifyCNName and SSLVerifyCNScheme

SSLVerifyCNName sets the name which is used when verifying the hostname against the certificate presented by Duo's server. SSLVerifyCNScheme controls how the verification is done, for example, if wildcards are allowed. For more information, see \texttt{IO::Socket::SSL} [http://search.cpan.org/perldoc/IO::Socket::SSL].

The following allow wildcard certificate name *.duosecurity.com to match.

\begin{verbatim}
SSLVerifyCNName duosecurity.com
SSLVerifyCNScheme http
\end{verbatim}

3.67.17. SSL_CertificateFile

Specifies the name of a client certificate file which will be use to authenticate SSL connection to the AM server. The certificate will be sent to the AM server SSL authentication. The certificate file must be in PEM. The certificate file can also contain the client’s TLS private key if the SSL_PrivateKeyFile parameter specifies the same file. Not required if AM does not require client certificate authentication.

3.67.18. SSL_PrivateKeyFile

Specifies the name of the file containing the SSL client's private key. It is sometimes in the same file as the client certificate (\texttt{SSL_CertificateFile}). The private key must not be encrypted and must not require a passphrase.

3.68. \texttt{<AuthBy SQLDIGIPASS>}

\textbf{Tip}

\texttt{<AuthBy SQLDIGIPASS>} was previously called \texttt{<AuthBy DIGIPASS>}. \texttt{<AuthBy SQLDIGIPASS>} is completely compatible with and replaces \texttt{<AuthBy DIGIPASS>}. Although \texttt{<AuthBy DIGIPASS>} is still a recognised name, it is officially deprecated, and support for it may be removed in the future. New installations are encouraged to use \texttt{<AuthBy SQLDIGIPASS>}.

This module provides authentication of Vasco Digipass tokens from an SQL database. For more information, see Vasco website [https://www.vasco.com/]. Digipass tokens are small hand-held devices that generate one-time passwords that change every minute. They can be purchased from Vasco and issued to your users. Such tokens provide much higher levels of security than static passwords. Additionally, with some types of token, users can set up individual PINs, which provides even higher levels of security with two-factor authentication. Some types of Digipass token can operate in a Challenge-Response mode. Vasco Digipass is supported by Radiator on Solaris, Linux, and Windows.

\texttt{<AuthBy SQLDIGIPASS>} supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.
<AuthBy SQLDIGIPASS> can be used to authenticate PAP, CHAP, MSCHAP, MSCHAPV2, EAP-MSCHAPV2, EAP-OTP, and EAP-GTC protocols.

<AuthBy SQLDIGIPASS> supports for Response Only (RO) and Challenge/Response (CR) tokens. It supports RADIUS PAP, TTLS-PAP, EAP-GTC, and EAP-OTP authentication methods. When using Challenge/Response tokens with PAP or TTLS-PAP, when the user enters an empty password, <AuthBy SQLDIGIPASS> generates the Challenge to enter into the Digipass token. The token then generates a Response which the users enters as their real password.

Radiator and <AuthBy SQLDIGIPASS> can be configured in several ways including:

- As a simple stand-alone system. A single SQL table contains information about each Digipass token and the user it is assigned to. You can use the digipass.pl program supplied with Authen-Digipass to import tokens, assign them to users and otherwise administrate tokens and users. The example digipass.cfg Radiator configuration file shows a simple example of how to configure Radiator for such a system. Sample SQL database table definition files are provided with Radiator for a range of free and commercial SQL databases.

- As an addition to a Radiator-compatible user-management system or ISP billing system. In this mode, Radiator is configured to authenticate using <AuthBy SQLDIGIPASS> from an SQL table, but also uses other information from the user-management system to save usage data, get user- or service-specific RADIUS reply items and so on.

- In conjunction with OSC’s RAdmin RADIUS user management system. RAdmin provides an easy-to-install, easy-to-use web-based graphical system for managing RADIUS users for dial-up, wired and wireless authentication. RAdmin version 1.9 includes support for importing, allocating and administering Digipass tokens for authenticating users against Digipass instead of static passwords. RAdmin also works with any free or commercial SQL database. For more information about RAdmin, see RAdmin website [https://www.open.com.au/radmin/].

<AuthBy SQLDIGIPASS> requires an additional Authen-Digipass module to be installed. The Authen-Digipass Perl module provides access to the Vasco Controller software that does the authentication of each token. Contact OSC to obtain Authen-Digipass module for Solaris, Linux and Windows. See goodies/digipass-install.txt in your distribution for details on how to install and test Authen-Digipass for your platform.

<AuthBy SQLDIGIPASS> also requires an SQL database to hold information about each Digipass token that your system knows about. When you purchase a Digipass token from Vasco, you get also a DPX file that contains important data about the token. This DPX file must be imported into the <AuthBy SQLDIGIPASS> database before the token can be authenticated by Radiator. You can use any free or commercial SQL database with <AuthBy SQLDIGIPASS>.

RAdmin provides all the tools you need for importing, allocating and administrating Digipass tokens and users. In this case, use goodies/radminDigipass.cfg as an example Radiator configuration.

If you intend to use Digipass tokens with the example SQL database schema supplied in goodies/*.sql, use the digipass.pl program supplied and installed with Authen-Digipass for importing, allocating and administrating Digipass tokens and users. In this case, use goodies/digipass.cfg as an example Radiator configuration.

**Using Vasco Digipass tokens to generate passwords for AuthBy SQLDIGIPASS**

Vasco produces a number of different types of token, some which require a PIN to be entered into the token, some which support user selected PINs, and some which do not support PINs. All tokens display a ‘tokencode’, usually in response to pressing a button on the face of the token. The different types of token are described below.
The simplest Digipass tokens include the Go-3, and which have an LCD display and a single button but no keypad. For these tokens, you press the button and use the tokencode displayed on the token as your password. Note that any attempt to use the same tokencode twice results a rejection. The error message on the Radiator log says ‘Code Replay Attempt’.

Go-1 and Go-3 tokens among others support user-selected static PINs, and also support the ability to change your PIN dynamically. Your initial PIN may have been selected by your administrator and given to you with your token. In any case, if you have a PIN, the password is made from the PIN followed by the tokencode displayed on the token. For example, if your PIN is 1234, and the token displays 89574526, then your password is ‘123489574526’. If you have not been assigned a PIN for your token, just use the tokencode displayed on the token as your password: ‘89574526’.

Go-1 and Go-3 tokens (among others) also support the ability to change your PIN. To change your PIN, you form the login password from your current PIN, followed by the tokencode, followed by the new PIN, followed by the new PIN again. For example, if your current PIN is 1234, and you wish to change the PIN to 9876, and the token is displaying 89574526, then you use the password 12348957452698769876. After this password has been accepted, your new PIN is active, and you must enter the new PIN at the beginning of each subsequent password.

Figure 2. Digipass Go-1 PIN passwords

After resetting the PIN (using either the digipass.pl application that comes with Authen-Digipass or the ‘Reset static password (PIN) for this token’ button in RAdmin), the token has no PIN associated with it. In that case, provide a new PIN with the next authentication attempt.

To do this enter the tokencode from the token followed by the new PIN twice. For example, if the current tokencode is 656565 and you want your new PIN to be 1234, enter 65656512341234 at your next authentication. For subsequent authentications, prefix the token code with your new PIN.

Some Digipass tokens have a keypad, which requires the token's PIN to be entered, and which also support Challenge-Response (CR). In Challenge-Response, when you first attempt to log in, Radiator sends a ‘Challenge’ (a sequence of digits) that you must enter into the token in order to generate the correct Response, which is then used as your password.

The first step is to attempt to log in with an empty password (i.e. a password with nothing in it). If the user's token supports CR, Radiator <AuthBy SQLDIGIPASS> sends a challenge of (typically) 4 digits:

Digipass Challenge: 8077

You use this challenge shortly. Now start the token by pressing the arrow button. The token asks for your PIN. Enter the 4 digit PIN (e.g. 1 - 2 - 3 - 4). The token will then display ‘APPL1’. Press ‘3’ to request Challenge-Response. The token displays ‘- - -’. Enter the Digipass Challenge sent to you by Radiator (8077 in this example). The token displays a tokencode of 7 digits. Use the tokencode as your password.
Virtual Digipass

<AuthBy DIGIPASS> supports Virtual Digipass. Virtual Digipass tokens do not require an actual physical token. When the user attempts to log in, <AuthBy SQLDIGIPASS> generates the correct password and sends it to the user by a separate secure method such as SMS, voice etc. The user then enters the tokencode they receive from the separate channel, and <AuthBy SQLDIGIPASS> authenticates it just like a normal Digipass tokencode. Not all Vasco tokens support Virtual Digipass. This is determined by a flag in the token's DPX data file. In order to use Virtual Digipass, you need to purchase one or more Virtual Digipass token data files from Vasco. Real physical Digipass tokens can have DPX token files that also permit use of Virtual Digipass as a backup for the case where the token is lost or stolen.

Virtual Digipass allows Vasco token support even if the user does not have a physical token or has lost it. The SupportVirtualDigipass parameter makes <AuthBy SQLDIGIPASS> support Virtual Digipass tokens: If the incoming password is empty, and the token supports Virtual Digipass, <AuthBy SQLDIGIPASS> generates the user’s correct tokencode and passes it to the VirtualTokencodeHook for delivery to the user by some secure out-of-band method such as SMS.

3.68.1. AuthSelect

This optional parameter specifies the SQL query that will be used to fetch Digipass data from the database. Special characters are permitted, and %0 is replaced with the quoted user name. Defaults to select DP_DATA, DIGIPASS from TBL_VASCODP where USER_ID=%0, which is compatible with the sample schemas provided in goodies/*.sql. The query is expected to return 2 fields in this order:

1. Digipass data block. This is 248 characters of encrypted data about the Digipass. It is encoded in printable characters.

   Example: 10AFIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
   AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
   +RmOzmh1lFwAAAAAQAAERQMsEr8AcwAAAAAAAACN0QpB57zTB/ XrAgg+7W/y

2. The Digipass serial number of 22 characters, including the token number and application name, and often some spaces, Example: '0097123456APPL 1 '. The spaces and application name are significant.

3.68.2. UpdateQuery

This optional parameter specifies the SQL query that will be used to store Digipass token data back to the database after authentication. The process of authentication (whether or not it is successful) results in the Digipass data block for that token being changed, and it must be written back to the database after each authentication attempt for correct operation. Special characters are permitted, and %0 is replaced with the new data block, and %1 is replaced with the Digipass serial number retrieved by AuthSelect.

Defaults to update TBL_VASCODP set DP_DATA='%0' where DIGIPASS='% 1 ', which is compatible with the sample schemas provided in goodies/*.sql.

3.68.3. ITimeWindow

This optional parameter specifies the size of the window of opportunity that a token can login with (this is counted in multiples of one-time password "rollovers" in the token. Value can be 2 to 1000. Default is 100 (that means +- 30 minutes for default tokens)

3.68.4. IThreshold

This optional parameter specifies the number of times that a person can unsuccessfully try to login before being locked out. 0 means disabled. Defaults to 0.
3.68.5. SyncWindow

This optional parameter specifies the size of the larger window that is created for use the first time after a token has been reset. This means that if a token gets out of sync (which is not an often occurrence), the user cannot log in so the administrator resets the token, then a larger sync window is produced after the reset so that the token can be recognised and calibrated by the software to allow subsequent use. This parameter is expressed in hours. Value can be 1 to 60. Default is 6 (hours).

3.68.6. CheckChallenge

This optional parameter specifies whether or not to check if the challenge has been corrupted before validation. Value can be 0 to 4:

- 0: No password checking
- 1: Check the parameter then verify (default)
- 2: Always use the DPData to validate responses
- 3: Avoid Challenge-Response Replay Attack by allowing only one challengeresponse authentication per timestep
- 4: Avoid Challenge-Response Replay Attack by rejecting the second response if responses from two consecutive authentication requests are equal and in the same time-step

3.68.7. ChklnactDays

This optional parameter specifies number of days of token inactivity. Past this number of days, the token will have to be reset. Values from 0 to 1024. Default is 0, which means the feature is disabled.

3.68.8. DeriveVector

This optional advanced parameter can be used to make data encryption unique for a host. Defaults to 0x00000000.

3.68.9. EventWindow

This optional advanced parameter specifies the Event Window size by number of iterations. Represents the acceptable event counter difference between Digipass token a and the host. It only applies to event-based operating modes. From 10 to 1000. Defaults to 100.

3.68.10. HSMSlotId

This optional advanced parameter specifies the HSM slot ID which will be used to store the Storage and Transport keys. 0 to 60. Defaults to 0.

3.68.11. StorageKeyId

This optional advanced parameter specifies the key which will be used to decrypt the Digipass data retrieved from the database. 0x00000000 to 0xffffffff. Defaults to 0x00000000.

3.68.12. TransportKeyId

This optional advanced parameter specifies the key which will be used to encrypt the Digipass data written to the database. 0x00000000 to 0xffffffff. Defaults to 0x00000000.
3.68.13. StorageDeriveKey1, StorageDeriveKey2, StorageDeriveKey3, StorageDeriveKey4

These optional advanced parameters specify the derivation keys used to make data encryption unique for a host.

3.68.14. ChallengeMessage

This parameter allows you to customise or internationalise the Reply-Message sent when the user is challenged to enter a Digipass tokencode. %0 is replaced with the digipass challenge string. Defaults to “Digipass Challenge: %0”

```bash
# French challenge message:
ChallengeMessage Votre challenge du Digipass: %0
```

3.68.15. SupportVirtualDigipass

This optional parameter causes AuthBy SQLDIGIPASS to support Vasco Virtual Digipass tokens.

3.68.16. VirtualTokencodeHook

If the SupportVirtualDigipass flag is enabled, this parameter specifies Perl code that is called whenever a Virtual Digipass tokencode is to be sent to a user. The hook is expected to transmit the tokencode to the user over some prompt, secure out-of-band method, such as SMS. The VirtualTokencodeHook is called like:

```perl
VirtualTokencodeHook($self, $username, $tokencode, $p)
```

VirtualTokencodeHook must return an error message if it fails to start delivery of the tokencode the user, otherwise it must return undef.

3.68.17. ChallengeTimeout

This optional parameter sets the maximum period of time that a challenge from a Challenge-Response (CR) token will be valid for. Time is in seconds and defaults to 300 seconds (5 minutes).

3.69. <AuthBy LDAPDIGIPASS>

This module provides authentication of Vasco Digipass tokens from an LDAP database. For more information, see Vasco website [https://www.vasco.com/]. For more information about details about Digipass tokens, how to obtain and operate them, see Section 3.68. <AuthBy SQLDIGIPASS> on page 259.

<AuthBy LDAPDIGIPASS> requires an additional Authen-Digipass module to be installed. The Authen-Digipass Perl module provides access to the Vasco Controller software that does the authentication of each token. Radiator includes pre-compiled binaries of the Authen-Digipass module for Solaris, Linux, and Windows. The Authen-Digipass module also includes the digipass.pl command line application for administering Digipass tokens in SQL and LDAP databases. See goodies/digipassinstall.txt in your distribution for details on how to install and test Authen-Digipass for your platform.

<AuthBy LDAPDIGIPASS> can be used to authenticate the following protocols:

- PAP
- CHAP
- MSCHAP
- MSCHAPV2
- EAP-MSCHAPV2
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- EAP-OTP
- EAP-GTC

/AuthBy LDAPDIGIPASS/ can be configured to work in different LDAP environments and schemas. The example file goodies/radiator-ldap.schema has a sample LDAP schema to hold Digipass token data. This schema is suitable for OpenLDAP and other compatible LDAP servers. See the notes in the top of that file for details on how to install the schema in your LDAP server, so that you can use it to store Digipass token data. You can use digipass.pl program included in the Authen-Digipass module to import token data into this example schema, and to assign them to users, reset tokens, get detailed token information, and so on. By default, /AuthBy LDAPDIGIPASS/ works with this sample schema on a local LDAP database, but you can use the /AuthBy LDAPDIGIPASS/ parameters to configure it to work with other schemas and databases. There is also a sample Radiator configuration file in goodies/digipass_ldap.cfg.

This clause supports all the common LDAP configuration parameters. For more information about the LDAP configuration parameters, see Section 3.9. LDAP configuration on page 50.

/AuthBy LDAPDIGIPASS/ understands also the same parameters as /AuthBy xxxxxx/. For more information, see Section 3.31. /AuthBy xxxxxx/ on page 147.

3.69.1. SearchFilter

This is the LDAP filter to use when searching for the user. It is used in similar way as with all LDAP modules. For more information, see Section 3.9.2. SearchFilter on page 51.

This optional parameter specifies the LDAP search filter that is used to find the Digipass token record for the user attempting to log in. Special characters can be used. %0 is replaced by UsernameAttr and %1 by the user name, whose token is searched. The default value is (%0=%1).

3.69.2. UsernameAttr

This optional parameter gives the name of the LDAP attribute that contains the user name of the user assigned to that token. It is used as %0 in the SearchFilter. The default value is oscDigipassTokenAssignedTo.

3.69.3. TokenDataAttr

This parameter specifies the name of the LDAP attribute that contains the Digipass token data, which is used to authenticate Digipass token logins. Defaults to oscDigipassTokenData.

3.69.4. MaxRecords

This optional parameter specifies the maximum number of Digipass tokens returned by the SearchFilter that will be examined. Defaults to 1.

3.69.5. BaseDN

This is the base DN where searches will be made. For each authentication request, Radiator does a SUBTREE search starting at BaseDN, looking for a UsernameAttr that exactly matches the user name in the radius request (possibly after user name rewriting).

Special formatting characters are permitted. %0 is replaced by UsernameAttr and %1 by the user name, whose token is searched.

Here is an example of using BaseDN with /AuthBy LDAPDIGIPASS/:

```bash
# Start looking here
BaseDN o=University of Michigan, c=US
```
3.69.6. Vasco Controller Library parameters

These parameters can be used to control the behaviour of the Vasco Controller Library:

- UpdateQuery
- ITimeWindow
- IThreshold
- SyncWindow
- CheckChallenge
- ChkInactDays
- DeriveVector
- EventWindow
- HSMSlotId
- StorageKeyId
- TransportKeyId
- StorageDeriveKey1
- StorageDeriveKey2
- StorageDeriveKey3
- StorageDeriveKey4
- ChallengeMessage

For more information about these parameters, see Section 3.68. <AuthBy SQLDIGIPASS> on page 259.

3.70. <AuthBy LDAP_APS>

This clause finds user details in a Mac OS-X Directory Server LDAP database, and then authenticates the user password against a Mac OS-X Apple Password Server.

Mac OS-X Server includes a facility called Directory Server which provides information about users (amongst other things). Part of the Directory Server facility is an LDAP server that contains the user details. However, the LDAP server never contains any user passwords, it merely contains information about valid methods for authenticating that user. Users that have been configured to use the ‘Password Server’ authentication method can have passwords authenticated by the Apple Password Server facility.

Therefore, AuthBy LDAP_APS can authenticate any user configured into the Apple Directory Server LDAP server, and configured to use the Apple Password Server authentication method.

AuthBy LDAP_APS is a subclass of AuthBy LDAP2. It queries the Mac OS-X LDAP server for information about a specific user in the same way as AuthBy LDAP2. It uses the user's authAuthority attribute from the
LDAP database to determine how to authenticate the password. If the user is configured to be able to use the Apple Password Server (i.e. the authAuthority contains ApplePasswordServer, a user id and a Password Server address) then AuthBy LDAP_APS will authenticate the user’s password by contacting (via TCP/IP) the specified Apple Password Server.

At Mac OS-X Server 10.4, Apple Password Server does not support all possible password authentication methods. In particular, it supports Plaintext (via CRAM-MD5), Digest-MD5 and MSCHAPV2. It does not support CHAP or MSCHAPV1. Therefore you can only use AuthBy LDAP_APS to authenticate PAP, MSCHAPV2, TTLS-PAP, TTLS-MSCHAPV2 or PEAP-MSCHAPV2 requests.

AuthBy LDAP_APS is configured in the same was as AuthBy LDAP2, except that you must specify PasswordAttr as authAuthority, since AuthBy LDAP_APS uses that attribute to find and contact the Password Server for that user.

Since standard TCP/IP is used to talk to the LDAP server and the Apple Password Server, it is not necessary to run Radiator and AuthBy LDAP_APS on the Mac OS-X Directory Server host. Radiator could run on a remote Mac, Linux, Windows or other host, different to the Mac OS-X host running the Directory Server and, in the general case, the Apple Password Server could be on a third host.

AuthBy LDAP_APS understands also the same parameters as <AuthBy LDAP2>. For more information, see Section 3.48. <AuthBy LDAP2> on page 210. There is a sample configuration file in goodies/ldap-aps.cfg in your Radiator distribution.

### 3.70.1. PasswordServerAddress

If this optional parameter is set, it forces Radiator to use the specified address as the address of the Apple Password server, instead of deducing it from the users data record. Addresses may be one of the forms:

- 203.63.154.59
- dns/yoke.open.com.au
- ipv4/203.63.154.59
- ipv6/2001:720:1500:1::a100

This can be useful with replicated password servers. It is common to set it to localhost:

```plaintext
PasswordServerAddress 127.0.0.1
```

### 3.71. <AuthBy URL>

This clause authenticates using HTTP from any URL. It can use any given CGI or ASP, that validates user name and password. It requires the Digest::MD5 and HTTP::Request and LWP::UserAgent Perl modules in libwww-perl-5.63 or later. They are part of CPAN. For more information, see Section 2.1.2. CPAN on page 3. <AuthBy URL> supports both GET and POST Method for http query strings.

The user name and password being authenticated are passed as URL tags to the program (i.e. it does not use the web server's HTTP authentication). The CGI or ASP can then validate the user name and password and return a string that indicates whether the authentication succeeded or not. Passwords may be sent in the clear, or Unix crypt or MD5 encrypted. Example CGI scripts are available in the goodies directory of your Radiator distribution. See goodies/README.

This module was contributed by Mauro Crovato <mauro@crovato.com.ar>. See the example configuration file in goodies/url.cfg in your Radiator distribution.

AuthBy URL understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.
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**Tip**
The libwww module that AuthBy URL uses can also support HTTPS requests. In order to enable this support, you must build and install either the Crypt::SSLeay or IO::Socket::SSL Perl modules before building the libwww module (see the README.SSL in the libwww distribution for more details). After that you can specify an HTTPS URL with something like:

```
AuthUrl https://www.mysite.com/validate.cgi
```

### 3.71.1. AuthUrl

This optional parameter specifies the complete URL that will be used to authenticate the user name and password. It is usually set to the URL of a CGI or ASP program on a web server that you control. HTTPS is supported. For more information, see Section 3.71. <AuthBy URL> on page 267.

```
AuthUrl www.mysite.com/validate.cgi
or ....
AuthUrl https://www.mysite.com/validate.cgi
```

### 3.71.2. AcctUrl

This optional parameter specifies the complete URL that will be used to save accounting data from Accounting-Request packets. All the attributes in the request will be sent as HTTP tags, using either GET or POST, depending on the setting of UrlMethod.

```
AcctUrl http://www.mysite.com/cgi-bin/save-accounting.cgi
```

### 3.71.3. UrlMethod

This optional parameter specifies what type of submit method is going to be used to pass user and pass to the URL. Possible values are GET or POST. It is not sensitive to case. The default is GET.

```
UrlMethod POST
```

### 3.71.4. Debug

This optional flag parameter specifies if any incoming authentication that result in Auth-Accept, will be logged with the Radiator logging system. The default is to not log.

```
Debug 1
```

### 3.71.5. Timeout

This optional parameter specifies the timeout (in seconds) for the http connection to the web server. The default 5.

```
Timeout 3
```

### 3.71.6. UserParam

This optional parameter specifies the name of the URL tag variable used to pass the Username being authenticated, to the URL. The default is ‘user’.
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UserParam username

3.71.7. PasswordParam

This optional parameter specifies the name of the URL tag variable used to pass the Password being authenticated, to the URL. The default is `password`.

PasswordParam key

3.71.8. AuthOKKeyword

This optional parameter specifies the name of the string that has to be found in the response from the web server, to select an Auth-Accept response message. The default is `AuthOK`.

AuthOKKeyword "auth accept"

3.71.9. AuthChallengeKeyword

This optional parameter specifies the name of the string that has to be found in the response from the web server, to select an Auth-Challenge response message. The default is `AuthChallenge`.

3.71.10. BadUserKeyword

This optional parameter specifies the name of the string that has to be found in the response from the web server, to select an Auth-Reject Bad User response message. The default is `BadUser`.

BadUserKeyword "auth reject bad user"

3.71.11. BadPasswordKeyword

This optional parameter specifies the name of the string that has to be found in the response from the web server, to select an Auth-Reject Bad Password response message. The default is `BadPassword`.

BadPasswordKeyword "auth reject bad pass"

3.71.12. PasswordEncryption

This optional parameter specifies the type of encryption that is going to be used, to send the PAP password to the URL. The options available are Clear, Crypt and MD5 (case insensitive). The default is `Clear`.

PasswordEncryption Md5

3.71.13. ChapChallengeParam

For CHAP authentication, the name of the web parameter to use to send the CHAP challenge. Not used for PAP or other types of authentication. Defaults to `chap_challenge`.


For CHAP authentication, the name of the web parameter to use to send the CHAP response. Not used for PAP or other types of authentication. Defaults to `chap_response`.
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### 3.71.15. MSChapChallengeParam

For MSCHAP authentication, the name of the web parameter to use to send the MSCHAP challenge. Not used for PAP or other types of authentication. Defaults to mschap_challenge.

### 3.71.16. MSChapResponseParam

For MSCHAP authentication, the name of the web parameter to use to send the MSCHAP response. Not used for PAP or other types of authentication. Defaults to mschap_response.

### 3.71.17. MSChapV2ChallengeParam

For MSCHAPV2 authentication, the name of the web parameter to use to send the MSCHAPV2 challenge. Not used for PAP or other types of authentication. Defaults to mschapv2_challenge.

### 3.71.18. MSChapV2ResponseParam

For MSCHAPV2 authentication, the name of the web parameter to use to send the MSCHAPV2 response. Not used for PAP or other types of authentication. Defaults to mschapv2_response.

### 3.71.19. CopyRequestItem

Adds a tagged item to the HTTP request. Format is CopyRequestItem xxx yyy. The text of yyy (which may contain special characters) will be added to the HTTP request with the tag xxx. In the special case where yyy is not defined, the value of attribute named xxx will be copied from the incoming RADIUS request and added to the HTTP request as the tagged item yyy. All values are HEX encoded before adding to the HTTP request. Multiple CopyRequestItem parameters are permitted, one per line.

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CopyRequestItem NAS-Port</td>
<td></td>
</tr>
<tr>
<td>CopyRequestItem Calling-Station-Id %{OuterRequest:Calling-Station-Id}</td>
<td></td>
</tr>
</tbody>
</table>

### 3.71.20. CopyReplyItem

Copies an attribute=value pair in a successful HTTP response to the RADIUS reply. Format is CopyReplyItem xxx yyy. If a successful HTTP reply contains a string like "xxx=hexencodedvalue" the value will be copied to the RADIUS reply as attribute yyy=value. Multiple CopyReplyItem parameters are permitted, one per line.

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CopyReplyItem MS-CHAP2-Success</td>
<td></td>
</tr>
<tr>
<td>CopyReplyItem Reply-Message reply_tag</td>
<td></td>
</tr>
</tbody>
</table>

### 3.72. <AuthBy KRB5>

This clause authenticates using the Kerberos 5 authentication system, which is available on most types of operating system. It authenticates from a previously defined Kerberos KDC (Key Distribution Centre). There is a sample configuration file in goodies/krb5.cfg in your distribution. AuthBy KRB5 can authenticate PAP and TTLS-PAP. Accounting are ACCEPTed but discarded.

Requires the Authen::Krb5 module version 1.3 or later. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

#### 3.72.1. KrbRealm

This optional parameter is the name of the Kerberos realm that all Kerberos users are assumed to be in. Defaults to the default Kerberos realm defined by your Kerberos administrator.
Kerberos principal names are constructed by appending @KrbRealm to the RADIUS user name (after any RADIUS realm has been stripped off. So if a user tries to authenticate as user@realm.com, and KrbRealm is set to mykrb.com, then the Kerberos principal name that will be authenticated will be ‘user@mykrb.com’.

```
# All users are in this realm.
KrbRealm OPEN.COM.AU
```

### 3.72.2. KrbServerRealm

This optional parameter is the name of the Kerberos realm that the Kerberos server is assumed to be in. Defaults to the KrbRealm value.

### 3.72.3. KrbKeyTab

This optional parameter provides the path to a Kerberos keytab file. When this option is present, a service ticket will be obtained as part of each Kerberos authentication attempt to guard against Key Distribution Center spoofing. By default, the keytab is examined to locate the key for the service radius/server@realm where server is the fully qualified domain name of the machine running Radiator and realm is the Kerberos realm used during authentication. The name of the service may be overridden with the KrbService parameter, the fully qualified domain name with the KrbServer parameter and the realm with the KrbRealm parameter.

```
# Enable KDC spoof detection using service ticket
KrbKeyTab /etc/krb5-radius.keytab
```

### 3.72.4. KrbService

This optional parameter overrides the default value of "radius" for the service name used when locating a key to obtain a service ticket as part of Kerberos Key Distribution Center spoof detection. This parameter has no effect unless the KrbKeyTab parameter is defined. For more information, see Section 3.72.3. KrbKeyTab on page 271. This parameter should be set to the service name of the service key obtained from your Kerberos administrator.

```
# Service name for radius
KrbService radiusproxyauthentication
```

### 3.72.5. KrbServer

This optional parameter overrides the default value of the fully qualified domain name of the server running radiator when locating a key to obtain a service ticket as part of Kerberos Key Distribution Center spoof detection. This parameter has no effect unless the KrbKeyTab parameter is defined. For more information, see Section 3.72.3. KrbKeyTab on page 271. This parameter should be set to the hostname included in the service key obtained from your Kerberos administrator.

```
# Hostname of the server
KrbServer radius.example.com
```

### 3.73. <AuthBy MULTICAST>

This clause sends copies of some or all RADIUS requests to all the remote RADIUS servers indicated by the embedded Host clauses. The syntax for this clause is very similar to <AuthBy RADIUS>, but where <AuthBy RADIUS> only sends to the second and subsequent Host if no reply is heard from previous Hosts, <AuthBy MULTICAST> always sends to all of them. If any Hosts do not reply, the usual retransmissions will occur (the number and timeout is configurable on a per-Host basis). For more information, see Section 3.41. <AuthBy RADIUS> on page 182.
Tip
It is not normally useful to send multiple copies of authentication requests to multiple hosts.
However, it is sometimes desirable to send multiple copies of Accounting-Request. In this case, the
IgnoreAuthentication flag will be useful.

This module was contributed by Andrew Ivins and Swiftel.

(AuthBy MULTICAST) understands also the same parameters as (AuthBy RADIUS). For more information,
see Section 3.41. (AuthBy RADIUS) on page 182.

3.73.1. HandleAcctStatusTypes

This optional parameter specifies a list of Acct-Status-Types that will be forwarded. The value is a comma-
separated list of valid Acct-Status-Type attribute values (see your dictionary for a full list) including, Start, Stop,
Alive, Modem-Start, Modem-Stop, Cancel, Accounting-On, Accounting-Off etc.

If HandleAcctStatusTypes is specified and an Accounting request has an Acct-Status-Type not mentioned in
HandleAcctStatusTypes, then the request will be ACCEPTed but not forwarded to any of the Hosts. The default
is to forward all Acct-Status-Types.

```
# Only forward Accounting Start and Stop requests,
# ack all other accounting without forwarding
HandleAcctStatusTypes Start,Stop
```

3.73.2. LoopDetection

If this optional parameter is set, Radiator will not forward a request to a Host if the request to be forwarded was
originally received from the same address. Defaults to no loop detection.

```
# Enable loop detection
LoopDetection yes
```

3.74. <AuthBy RADSEC>

(AuthBy RADSEC) proxies RADIUS requests to a <ServerRADSEC> clause on remote Radiator using the
RadSec (RFC 6614) secure reliable RADIUS proxying protocol. It can be used instead of (AuthBy RADIUS)
when proxying across insecure or unreliable networks such as the internet. For more information about the
RadSec protocol, see Section 16. RadSec (RFC 6614) on page 475.

(AuthBy RADSEC) attempts to establish a RadSec connection to the server Hosts when Radiator start
up. If the connection subsequently fails or is disconnected, it will attempt to reestablish the connection at
ReconnectTimeout intervals.

(AuthBy RADSEC) can be configured for multiple target hosts by specifying multiple Host clauses inside the
(AuthBy RADSEC) clause. Normally when a packet is to be forwarded, (AuthBy RADSEC) attempts first to send
it to the first Host. If no reply is received from that Host within NoreplyTimeout seconds, it attempts to send
the request to the next Host and so on. If no reply is heard from any Host, the NoReplyHook is called.

Tip
For compliance with RFC 6614, (AuthBy RADSEC) defaults to a Secret of RADSEC. Transport of
‘tcp’ and UseTLS enabled.
<AuthBy RADSEC> supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

Failure algorithm

<AuthBy RADSEC> implements a configurable algorithm to detect failed RadSec hosts, and to temporarily disregard failed hosts. The algorithm uses the MaxFailedRequests, MaxFailedGraceTime, and FailureBackoffTime parameters to customise the operation of the algorithm. For more information, see Section 3.41.15. MaxFailedRequests on page 189, Section 3.41.16. MaxFailedGraceTime on page 189, and Section 3.41.14. FailureBackoffTime on page 189. It also uses KeepaliveTimeout and UseStatusServerForFailureDetect in order to use only Status-Server requests for failure detection, instead of any request. For more information, see Section 3.41.9. KeepaliveTimeout on page 188 and Section 3.41.13. UseStatusServerForFailureDetect on page 189.

<AuthBy RADSEC> initially assumes that each Host is not failed. After a request is sent to a RadSec server, if no reply is received after the NoreplyTimeout, that request is deemed to have failed for that Host. <AuthBy RADSEC> keeps track of how many consecutive requests failed for each Host since the last time a reply was heard from that Host. If more than MaxFailedRequests consecutive requests are deemed to have failed within MaxFailedGraceTime seconds of that last reply heard from that Host, that Host is deemed to have failed.

When the Host is deemed to be failed, <AuthBy RADSEC> does not attempt to send any requests to it until FailureBackoffTime seconds have elapsed. In the meantime, <AuthBy RADSEC> attempts to connect or reconnect to the host according to ReconnectTimeout. It also skips sending requests to that Host, and instead attempts to send to the next Host in its list of Hosts (if any).

The default values for these parameters are:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MaxFailedRequests</td>
<td>1</td>
</tr>
<tr>
<td>MaxFailedGraceTime</td>
<td>0</td>
</tr>
<tr>
<td>FailureBackoffTime</td>
<td>0</td>
</tr>
</tbody>
</table>

These values mean that by default<AuthBy RADSEC> declares the Host failed after a single packet transmission failure, but that it always tries to transmit the next request to the Host. This means that <AuthBy RADSEC> always tries to send every request to the first Host, and if nothing is heard from that Host within NoreplyTimeout, it attempts to send to the next Host.

Tip

Judicious use of these parameters allows you to implement a RadSec Host fallback policy, where if one RadSec Host fails to respond to requests, then it will automatically temporarily fall back to the next RadSec Host and so on.

Certificate validation

When a RadSec Server presents a server certificate to an <AuthBy RADSEC> Client, the Client performs a number of checks to validate the server certificate. The server certificate is checked for valid start and end dates, and it also checks the chain of validity back to the issuing Certificate Authority, using the root certificates specified in TLS_CAFile or TLS_CAPath. If TLS_PolicyOID parameter is defined, the OIDs must be present in the certificate path. Also a server certificate is accepted only if at least one of the following conditions are true:

- The Host name used to connect to the server matches a subjectAltName with type IPADD (IP Address) or DNS (DNS name) in the certificate. Exact or wild card matches are permitted, so a subjectAltName type DNS of '*.xyz.com' matches for any Host in xyz.com.
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- If there are no subjectAltNames of type DNS in the certificate, if one of the Subject CN (Common Names) in the certificate matches the Host name used to connect to the RadSec server. Exact or wild card matches are permitted.

- The Subject in the certificate matches the pattern specified by the `TLS_ExpectedPeerName` parameter in this `<AuthBy RADSEC>` clause.

And

- If `TLS_SubjectAltNameURI` parameter is defined in the `<AuthBy RADSEC>` clause, the certificate must contain a subjectAltName of type URI that matches the `TLS_SubjectAltNameURI` regular expression.

- If `TLS_CertificateFingerprint` parameter is defined in the `<AuthBy RADSEC>` clause, the certificate's fingerprint must match at least one of the `TLS_CertificateFingerprint` options.

Note that the default `TLS_ExpectedPeerName` pattern is undefined, which means that by default `<AuthBy RADSEC>` requires that the Host name used to connect to the RadSec server matches the subjectAltName or CN in the Server Certificate.

These certificate validation rules are consistent with RFC 2595.

---

**Important**

Normally, an `<AuthBy RADSEC>` clause completes as soon as the request has been forwarded to the remote RadSec server. It does not wait for a reply before moving on to other AuthBy clauses, or handling new requests. `<AuthBy RADSEC>` always returns IGNORE for `AuthByPolicy`.

---

**Gossip support in AuthBy RADSEC**

The RadSec Hosts can now distribute information about next hop proxy reachability with Gossip. Instead of the current IP address, the configured host name is used as the key when determining if the current report must be processed.

### 3.74.1. Host

This parameter specifies the host name or address of a RadSec server (the instance of Radiator with a ServerRADSEC clause) that this `<AuthBy RADSEC>` is to connect to. The address can be an IPv4 or IPv6 name or address. Multiple Host lines are supported, which is equivalent to specifying multiple `<Host>` clauses. Special formatting characters are supported.

Here is an example of using `Host`:

```bash
# Example Host lines for IPv4 and IPv6 addresses
Host 203.63.154.1
Host oscar.open.com.au
Host ipv6:your.ipv6.host.com
Host 2001:db8:1500:1::a100
# IPv6 loopback:
Host ::1
```

### 3.74.2. Secret

This parameter specifies the shared secret that will be used to encrypt passwords and provide basic RADIUS protocol authentication mechanisms for requests and replies passed over the RadSec connection. It must be the same as the Secret configured into the `<ServerRADSEC>` this clause connects to. The Secret is used to protect passwords even when TLS is not configured for use. If TLS is used, it is not necessary to change it from the
default, since the security of TLS does not depend on the shared secret. For compliance with RFC 6614, the default value is **radsec**. There usually is no need to change this.

### 3.74.3. Port

This optional parameter specifies the symbolic service name or port number of the port to connect to on Host. The default value is **2083**, the official IANA port number for RadSec. Special formatting characters are supported.

### 3.74.4. LocalAddress and LocalPort

These parameters control the address and optionally the port number used for the client source port, although this is usually not necessary. **LocalPort** is a string, it can be a port number or name. It binds the local port if **LocalAddress** is defined. If **LocalPort** is not specified or if it is set to 0, a port number is allocated in the usual way.

When SCTP multihoming is supported, multiple comma separated addresses can be configured. All addresses defined with **LocalAddress** must be either IPv4 or IPv6 addresses.

```
LocalAddress 203.63.154.29
LocalPort 12345
```

### 3.74.5. NoreplyTimeout

If no reply is received to a proxied request within this number of seconds, the request is sent to the next Host in the list (if any). If there are no further Hosts, the **NoReplyHook** is called for this request. The default value is 5 seconds.

### 3.74.6. KeepaliveTimeout

This optional integer specifies the maximum time in seconds that a RadSec connection can be idle before a Status-Server request is sent to keep the current TCP connection alive. This helps to keep TCP connections open in the face of "smart" firewalls that might try to close idle connections down. The default value is 0 seconds. If set to 0, keepalives are not used.

### 3.74.7. KeepaliveNoreplyTimeout

This is an optional integer that specifies the waiting time, in seconds, for Status-Server request. If no reply is received within time **KeepaliveNoreplyTimeout** defines, the Status-Server request is marked as lost.

If this is not used, the used parameter value depends on the AuthBy you are using:

- **<AuthBy RADCSEC>**: **NoreplyTimeout** value is used instead.
- **<AuthBy RADIUS>**: **RetryTimeout** value is used instead.

Usually it is recommended to have a smaller value for **KeepaliveNoreplyTimeout** and larger value for **NoreplyTimeout** or **RetryTimeout**. The Status-Server receiver is on the next host and the reply comes quickly. To have a short waiting time for **KeepaliveNoreplyTimeout**, the possible failure situation is discovered quickly and request is rerouted to another server. The Access-Request or Accounting-Request receivers may be located on many hops away and it is possible that it take longer time to get the replies from them.

Here is an example of using both **KeepaliveNoreplyTimeout** and **NoreplyTimeout** in **<AuthBy RADSEC>**:

```
<AuthBy RADSEC>
    NoreplyTimeout 10
```

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KeepaliveNoreplyTimeout 3
</AuthBy>

To use this example with <AuthBy RADIUS>, you must use Retrytimeout instead of NoreplyTimeout.

3.74.8. KeepaliveRequestType

This string defines the type of RADIUS request that is sent as a keep-alive request. Any RADIUS request type is allowed. The default value is Status-Server.

Here is an example of using KeepaliveRequestType with AddToKeepaliveRequest:

```bash
# Send Access-Request as keepalive probe
KeepaliveRequestType Access-Request
AddToKeepaliveRequest User-Name=mikem,User-Password=fred
```

3.74.9. AddToKeepaliveRequest

This string adds attributes to the keep-alive request before sending it to Host. The value is a comma-separated list of attribute value pairs on one line, exactly as for any reply item. Special formatting characters are allowed, for more information, see Section 3.3. Special formatters on page 19.

Here is an example of using AddToKeepaliveRequest with KeepaliveRequestType:

```bash
# Send Access-Request as keepalive probe
KeepaliveRequestType Access-Request
AddToKeepaliveRequest User-Name=mikem,User-Password=fred
```

3.74.10. UseStatusServerForFailureDetect

If this optional flag is enabled, use only Status-Server requests (if any) to determine that a target server is failed when there is no reply. If not enabled (the default) use no-reply to any type of request. This parameter uses NoreplyTimeout, MaxFailedRequests, MaxFailedGraceTime, FailureBackoffTime during failure detection.

If you enable this, ensure also KeepaliveTimeout is set to a sensible interval to balance between detecting failures early and loading the target server.

3.74.11. StripFromRequest

Strips the named attributes from the request before forwarding it to any Host. The value is a comma-separated list of attribute names. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. There is no default.

```bash
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port
```

3.74.12. AddToRequest

Adds attributes to the request before forwarding to any Host. Value is a list of comma separated attribute value pairs all on one line, exactly as for any reply item. StripFromRequest removes attributes from the request before AddToRequest adds any to the request. You can use any of the special % formats in the attribute values. There is no default.

```bash
# Append a Filter-ID and host name
AddToRequest Calling-Station-Id=1,Login-IP-Host=%h
```
3.74.13. AddToRequestIfNotExist

Adds attributes to the request before forwarding to any Host. Unlike AddToRequest, an attribute will only be added if it does not already exist in the request. Value is a list of comma separated attribute value pairs. You can use any of the special % formats in the attribute values. There is no default.

```
# Possibly add our default Operator-Name
AddToRequestIfNotExist Operator-Name=example.com
```

3.74.14. IgnoreReject

This optional parameter causes Radiator to ignore (not send back to the original NAS) any Access-Reject messages received from the remote RadSec server. This is sometimes useful for authenticating from multiple RADIUS servers. However, note that if all the remote RADIUS servers reject the request, then the NAS receives no reply at all.

```
# If we get a reject from the remote, do not send it to the NAS
IgnoreReject
```

3.74.15. IgnoreAccountingResponse

This optional flag causes <AuthBy RADSEC> to ignore replies to accounting requests, instead of forwarding them back to the originating host. This can be used in conjunction with the AccountingHandled flag in a Handler or Realm to ensure that every proxied accounting request is replied to immediately, and the eventual reply from the remote RADSEC server is dropped. For more information about AccountingHandled flag, see Section 3.30.6. AccountingHandled on page 135.

3.74.16. AcctFailedLogFileName

The name of a files used to log failed Accounting-Request messages in the standard radius accounting log format. If no reply is ever received from any of the remote hosts, the accounting message is logged to the named file. For more information about log file format, see Section 9.5. Accounting log file on page 460. If no AcctFailedLogFileName is defined, failed accounting messages are not logged. The default is no logging. The file name can include special formatting characters as described in Section 3.3. Special formatters on page 19, which means that, for example, using the %c specifier, you can maintain separate accounting log files for each Client. The AcctFailedLogFileName file is always opened, written and closed for each failure, so you can safely rotate it at any time.

The user name that is recorded in the log file is the rewritten user name when RewriteUsername is enabled.

```
Tip
You can change the logging format with AcctLogFileName.
```

```
Tip
You may want to make the filename depend on the date, so you get one missed accounting file per day.
```

```
# Log all accounting to a single log file in LogDir
AcctFailedLogFileName %L/misseddetails
```
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3.74.17. AcctLogFileFormat

This optional parameter is used to alter the format of the failed accounting log file from the standard radius format when AcctLogFileFormatHook is not defined. AcctLogFileFormat is a string containing special formatting characters. It specifies the format for each line to be printed to the accounting log file. A new line is automatically appended. It is most useful if you use the \{attribute\} style of formatting characters (to print the value of the attributes in the current packet).

```
AcctLogFileFormat \{Timestamp\} \{Acct-Session-Id\}\
\{User-Name\}
```

3.74.18. AcctLogFileFormatHook

This specifies an optional Perl hook that is used to alter the format of the failed accounting log file from the standard radius format when defined. The hook must return the formatted accounting record. A new line is automatically appended. By default no hook is defined and AcctLogFileFormat or the default format is used. The hook parameter is the reference to the current request.

3.74.19. ReplyHook

This optional parameter allows you to define a Perl function that is called after a reply is received from a remote RadSec server and before it is relayed back to the original client. The following arguments are passed in the following order:

- Reference to the reply received from the remote RadSec server is passed as the first argument
- Reference to the reply packet being constructed for return to the NAS is passed as the second argument
- Reference to the original request from the NAS is passed as the third argument
- Reference to the request that was sent to the remote RadSec server is passed as the fourth argument
- Reference to the Radius::AuthRADSEC structure is passed as the fifth argument

The response type can be enforced when needed. For example, when the remote RadSec server has rejected the request, the ReplyHook can do any local processing required for rejects and then change the response type to accept.

```
# Change RadiusResult in the 3rd argument, the original request
ReplyHook sub { ${$_[2]}->{RadiusResult} = $main::ACCEPT; }
```

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code will be reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks (with trailing backslashes (\)) are parsed by Radiator into one long line. Therefore do not use trailing comments in your hook.

ReplyHook Can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things.

```
# Fake a new attribute into the reply going back to the client
ReplyHook sub { ${$_[1]}->add_attr('test-attr', \n    'test-value');}
```

3.74.20. NoReplyHook

This optional parameter allows you to define a Perl function that is called if no reply is received from any RadSec server. A reference to the original request received from the NAS is passed as the first argument. A reference to the request that was forwarded to the remote RADIUS server is passed as the second argument. A
3. Configuring Radiator

reference to the reply packet being constructed for return to the NAS is passed as the third argument (note that
the normal behaviour in case of no reply, is for no reply to be sent to the NAS).

The hook code is compiled by Perl when Radiator starts up.Compilation errors in your hook code are reported
to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook
executes. Multiline hooks (with trailing backslashes ()) are parsed by Radiator into one long line. Therefore do
not use trailing comments in your hook.

NoReplyHook can be an arbitrarily complicated Perl function, that might run external processes, consult
databases, change the contents of the current request or many other things. In particular, you can forward the
request to another AuthBy RADSEC clause, allowing you to implement automatic failover of RadSec hosts.

```perl
NoReplyHook sub { Radius::AuthGeneric::find('RADSEC2')
    ->handle_request(${$_[0]}, ${$_[2]});} # Call another AuthBy RADSEC if this one fails to respond

3.74.21. NoReplyReject

This is an optional flag parameter. When this parameter is set, it forces <AuthBy RADSEC> to return with result
REJECT to trigger an Access-Reject when a proxied request times out. This parameter is not set by default.

When NoReplyReject is enabled, the reject reason is set to 'Upstream timeout'.

Tip
NoReplyReject allows rejecting timed out requests without hooks such as NoReplyHook. For more
information, see Section 3.74.20. NoReplyHook on page 278

3.74.22. Asynchronous

The default behaviour for <AuthBy RADSEC> is to return IGNORE as soon as the request has been forwarded
to the remote RadSec server. It does not wait for a reply before moving on to other AuthBy classes or handling
new requests. You can change this behaviour with the Asynchronous flag.

When you enable the Asynchronous flag, Handler continues to evaluate its AuthBy policy after a reply or
timeout from the remote proxy. Other requests are processed while the reply is pending.

For more information about how proxied requests are waited for by <AuthBy RADSEC>, see Section 3.74.
<AuthBy RADSEC> on page 272.

Here is an example of using Asynchronous:

```perl
# Auth to server1 and continue to AuthBy FILE if server 1 accepts.
# Process other requests while the reply from server 1 is pending.
<Handler>
    AuthByPolicy ContinueWhileAccept
    <AuthBy RADSEC>
        # Evaluate the policy when we get a reply or a timeout
        Asynchronous
        Host server1
        # Other parameters
    </AuthBy>
    <AuthBy FILE>
        Filename %D/users
    </AuthBy>
</Handler>
```
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3.74.23. **ForwardHook**

This is a Perl hook that is called once for each request before the request is forwarded to a remote RADIUS or RadSec server. It allows you to modify the forwarded request without changing the current one. `ForwardHook` receives the following arguments:

- Current request
- Forwarded request

Here is an example of using `ForwardHook`:

```perl
ForwardHook sub { my $p = $_[0]; my $fp = $_[1]; 
    $fp->add_attr('OSC-AVPAIR', 'Added by ForwardHook'); }
```

3.74.24. **NoForwardAuthentication**

This parameter stops `<AuthBy RADSEC>` forwarding Authentication-Requests. They are ACCEPTED, but no further action is taken with them. This is different in meaning to `IgnoreAuthentication`, which IGNOREs them.

```
# Just ACCEPT Authentication-Requests, do not forward them
NoForwardAuthentication
```

3.74.25. **NoForwardAccounting**

This parameter stops `<AuthBy RADSEC>` forwarding Accounting-Requests. They are ACCEPTED, but no further action is taken with them. This is different in meaning to `IgnoreAccounting`, which IGNOREs them.

```
# Just ACCEPT Accounting-Requests, do not forward them
NoForwardAccounting
```

3.74.26. **AllowInRequest**

This optional parameter specifies a list of attribute names that are permitted in forwarded requests. Attributes whose names do not appear in this list are stripped from the request before forwarding.

```
# Strip everything except username and password
AllowInRequest User-Name, User-Password
```

3.74.27. **MaxBufferSize**

This optional advanced parameter specifies the maximum number of octets that are output buffered. The default value is 10000. 0 means no output buffering. This advanced parameter usually does not need adjusting.

3.74.28. **ReconnectTimeout**

This optional parameter specifies the number of seconds to wait before attempting to reconnect a failed, dropped or disconnected RadSec connection. It also specifies the timeout for the initial connect.

3.74.29. **FailureBackoffTime**

This is an integer that defines the number of seconds for how long `<AuthBy RADSEC>` does not attempt to send any requests after host is deemed to be failed. During that time, `<AuthBy RADSEC>` attempts to connect to
another host according to host configuration and to send the requests to the next host in the list of hosts, if there is any.

### 3.74.30. Protocol

This optional parameter specifies which Stream protocol is used to carry RadSec. Options are \texttt{tcp} for TCP/IP or \texttt{sctp} for SCTP (Stream Control Transmission Protocol). The default value is \texttt{tcp}. Not all hosts are able to support \texttt{sctp}, consult your vendor. The protocol setting must be the same in each RadSec server and client.

```plaintext
Protocol sctp
```

**Tip**

On modern Linux hosts, SCTP support is in a loadable module, and can be enabled with:

```plaintext
modprobe sctp
```

### 3.74.31. ConnectOnDemand

This optional parameter tells \texttt{<AuthBy RADSEC>} not to connect to the RadSec server as soon as possible, but to wait until a request has been received that must be sent to that server. After the RadSec connection has been established and request has been delivered, the connection remains as long as possible. If the RadSec connection is lost for any reason, it is only re-established when and if there is another request to be sent.

### 3.74.32. Gossip

The \texttt{Gossip} flag parameter enables this AuthBy to send and listen for notifications (aka. gossip) to/from other Radiator servers when any remote Radius server fails to reply. This is disabled by default.

See Section 3.134. \texttt{<GossipRedis>} on page 400 for more about the Gossip framework and \texttt{goodies/farmsize.cfg} for a configuration sample.

```plaintext
# Use the configured Gossip implementation for notifications
Gossip
```

### 3.74.33. NoKeepaliveTimeoutForChildInstances

If this optional flag is enabled, only the first instance of this server farm will send Status-Server requests. Recommended when Gossip is used to distribute reachability information. This is not set by default.

### 3.74.34. GossipNoReply

If the \texttt{GossipNoReply} flag parameter is set, then a notification is sent when a remote Radius server fails to reply. Radiator server also increases a counter for failed requests when a notification is received. This is enabled by default.

### 3.74.35. GossipHostDown

If the \texttt{GossipHostDown} flag parameter is set, then a notification is sent when a remote Radius server is marked down. Radiator server also marks the remote Radius server down when a notification is received. This is enabled by default.
3.74.36. GossipHostUp

If the GossipHostUp flag parameter is set, then a notification will be send when a remote Radius server is marked up and alive again. Radiator server also marks the remote Radius server healthy when a notification is received. This is enabled by default.

3.74.37. ProxyAlgorithm

You can specify one or more hosts to connect to. The default proxy algorithm is to attempt to connect to the first listed host. If it does not reply within NoreplyTimeout seconds, Radiator logs a fail-over and attempts to connect the next listed host.

You can change this default proxy algorithm by configuring ProxyAlgorithm. Currently, it supports the following values:

- FailOver
- EAPBalance
- HashBalance
- LoadBalance
- VolumeBalance
- RoundRobin

ProxyAlgorithm is not set by default, which means that FailOver method is used.

Note

LoadBalance and VolumeBalance use BogoMips parameter to determine which target Host to use. For more information, see Section 3.42.1. BogoMips on page 200.

3.74.38. HashAttributes

The HashBalance proxy algorithm uses HashAttributes configuration parameter to specify which attributes in the incoming request are used to select the target host. The default value is %{Request:Calling-Station-Id}:%n.

Here is an example of using HashAttributes:

```
HashAttributes %{Request:NAS-IP-Address}
```

3.75. <Host xxxxxxx> within <AuthBy RADSEC>

This clause can be used to specify the name and details of remote RadSec servers inside <AuthBy RADSEC> and its subtypes. The <Host xxxxxxx> clause further allows you to customise details for individual hosts. <AuthBy RADSEC> permits one or more Host clauses.

In the <Host xxxxxxx> clause header, the xxxxxxx is the Host name or IP address of the remote RadSec host to proxy to. The Host name can contain special formatting characters, which are resolved at startup. Here is an example of using Host clause within <AuthBy RADSEC>:

```
<AuthBy RADSEC>
  <Host server1.test.com>
    Secret xyzzy
    UseTLS
```

TLS_CAFile ....
......
</Host>
<Host server2.test.com>
    Secret xyzzy
    Port 1645
    UseTLS 0
</Host>
</AuthBy>

The following parameters can be used within a Host clause. They have the same meaning and default values as the parameter of the same name in the enclosing <AuthBy RADSEC>:

- Secret on page 274
- Port on page 275
- NoreplyTimeout on page 275
- MaxFailedRequests on page 189
- MaxFailedGraceTime on page 189
- FailureBackoffTime on page 280
- ReconnectTimeout on page 280
- ConnectOnDemand on page 281
- Protocol on page 281
- MaxBufferSize on page 280
- UseTLS on page 84
- TLS_CAFile on page 75
- TLS_CAPath on page 75
- TLS_CertificateFile on page 76
- TLS_CertificateChainFile on page 76
- TLS_CertificateType on page 76
- TLS_PrivateKeyFile on page 76
- TLS_PrivateKeyPassword on page 76
- TLS_RandomFile on page 77
- TLS_DHFile on page 77
- TLS_ECDH_Curve on page 77
- TLS_CRLCheck on page 77
- TLS_CRLCheckAll on page 78
- TLS_CRLFile on page 78
- TLS_SessionResumption on page 84
- TLS_SessionResumptionLimit on page 84
- TLS_ExpectedPeerName on page 79
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- TLS_SubjectAltNameURI on page 79
- TLS_CertificateFingerprint on page 80
- TLS_PolicyOID on page 79
- TLS_SRVName on page 82

3.76. <AuthBy SASLAUTHD>

This clause authenticates against a saslauthd server running on the same host as Radiator. Saslauthd is a Unix authentication server program, part of the Cyrus SASL suite. It can be configured to authenticate from a variety of sources, including PAM, Kerberos, DCE, shadow password files, IMAP, LDAP, SIA or a special SASL user password file. It is part of the Cyrus SASL suite.

Saslauthd then authenticates the user using whatever method it has been configured to use and then sends the response back to AuthBy SASLAUTHD.

Requires that saslauthd be installed, configured and running on the Radiator host.

**Tip**

You can run saslauthd with the -d flag to get a fairly detailed log of what it is doing printed to stdout. This can be helpful determining why authentication is failing.

**CAUTION**

AuthBy SASLAUTHD is synchronous: it waits until saslauthd responds to an authentication request before sending a RADIUS response to the NAS. Some authentication methods implemented by saslauthd are slow. For example PAM will wait several seconds before responding if the password is incorrect (this part of the normal behaviour of PAM; it discourages brute force cracking of passwords).

3.76.1. SocketPath

This optional parameter specifies the name of the UNIX domain socket to use to connect to the saslauthd server. Defaults to /var/lib/sasl2/mux.

```
# Connect to a non-standard socket
SocketPath /var/state/saslauthd
```

3.76.2. Service

This optional parameter specifies the service name that will be passed to saslauthd in each authentication request. The service name is used by some types of saslauthd authentication methods, for example if saslauthd is using PAM, then this specifies the PAM service name to use. Defaults to ‘login’.

```
# Use the PAM system-auth method
Service system-auth
```

3.77. <AuthBy NTLM>

This clause authenticates against a Windows Domain Controller, using the ntlm_auth program, which is part of the Samba suite. For more information, see Samba website [https://www.samba.org/]. ntlm_auth runs on all
Unix and Linux platforms, and therefore <AuthBy NTLM> can be used on Unix or Linux to authenticate to a Windows Domain Controller.

<AuthBy NTLM> supports PAP, MSCHAP, MSCHAPV2 and EAP-MSCHAPV2 authentication. CHAP is not supported due to limitations in the Windows support for CHAP authentication.

<AuthBy NTLM> requires that ntlm_auth and winbindd, both part of Samba, are installed and configured correctly. See goodies/smb.conf.winbindd for sample configuration and installation hints.

<AuthBy NTLM> runs the Samba utility ntlm_auth as a child process in order to authenticate requests. It keeps ntlm_auth running between requests and passes it authentication information on stdin, and gets back the authentication results from stdout.

Because AuthBy NTLM requires that ntlm_auth be properly installed and configured with winbindd, it is vitally important that you confirm that ntlm_auth is working properly before trying to use AuthBy NTLM. You can test ntlm_auth like this:

```
ntlm_auth --username=yourusername --domain=yourdomain --password=yourpassword
```

if that does not work for a valid user name and password, there is no way that AuthBy NTLM will work. Make sure ntlm_auth works first!

---

**CAUTION**

AuthBy NTLM blocks while waiting for the result output of ntlm_auth.

---

**Tip**

If you are running Radiator on Windows, and wish to authenticate to Windows Active Directory or to a Windows Domain Controller. For more information, see Section 3.63. <AuthBy LSA> on page 246.

---

**Tip**

Depending on the ownerships and permissions of certain samba files, Radiator may need to run with root permission.

---

### 3.77.1. Domain

This optional parameter specifies which Windows domain will be used to authenticate passwords, regardless of whether the user supplies a domain when they log in. It can be the name of any valid domain in your network. Special characters are permitted. The default is to use the domain configured into winbindd.

### 3.77.2. DefaultDomain

This optional parameter specifies the Windows Domain to use if the user does not specify a domain in their user name. Special characters are supported. Can be an Active directory domain or a Windows NT domain controller domain name. Empty string (the default) means the domain configured into winbindd.
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3.77.3. NtlmAuthProg

This optional parameter specifies the path name and arguments for the ntlm_auth program. The default value is "/usr/bin/ntlm_auth --helper-protocol=ntlm-server-1." The --helper-protocol=ntlm-server-1 is an important part of the arguments to ntlm_auth and it is required for the correct interaction between <AuthBy NTLM> and ntlm_auth. If it is not included, <AuthBy NTLM> does not work correctly.

Here is an example how to require the authenticated user to belong to a certain group:

```bash
NtlmAuthProg /usr/bin/ntlm_auth --helper-protocol=ntlm-server-1 --require-membership-of=MyGroupName
```

Here is an example how to specify that the NTLM authentication request appear to come from a workstation with a specified name. This can be used to restrict authentication for certain users by setting workstation requirements in their Windows user configuration.

```bash
NtlmAuthProg /usr/bin/ntlm_auth --helper-protocol=ntlm-server-1 --workstation=MyWorkstationName
```

**Note**

Use --allow-mschapv2 flag when LMCombatibilityLevel registry key in Windows configuration is set to value 5 to disable older authentication methods. In this case, MSCHAP and MSCHAP-V2, and EAP-MSCHAP-V2 authentications fail while PAP authentication works with <AuthBy NTLM> on Radiator. The availability of --allow-mschapv2 flag depends on the ntlm_auth version.

3.77.4. UsernameMatchesWithoutRealm

Forces AuthBy NTLM to strip any realm from the user name before authenticating to the domain controller.

3.77.5. UsernameFormat

Controls how the user name that will be sent to NTLM will be derived from User-Name in the incoming request. Special characters are permitted. %0 is replaced with the user name portion of ‘domain\username’. Defaults to ‘%0’.

3.77.6. DomainFormat

Controls how the domain name that will be sent to NTLM will be derived from User-Name in the incoming request. Special characters are permitted. %0 is replaced with the domain portion of ‘domain\username’. Defaults to ‘%0’.

3.78. <AuthBy DNSROAM>

This clause proxies RADIUS requests to remote RADIUS and/or RadSec servers based on the Realm in the User-Name. The appropriate server to send to and the protocol to use is discovered through DNS lookups configured through the Resolver clause. For more information, see Section 3.118. <Resolver> on page 362. You must include a <Resolver> clause in your configuration if you intend to use <AuthBy DNSROAM>.

AuthBy DNSROAM is intended to make it easy to set up a secure, reliable, low maintenance RADIUS/RadSec federation. A RADIUS federation (sometimes called a RADIUS mesh) is a set of RADIUS servers, operated by a set of independent but cooperating organisations. The goal is to permit users who belong to one organisation to be able to use RADIUS-controlled resources at another organisation. A typical example is for a group of Universities to cooperate to permit a user from one University to connect to the wireless network at any other...
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University in the group using their home user name and password. Radiator also permits RADIUS requests to be sent to another Radiator server through RadSec. RadSec provides secure, encrypted, reliable transport of RADIUS requests, with optional mutual authentication of RadSec client and server. For more information about RadSec protocol, see RadSec white paper [http://www.open.com.au/radiator/radsec-whitepaper.pdf].

Using AuthBy DNSROAM and DNS to hold information about the target server for each Realm permits convenient and scalable administration of the routing topology within a RADIUS/RadSec mesh.

DNSROAM cooperates well with existing RADIUS infrastructure, and can interoperate with other RADIUS servers and clients, as well as other RadSec servers and clients. It supports hardwired preconfigured RADIUS and RadSec routes as well as DNS discovered routes. It can provide a default fallback, so that Realms that are neither discovered nor hardwired can be forwarded to some catchall server (or dropped). It supports forwarding to IPv4 and/or IPv6 addresses. RadSec can use TCP or SCTP protocol for transport over IPv4 or IPv6. DNSROAM supports discovering RADIUS proxy servers as well as RadSec proxy servers.

The <AuthBy DNSROAM> clause can contain one or more <Route> subclauses which specify hardwired target servers for certain Realms or a DEFAULT fallback server. <Route> subclauses can specify RADIUS or RadSec target servers.

A sample configuration file showing how to use <Resolver>, <AuthBy DNSROAM> and <Route> clauses together can be found in goodies/dnsroam.cfg in your Radiator distribution.

AuthBy DNSROAM uses the following algorithm when it receives a RADIUS request for handling:

1. Extract the Realm from the User-Name in the RADIUS request. (The user name and/or realm can be configured to be rewritten by patterns in the enclosing Handler or Client clause).

2. Look for a preconfigured target server <Route> subclause for that Realm.

3. If no preconfigured target server <Route> subclause is found for that Realm, try to discover a target server name or address using DNS (more below on exactly how this is done).

4. If no target server is preconfigured or discovered, try to find a DEFAULT preconfigured target server <Route> subclause.

5. If there is still no target server found, log and drop the request.

6. If the target server is a RadSec server (Protocol=radsec) establish a RadSec connection to the target server (using a private AuthBy RADSEC clause), and if so configured, set up TLS tunnel and perform mutual authentication based on PKI certificates.

7. If the target server is a RADIUS server (Protocol=radius) forward the request using RADIUS protocol over UDP (using a private AuthBy RADIUS clause).

8. When a reply is received from the target server, send the reply back to wherever the request originally came from (there may be multiple proxying hops until the request reaches the home RADIUS server for that Realm).

AuthBy DNSROAM creates private AuthBy RADIUS and/or AuthBy RADSEC clauses to implement each discovered and hardwired RADIUS and RadSec Route. The default values for the parameters for these private clauses are obtained from the enclosing <Route> and/or <AuthBy DNSROAM> clauses, and can be overridden by <Route> clause parameters and parameters discovered from DNS by the <Resolver> clause. For more information, see Section 3.79. <Route> on page 290 and Section 3.118. <Resolver> on page 362.

AuthBy DNSROAM supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

AuthBy DNSROAM understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.
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3.78.1. RewriteTargetRealm

This optional parameter can be used to specify one or more rewriting rules which will be used to rewrite the Realm name used by Resolver to discover the appropriate target server.

```bash
# Find the target server for users@uninett.no by looking up # as if it were @no.eduroam.org
RewriteTargetRealm s/uninett.no/no.eduroam.org/
```

You can also set up a default realm that will be used if there is no realm in the user name after rewriting by having the last RewriteTargetRealm like this:

```bash
RewriteTargetRealm s/^$/default.realm.com/
```

3.78.2. RedespatchIfNoTarget

For a given request, if Resolver does not find a target and there is no explicit Route, and no DEFAULT Route and this flag is set, the request will be redespatched to the Handler/ Realm system for handling. This allows for a flexible fallback in the case where DNSROAM cannot find how to route a request. The redespatched request will have the attribute OSC-Environment-Identifier set to the AuthBy DNSROAM’s Identifier value or ‘DNSROAM’ if the Identifier is not set.

To create a fallback to multiple target hosts, configure AuthBy DNSROAM without DEFAULT Route and with RedespatchIfNoTarget set. Then create a `<Handler OSCEnvironment- Identifier=DNSROAM>` to match the redespatched requests. This Handler can have, for example, AuthBy RADSEC clause with two hosts which are used if DNSROAM cannot route the request.

3.78.3. `<Route>` parameters

Any of the following `<Route>` parameters may be placed in `<AuthBy DNSROAM>` as defaults for the enclosed `<Route>` clauses:

- Address on page 290
- Transport on page 290
- Protocol on page 290
- Port on page 291
- UseTLS on page 291

3.78.4. `<AuthBy RADIUS>` parameters

Any of the following `<AuthBy RADIUS>` parameters may be placed in `<AuthBy DNSROAM>` as defaults for any RADIUS proxy. These defaults can be overridden for individual Routes in the `<Route>` clause, and can be overridden by automatically discovered Routes. For more information, see Section 3.41. `<AuthBy RADIUS>` on page 182.

- Section 3.41.18. StripFromRequest on page 189
- Section 3.41.19. AddToRequest on page 190
- Section 3.41.20. AddToRequestIfNotExist on page 190
- Section 3.41.24. ReplyHook on page 191
- Section 3.41.25. NoReplyHook on page 192
- Section 3.41.21. NoForwardAuthentication on page 190
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- Section 3.41.22. NoForwardAccounting on page 190
- Section 3.41.47. AllowInRequest on page 198
- Section 3.41.4. AuthPort on page 186
- Section 3.41.5. AcctPort on page 187
- Section 3.41.3. Secret on page 186
- Section 3.41.7. Retries on page 187
- Section 3.41.8. RetryTimeout on page 187
- Section 3.41.33. UseOldAscendPasswords on page 195
- Section 3.41.34. ServerHasBrokenPortNumbers on page 195
- Section 3.41.35. ServerHasBrokenAddresses on page 195
- Section 3.41.38. IgnoreReplySignature on page 196
- Section 3.41.32. UseExtendedIds on page 194
- Section 3.41.15. MaxFailedRequests on page 189
- Section 3.41.16. MaxFailedGraceTime on page 189
- Section 3.41.14. FailureBackoffTime on page 189

3.78.5. <AuthBy RADSEC> parameters

Any of the following <AuthBy RADSEC> parameters may be placed in AuthBy DNSROAM as defaults for any RADSEC proxy. These defaults can be overridden for individual Routes in the <Route> clause, and can be overridden by automatically discovered Routes. For more information, see Section 3.74. <AuthBy RADSEC> on page 272.

- Section 3.74.3. Port on page 275
- Section 3.74.2. Secret on page 274
- Section 3.74.11. StripFromRequest on page 276
- Section 3.74.12. AddToRequest on page 276
- Section 3.41.20. AddToRequestIfNotExist on page 190
- Section 3.74.19. ReplyHook on page 278
- Section 3.74.20. NoReplyHook on page 278
- Section 3.74.24. NoForwardAuthentication on page 280
- Section 3.74.25. NoForwardAccounting on page 280
- Section 3.74.26. AllowInRequest on page 280
- Section 3.74.5. NoReplyTimeout on page 275
- Section 3.74.14. IgnoreReject on page 277
- Section 3.74.15. IgnoreAccountingResponse on page 277
- Section 3.74.29. FailureBackoffTime on page 280
- Section 3.74.27. MaxBufferSize on page 280
- Section 3.74.28. ReconnectTimeout on page 280
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- Section 3.74.31. ConnectOnDemand on page 281
- Section 3.11.36. UseTLS on page 84
- Section 3.11.2. TLS_CAFile on page 75
- Section 3.11.3. TLS_CAPath on page 75
- Section 3.11.4. TLS_CertificateFile on page 76
- Section 3.11.5. TLS_CertificateChainFile on page 76
- Section 3.11.6. TLS_CertificateType on page 76
- Section 3.11.7. TLS_PrivateKeyFile on page 76
- Section 3.11.8. TLS_PrivateKeyPassword on page 76
- Section 3.11.11. TLS_RandomFile on page 77
- Section 3.11.12. TLS_DHFile on page 77
- Section 3.11.14. TLS_CRLCheck on page 77
- Section 3.11.17. TLS_CRLFile on page 78
- Section 3.11.38. TLS_SessionResumption on page 84
- Section 3.11.39. TLS_SessionResumptionLimit on page 84
- Section 3.11.19. TLS_ExpectedPeerName on page 79
- Section 3.11.20. TLS_SubjectAltNameURI on page 79
- Section 3.11.22. TLS_CertificateFingerprint on page 80

3.79. <Route>

Route clauses can be used inside an <AuthBy DNSROAM> clause to explicitly specify target servers and protocols for certain Realms, or a DEFAULT fallback server.

The Route clause understands the following parameters. In general, all the Route parameters default to the parameter of the same name in the enclosing AuthBy DNSROAM.

3.79.1. Realm

Specifies the Realm that this Route will apply to. All requests with a User-Name whose Realm component (after applying any RewriteTargetRealm rules) match this realm will by processed using this Route. If the Realm is ‘DEFAULT’ then this Route will be used to process requests for which no explicit Route exists, and no route could be discovered through DNS and the <Resolver> clause.

3.79.2. Address

Specifies the name or address of the target server to be used to process requests for this Route. Defaults to ‘localhost’. There can be only one Address for a Route. For more information about handling a default route with more than one address, see Section 3.78.2. RedespatchIfNoTarget on page 288.

3.79.3. Transport

Specifies the transport to be used to contact the target server. Can be ‘sctp’, ‘tcp’, or ‘udp’. Defaults to ‘tcp’.

3.79.4. Protocol

Specifies the protocol to be used to contact the target server. Can be ‘radsec’ or ‘radius’. Defaults to ‘radsec’.
3.79.5. Port

Specifies the port number to be used to contact the target server. Defaults to 2083, the standard port number for RadSec protocol.

3.79.6. UseTLS

Specifies whether TLS is to be used to encrypt the connection to the target server. Valid only for Protocol=radsec. Although it is possible to not use TLS for a RadSec connection, it is recommended that RadSec connections always be configured to use TLS. Defaults to true.

3.79.7. <AuthBy RADIUS> parameters

Any of the following <AuthBy RADIUS> parameters may be placed in <Route> as defaults for a RADIUS proxy. For more information, see Section 3.41. <AuthBy RADIUS> on page 182.

- Section 3.41.18. StripFromRequest on page 189
- Section 3.41.19. AddToRequest on page 190
- Section 3.41.24. ReplyHook on page 191
- Section 3.41.25. NoReplyHook on page 192
- Section 3.41.21. NoForwardAuthentication on page 190
- Section 3.41.22. NoForwardAccounting on page 190
- Section 3.41.47. AllowInRequest on page 198
- Section 3.41.4. AuthPort on page 186
- Section 3.41.5. AcctPort on page 187
- Section 3.41.3. Secret on page 186
- Section 3.41.7. Retries on page 187
- Section 3.41.8. RetryTimeout on page 187
- Section 3.41.33. UseOldAscendPasswords on page 195
- Section 3.41.34. ServerHasBrokenPortNumbers on page 195
- Section 3.41.35. ServerHasBrokenAddresses on page 195
- Section 3.41.38. IgnoreReplySignature on page 196
- Section 3.41.32. UseExtendedIds on page 194
- Section 3.41.15. MaxFailedRequests on page 189
- Section 3.41.15. MaxFailedRequests on page 189
- Section 3.41.16. MaxFailedGraceTime on page 189
- Section 3.41.14. FailureBackoffTime on page 189

<AuthBy DNSROAM>

    # Defaults for all enclosed Routes:
    Port 1645
    Transport udp
    Protocol radius
    Secret mysecret
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<Route>
   Realm realm3.open.com.au
   Address oscar.open.com.au
   # Override parameters for AuthBy RADIUS
   Secret xyzzy
</Route>
...
</AuthBy>

3.79.8. <AuthBy RADSEC> parameters

Any of the following <AuthBy RADSEC> parameters may be placed in <Route> as defaults for a RADSEC proxy. For more information, see Section 3.74. <AuthBy RADSEC> on page 272.

- Section 3.74.3. Port on page 275
- Section 3.74.2. Secret on page 274
- Section 3.74.11. StripFromRequest on page 276
- Section 3.74.12. AddToRequest on page 276
- Section 3.74.19. ReplyHook on page 278
- Section 3.74.20. NoReplyHook on page 278
- Section 3.74.24. NoForwardAuthentication on page 280
- Section 3.74.25. NoForwardAccounting on page 280
- Section 3.74.26. AllowInRequest on page 280
- Section 3.74.5. NoreplyTimeout on page 275
- Section 3.74.14. IgnoreReject on page 277
- Section 3.74.15. IgnoreAccountingResponse on page 277
- Section 3.74.29. FailureBackoffTime on page 280
- Section 3.74.27. MaxBufferSize on page 280
- Section 3.74.28. ReconnectTimeout on page 280
- Section 3.74.31. ConnectOnDemand on page 281
- Section 3.11.36. UseTLS on page 84
- Section 3.11.2. TLS_CAFile on page 75
- Section 3.11.3. TLS_CAPath on page 75
- Section 3.11.4. TLS_CertificateFile on page 76
- Section 3.11.5. TLS_CertificateChainFile on page 76
- Section 3.11.6. TLS_CertificateType on page 76
- Section 3.11.7. TLS_PrivateKeyFile on page 76
- Section 3.11.8. TLS_PrivateKeyPassword on page 76
- Section 3.11.11. TLS_RandomFile on page 77
- Section 3.11.12. TLS_DHFile on page 77
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- Section 3.11.14. TLS_CRLCheck on page 77
- Section 3.11.17. TLS_CRLFile on page 78
- Section 3.11.38. TLS_SessionResumption on page 84
- Section 3.11.39. TLS_SessionResumptionLimit on page 84
- Section 3.11.19. TLS_ExpectedPeerName on page 79
- Section 3.11.20. TLS_SubjectAltNameURI on page 79
- Section 3.11.22. TLS_CertificateFingerprint on page 80

```xml
<AuthBy DNSROAM>
  # Defaults for all enclosed Routes:
  Port 1645
  Transport tcp
  Protocol radsec
  UseTLS 1
  Secret mysecret
 _TLS_CAFile ....
  ....
  <Route>
    Realm realm3.open.com.au
    Address oscar.open.com.au
    # Override parameters for AuthBy RADSEC
    Secret xyzzy
    UseTLS 0
    ....
  </Route>
  ...
</AuthBy>
```

### 3.80. <AuthBy SAFEWORD>

This clause authenticates users from a local or remote SafeWord PremierAccess (SPA) server. SafeWord PremierAccess and tokens are available in Secure Computing website [http://securecomputing.intelsecurity.com/]. It supports PAP, CHAP, TTLS-PAP, EAP-OTP and EAP-GTC. It supports password changing, fixed (static) passwords and Safe-Word Silver and Gold tokens.

Only the first authenticator configured into SPA for the user will be used by Radiator to authenticate the user. The second and subsequent authenticators configured for a user will be ignored.

**Note**

In order to support CHAP, the user must have a fixed password profile with ‘case sensitive password’ enabled in the SafeWord server.

**Note**

A user can changed their fixed password at any time by entering their current and new passwords in a special format. The password change will only succeed if the old password is correct, and the two copies of the new password are identical and conform to the password length and other constraints configured into SPA for the user’s fixed password authenticator.
<AuthBy SAFEWORD> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

### 3.80.1. Host

This parameter specifies the name or address of the SafeWord PremierAccess server to connect to. The connection will be made with SSL. Defaults to ‘localhost’.

### 3.80.2. Port

This parameter specifies the port name or number to connect to on Host. Defaults to 5031, the default SafeWord EASSP2 port.

### 3.80.3. SSLVersion

This optional parameter specifies SSL/TLS protocol version(s) to use when connection to the server. For further information, see Perl IO::Socket::SSL module documentation for SSL_version. The default value and supported versions depend on the IO::Socket::SSL, Net::SSLeay and OpenSSL version available on your system.

Here is an example of using `SSLVersion`:

```bash
SSLVersion TLSv1_2
```

### 3.80.4. SSLCipherList

This optional parameter specifies ciphers for SSL/TLS to use when connection to the server. For further information, see Perl IO::Socket::SSL module documentation for SSL_cipher_list. The default value and supported versions depend on the IO::Socket::SSL, Net::SSLeay and OpenSSL version available on your system.

Here is an example of using `SSLCipherList`:

```bash
SSLCipherList DEFAULT:!EXPORT:!LOW
```

### 3.80.5. SSLVerify, SSLOCAFile, SSLOCAPath, SSLCAClientCert, SSLCAClientKey, SSLCAClientKeyPassword

These parameters are used to control the SSL connection to the SafeWord server. They behave as described in “<AuthBy IMAP>”, see Section 3.62. <AuthBy IMAP> on page 244.

### 3.81. <AuthBy FREERADIUSQL>

This clause handles authentication and accounting from a FreeRadius compatible SQL database. The default SQL queries use the standard FreeRadius tables radcheck, radreply, radgroupcheck, radgroupreply and radacct.

#### Tip

The sample configuration file in `goodies/freeradiusql.cfg` in your Radiator distribution shows how to set up a complete FreeRadius emulator. Use of this configuration file can make migration from an existing FreeRadius installation easy.
3. Configuring Radiator

<AuthBy FREERADIUSSQL> understands also the same parameters as <AuthBy SQL>. For more information, see Section 3.40. <AuthBy SQL> on page 170.

### 3.81.1. AuthCheck

This optional parameter specifies an SQL query that is used to get check items for a user. Special characters are supported, as well as a single bind variable for the user name being searched. Defaults to:

```sql
SELECT id, UserName, Attribute, Value, op FROM radcheck WHERE Username=? ORDER BY id
```

### 3.81.2. AuthReply

This optional parameter specifies an SQL query that is used to get reply items for a user. Special characters are supported, as well as a single bind variable for the user name being searched. Defaults to:

```sql
SELECT id, UserName, Attribute, Value, op FROM radreply WHERE Username=? ORDER BY id
```

### 3.81.3. AuthGroupCheck

This optional parameter specifies an SQL query that is used to get check items for a user's group. Special characters are supported, as well as a single bind variable for the group name being searched. Defaults to:

```sql
```

### 3.81.4. AuthGroupReply

This optional parameter specifies an SQL query that is used to get reply items for a user's group. Special characters are supported, as well as a single bind variable for the group name being searched. Defaults to:

```sql
```

### 3.81.5. AcctOnoffQuery, AcctStartQuery, AcctStartQueryAlt, AcctUpdateQuery, AcctUpdateQueryAlt, AcctStopQuery, AcctStopQueryAlt

These optional parameters specify SQL queries to handle various accounting requests by inserting or updating the radacct table. The ‘Alt’ versions are run if the non-Alt version fails (usually because the appropriate accounting record is missing).

### 3.81.6. AcctFailedLogFileName, AcctLogFileFormat and AcctLogFileFormatHook

These parameters have the same meaning as described in “<AuthBy SQL>”, see Section 3.40. <AuthBy SQL> on page 170.
3. Configuring Radiator

3.82. `<AuthBy HTGROUP>`

Checks group membership according to an Apache htgroup file. Apache is a popular HTTP server, and supports flat group files for authenticating web access. With `<AuthBy HTGROUP>` Radiator can authenticate users against the same files that Apache uses, in order to provide a single source of authentication information for both Apache and Radiator.

In order to use `<AuthBy HTGROUP>`, the user record must specify an AuthBy check item naming the Identifier of the AuthBy HTGROUP to be used. See the example in goodies/htgroup.cfg for details. During authentication, the user's GroupList check items will be used to check for group membership against the Apache group file specified by the GroupFilename parameter.

3.82.1. GroupFilename

Specifies the name of the Apache group file to consult. Special characters are supported (so you may have a different group files for different categories of users).

3.83. `<AuthBy HOTSPOT>`

`<AuthBy HOTSPOT>` provides advanced support for hotspot functionality, including differentiated services and prepaid/postpaid quotas. It combines `<ServiceDatabase>`, `<SessionDatabase>`, an authenticating `<AuthBy xxxxxx>` to a working solution which can be used with captive portals (for example MikroTik) and network access controllers supporting RADIUS. Besides hotspot use-case, `<AuthBy HOTSPOT>` can also be used to implement quota control for fixed-line access or cellular APN. It can also utilise `<AuthBy DYNAUTH>` (RADIUS Dynamic Authorization) for sending CoA/DM, for example, after a successful authentication or when a quota has been depleted.

See goodies/hotspot.cfg and goodies/README.hotspot for a sample configuration file. For a derived AuthBy, see Section 3.85. `<AuthBy HOTSPOTFIDELIO>` on page 305.

`<AuthBy HOTSPOT>` understands also the same parameters as `<AuthBy xxxxxx>`. For more information, see Section 3.31. `<AuthBy xxxxxx>` on page 147.

3.83.1. ServiceId

This optional string parameter specifies how to derive the Identifier of the Service to provision a subscription. Special variable %0 contains identifier of this AuthBy. There is no default value.

3.83.2. SubscriptionId

This optional string parameter specifies how to derive the Identifier of the Subscription to handle a request. Special variable %0 contains identifier of this AuthBy, %1 the username and %2 hotspot id. Default value is %1.

```bash
# Lookup a subscription based on username (%1) and Calling-Station-Id MAC address
SubscriptionId %1-%{Calling-Station-Id}
```

3.83.3. SessionId

This optional string parameter specifies how to derive the Identifier of the Session to handle a request. Special variable %0 contains identifier of this AuthBy, %1 the username, %2 hotspot id and %3 Class attribute value. There is no default value.

```bash
# Lookup a session based on username, Class and Calling-Station-Id MAC address
SessionId %1-%3-%{Calling-Station-Id}
```
### 3.83.4. ServiceAttribute

This optional string parameter specifies name of RADIUS attribute that is used to detect different services. There is no default value.

```plaintext
# Our hotspot is configured this send this attribute in RADIUS requests
ServiceAttribute OSC-AVPAIR
```

### 3.83.5. ServiceAttributePrefix

This optional string parameter specifies the prefix in ServiceAttribute value. You need to specify this if there is possibility to have multiple RADIUS attributes that are defined to be ServiceAttribute. There is no default value.

```plaintext
# Access-Request from our captive portal has multiple instances
# of ServiceAttribute, use the ones with this prefix
ServiceAttributePrefix Mikrotik-Service=
```

### 3.83.6. SubscriptionAttribute

This optional string parameter specifies name of RADIUS attribute that is used to detect different subscriptions. There is no default value.

### 3.83.7. SubscriptionAttributePrefix

This optional string parameter specifies the prefix in SubscriptionAttribute value. You need to specify this if there is possibility to have multiple RADIUS attributes that are defined to be SubscriptionAttribute. There is no default value.

### 3.83.8. SessionAttribute

This optional string parameter specifies name of RADIUS attribute that is used to detect different sessions. If this is set to an empty value, `SessionId` parameter is used to detect sessions. Defaults to `Acct-Session-Id`.

```plaintext
# Set this to an empty value
SessionAttribute
```

### 3.83.9. SessionAttributePrefix

This optional string parameter specifies the prefix in SessionAttribute value. You need to specify this if there is possibility to have multiple RADIUS attributes that are defined to be SessionAttribute. There is no default value.

### 3.83.10. DefaultService

This optional string parameter specifies a name of default service when the request does not contain ServiceAttribute. Defaults to `default`.

```plaintext
# Name of default service defined in our ServiceDatabase
DefaultService free
```

### 3.83.11. DefaultServiceDefinition

This optional string parameter defines the default service to use when no service definition was found from our ServiceDatabase. Defaults to `name:default price:0`.

```plaintext
# Make this empty for no default configured service
```
3. Configuring Radiator

3.83.12. ConfirmSubscription

This optional flag parameter specifies if RADIUS Access-Reject message with Reply-Message attribute is used to ask for a confirmation of the upgrade or renewal charge. Disabled by default.

```bash
# Use Access-Reject with Reply-Message for confirmation
ConfirmSubscription
```

3.83.13. ConfirmationMessage

This optional string parameter specifies the message that will ask the guest to confirm the upgrade or renewal charges when ConfirmSubscription flag parameter is set. Defaults to: You are going to upgrade or renew your plan, please login again to confirm the charge.

```bash
# Change the default to more specific
ConfirmationMessage Please log in again to approve Wi-Fi charge at checkout.
```

3.83.14. PreProvisionSubscription

Set this optional flag parameter to create a subscription externally before the authentication. Defaults to not set.

3.83.15. PreProvisionSession

Set this optional flag parameter to create a session when the authentication is accepted. Defaults to not set.

```bash
# If RADIUS accounting will be used for quota monitoring,
# create a new session upon a successful authentication
PreProvisionSession
```

3.83.16. AuthBy

This string parameter specifies which AuthBy will be used to authenticate users. Special formatting characters are permitted. Defaults to not set but must be configured with a value.

```bash
# Authenticate Hotspot users with AuthBy that has this identifier
AuthBy AuthBy-FILE
```

3.83.17. ServiceDatabase

This string parameter specifies which ServiceDatabase will be used to query service and subscription information. Special formatting characters are permitted. Defaults to not set but should be configured with a value.

```bash
# Use ServiceDatabase with this identifier for services and subscriptions
ServiceDatabase ServiceDatabase-INTERNAL
```

3.83.18. SessionDatabase

This string parameter specifies which SessionDatabase will be used to query session information. Special formatting characters are permitted. Defaults to not set but should be configured with a value.

```bash
# Use SessionDatabase with this identifier for sessions
SessionDatabase SessionDatabase-INTERNAL
```
3.83.19. PoolIPv4Attribute

This optional string parameter specifies name of RADIUS attribute to return when Service/Subcription has IPv4 pool. Defaults to PoolHint.

# Use non-default IPv4 pool attribute name to return service pool name
PoolIPv4Attribute Framed-Pool

3.83.20. PoolIPv6Attribute

This optional string parameter specifies name of RADIUS attribute to return when Service/Subcription has IPv6 pool. Defaults to PoolHint6.

# Use non-default IPv6 pool attribute name to return service pool name
PoolIPv6Attribute Framed-IPv6-Pool

3.83.21. UsageMonitoring

When this optional flag parameter is set, deplete Subscription quotas only based on RADIUS accounting. Disabled by default.

# Use accounting and return to NAS remaining time quota with Session-Timeout
# and data quota with Mikrotik attributes.
UsageMonitoring
ReplyWithDataQuota
DataLimitAttribute Mikrotik-Total-Limit
DataLimitGigawordsAttribute Mikrotik-Total-Limit-Gigawords

3.83.22. ReplyWithBandwidthControl

When this optional flag parameter is set, add Service/Subcription bandwidth limit RADIUS attributes to the reply. Enabled by default.

# Enable BW control for pre-paid, post-paid and throttled (quota exceeded) cases
ReplyWithBandwidthControl
UploadRateAttribute WISPr-Bandwidth-Max-Up
DownloadRateAttribute WISPr-Bandwidth-Max-Down

3.83.23. UploadRateAttribute

This optional string parameter specifies name of RADIUS attribute that is used to return Service/Subcription Upload bandwidth limit. Default value is OSC-Upload-Rate. See Section 3.83.22. ReplyWithBandwidthControl on page 299 for an example.

3.83.24. DownloadRateAttribute

This optional string parameter specifies name of RADIUS attribute that is used to return Service/Subcription Download bandwidth limit. Default value is OSC-Download-Rate. See Section 3.83.22. ReplyWithBandwidthControl on page 299 for an example.

3.83.25. ReplyWithDataQuota

When this optional flag parameter is set, Add Service/Subcription data limit RADIUS attributes to the reply. Disabled by default. See Section 3.83.21. UsageMonitoring on page 299 for an example.
3. Configuring Radiator

3.83.26. DataLimitAttribute

This optional string parameter specifies name of RADIUS attribute that is used to return Service/Subscription data limit. Default value is `OSC-Data-Limit`. See Section 3.83.21. UsageMonitoring on page 299 for an example.

3.83.27. DataLimitGigawordsAttribute

This optional string parameter specifies name of RADIUS attribute that is used to return Service/Subscription data limit gigawords. Default value is `OSC-Data-Limit-Gigawords`. See Section 3.83.21. UsageMonitoring on page 299 for an example.

3.83.28. ChargeHook

This optional parameter allows you to define a Perl function to modify a subscription charge. 

ChargeHook must return new username, a charging reference and new price. Charging reference can be undefined. If username is undefined, charging is not done and request is rejected.

ChargeHook has the following arguments:

- The current request
- Username
- Id, such as room number, plane seat number or loyalty card number or other value typically sent as password with a hotspot service
- Price
- Subscription

Here is an example of ChargeHook:

```perl
# Charge mikem with double rate
ChargeHook sub {my $name = $_[1]; my $price = $_[3]; 
    return ($name, undef, $price*2);}
```

3.83.29. ReplyAdjustHook

This optional parameter allows you to define a Perl function to adjust RADIUS Access-Accept reply.

ReplyAdjustHook return value is ignored. However, it is passed references to current request and reply for modification.

ReplyAdjustHook has the following arguments:

- The current request
- The current reply
- Time left
- Octets left
- Gigawords left
- Reference to the Service object
- Reference to the Subscription object
- Reference to the Session object
• Reference to the current AuthBy

Here is an example of `ReplyAdjustHook`:

```perl
# Reply debugging for radpwtst testing
ReplyAdjustHook sub {my $rp = $_[1]; my $time_left = $_[2]; 
    $rp->add_attr('OSC-AVPAIR', "time-debug=$time_left"); }
```

### 3.83.30. SessionQuotaSupplyFraction

This optional integer parameter specifies percentage (1-100) of remaining Subscription quota to allocate for a session. Defaults to 20.

```bash
# Allocate only 10%
SessionQuotaSupplyFraction 10
```

### 3.83.31. SessionQuotaResupplyThreshold

This optional integer parameter specifies percentage threshold (1-100) for session quota usage to resupply session quotas from a subscription. Defaults to 80.

```bash
# Experiment with 90% threshold
SessionQuotaResupplyThreshold 90
```

### 3.83.32. SessionQuotaResupplyTimeMin

This optional string parameter specifies the minimum amount of time quota to allocate from a subscription for a session. Value is seconds or a string with one letter suffix of y,d,h,m for year, day, hour or minute, respectively. Defaults to 10 minutes.

```bash
# Change resupply time to 20 minutes. 1200 would work also as the value.
SessionQuotaResupplyTimeMin 20m
```

### 3.83.33. SessionQuotaResupplyDataMin

This optional string parameter specifies the minimum amount of data quota to allocate from a subscription for a session. Value is octets or a string with one letter suffix of G,M,K for 10^9, 10^6 or 10^3 octets, respectively. Defaults to 1M octets.

```bash
# Change resupply data to 20 000 000 octets. Can use 20M or 20000000 as the value.
SessionQuotaResupplyDataMin 20M
```

### 3.84. <AuthBy FIDELIO>

`<AuthBy FIDELIO>` authenticates users from Micros-Fidelio Opera. Opera is a popular hotel Property Management System from Micros Fidelio [http://www.micros-fidelio.eu/].

`<AuthBy FIDELIO>` acquires the hotel guest list from Opera, and by default, authenticates each guest using their Room Number as the User-Name and their Guest Number as their password (this is configurable). By default, RADIUS Accounting Stops generate Opera PS simple postings. This can be changed with the `PostingRecordID` parameter.
Note
If the acquired guest list is empty, this may be caused by Opera settings where the full guest list synchronisation is disabled. This option needs to be enabled for AuthBy FIDELIO to work.

By default, accounting postings are sent to Opera following receipt of an Accounting-Stop. The default PS record will contain:

- P# Automatically generated posting sequence number, starting at 1
- TA the cost computed by ComputeCostHook or CentsPerSecond
- DU The call duration in seconds
- PT fixed value of ‘C’ (Direct Charge)
- SO fixed value of ‘Internet connection’
- DD Called-Station-Id from the incoming request, with any non-digit characters stripped out

Additional fields can be added to the Opera posting record with the PostingExtraFields parameter.

AuthBy FIDELIO requires a connection to the Opera computer system. Both RS232 serial and TCP/IP (Ethernet) connections are supported. RS232 support requires Device::SerialPort. It is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

3.84.1. Protocol

Specifies the protocol to be used to connect to Opera. ‘serial’ or ‘tcp’ are supported. If ‘serial’ is specified, AuthBy FIDELIO will open the serial port specified by Port and configure it to use the RS232 parameters specified by Baudrate, Databits, Parity and Stopbits and Handshake. If ‘tcp’ is specified, AuthBy FIDELIO will connect to Opera by TCP/IP, using the parameters Host and Port. Defaults to ‘tcp’.

3.84.2. Port

When Protocol is serial, specifies the device name of the serial port to use (defaults to ‘/ dev/ttyS0’). When Protocol is tcp, specifies the service name or number of the TCP/IP port to connect to (defaults to 5010, the standard Opera TCP/IP port).

3.84.3. Host

When Protocol is tcp, specifies the DNS name or address of the Opera host. Defaults to ‘localhost’.

3.84.4. Baudrate

When Protocol is serial, specifies the baud rate for the serial port. Defaults to 9600.

3.84.5. Databits

When Protocol is serial, specifies the number of data bits for the serial port. Defaults to 8.

3.84.6. Parity

When Protocol is serial, specifies the data parity for the serial port. May be ‘odd’, ‘even’ or ‘n’. Defaults to ‘n’.

3.84.7. Stopbits

When Protocol is serial, specifies the number of stop bits for the serial port. Defaults to 1.
3.84.8. Handshake

When Protocol is serial, specifies the handshaking standard for the serial port. May be ‘none’, ‘rts’ or ‘xoff’. Defaults to ‘xoff’.

3.84.9. ReadCharTimeout

When Protocol is serial, specifies the character read timeout in milliseconds. Defaults to 2000ms. This should not need to be changed.

3.84.10. TransmitTimeout

Specifies the time in seconds to wait before retransmitting an unacknowledged message to Opera. Default to 2 seconds. This should not need to be changed.

3.84.11. ReconnectTimeout

Specifies the time in seconds to wait before attempting to reconnect to Opera after the connection is lost. Defaults to 5 seconds.

3.84.12. InterfaceFamily

Specifies the interface family that AuthBy FIDELIO will send to Opera, identifying the type of interface Opera is to use to communicate with Radiator. Defaults to ‘WW’, the standard Opera code for Internet.

3.84.13. FieldSeparator

Specifies the field separator character to be sued by Opera. Defaults to ‘|’. This should not need to be changed.

3.84.14. BindAddress

When Protocol is tcp, specifies the bind address to be used for the TCP/IP port. Defaults to the global BindAddress (if specified) or 0.0.0.0. Useful to specify the source address interface to use for multi-homed hosts. For more information, see Section 3.7.9. BindAddress on page 31.

3.84.15. MaxBufferSize

Specifies the maximum read buffer size. Defaults to 100000. Should not need to be changed.

3.84.16. UseChecksums

Specifies whether to use checksums in the communications with Opera. The correct setting for this depends on the version of Opera, but a setting of disabled will work for most modern installations. Defaults to enabled (1) for serial Protocol and disabled (0) for tcp Protocol.

3.84.17. LinkRecords

Specifies the list of required fields for each message type in messages passed between Radiator and Opera. This should only need to be changed if additional data is required for each guest in the GI (Guest In), GO (Guest Out) and GC (Guest Change) messages. Defaults to:

|  GI | FLG#RNGNSF  |
|  GO | FLG#RNS    |
|  GC | FLG#RNGN   |
|  PS | FLP#RNPPATIDUDADDSOCT |
3. Configuring Radiator

### 3.84.18. GuestNameField

Specifies the name of the Opera guest field that will be used to match the User-Name in authentication requests. Defaults to 'RN' (Room Number).

### 3.84.19. GuestPasswordField

This parameter specifies the name of the Opera guest field that is used to match the password in authentication requests. The default value is 'G#' (Guest Number). Usually there is no need to change this parameter. Use `UserPasswordHook` instead to extract password from user information.

### 3.84.20. ComputeCostHook

Specifies an optional Perl hook that can be used to calculate the cost when a RADIUS Accounting Stop is received. The hook is passed the call duration in seconds, and is expected to return the cost in cents. If `ComputeCostHook` is not specified, then `CentsPerSecond` will be used to calculate the cost.

### 3.84.21. UserPasswordHook

Specifies an optional Perl hook that can be used to determine the correct password for the user. It is expected to return the correct user password in plaintext.

The hook is passed the following arguments:

- `$_[0]` A reference to the current AuthBy module object
- `$_[1]` A reference to a hash containing the guest's Opera data (as received in a GI message from Opera)
- `$_[2]` A reference to the current RADIUS request

The default is:

```perl
UserPasswordHook sub {return $_[1]->{'G#'}}
```

which specifies the guests Guest Number (G#) is to be used as their password.

### 3.84.22. CentsPerSecond

When `UserPasswordHook` is not specified, this number will be used to compute the cost to be used in the accounting PS resulting from a RADIUS Accounting Stop. The charge will be computed from the call duration (in seconds) times CentsPerSecond.

### 3.84.23. PostingRecordID

Defines the type of transaction code to be used for sending Posting records to Opera. Defaults to PS but can be changed to PR.

---

**CAUTION**

Use of PR would also require a suitable LinkRecords entry for the desired PR data. For more information, see the example in Section 3.84.24. PostingExtraFields on page 305.

---

Contact your Micros representative for more details on field types and codes that can be sent to Opera.
3.84.24. PostingExtraFields

List of fields that are to be added to the standard fields sent to Opera in a Posting transaction. These are sent in addition to the standard ones of P#, TA, DU, PT, SO, CT and DD. Format is in the form: <fieldid>,<data>. Where <fieldid> is the 2 letter FieldID and <data> is the data to be sent in that field (special characters are permitted).

The special characters in <data> may include:

- %0 the user (room) name
- %1 the posting sequence number
- %2 the cost computed by CentsPerSecond or ComputeCostHook
- %3 the duration of the connection in 'hhmmss' format
- %4 the reservation number (G#) corresponding to the room number

In the following example, the type of posting is changed to PR, and the PR is defined to use the P#, TA, DU, PT, SO, CT and DD field (the defaults) and the additional field T1 (tax code). When a posting is sent, the T1 tax code is set to 3, and the additional G# (reservation number) is set to the user's reservation number from the Opera database.

```
PostingRecordID PR
LinkRecords PR,FLP#RNPTTATIDUDADDSDGCTT1
PostingExtraFields T1,3
PostingExtraFields G#,%4
```

3.84.25. MessageHook

MessageHook is called after a message from Fidelio has been unpacked into a hash and before the record is passed to handle_message(). It can be used to change or transform any fields in the record before it is passed to handle_message() and processed by Auth- FIDELIO. The first argument is a pointer to the AuthBy FIDELIO clause, and the second is a pointer to a hash containing the unpacked record fields.

3.84.26. CheckoutGraceTime

Specifies a number of seconds after check-out to still allow a user to log in. Defaults to 0.

3.85. <AuthBy HOTSPOTFIDELIO>

/AuthBy HOTSPOTFIDELIO/ combines /AuthBy HOTSPOT/ and /AuthBy FIDELIO/ to an easy way to integrate WiFi hotspots and captive portals with Opera hotel Property Management System from Micros Fidelio [http://www.micros-fidelio.eu/].

It uses a service database to keep track of prepaid access time blocks for Opera guests and tracks ongoing sessions with a session database. It authenticates new sessions with the guest's room number and guest number (as with /AuthBy FIDELIO/), creates new prepaid blocks (and posts the charge to Opera). Time-limited prepaid plans are supported.

/AuthBy HOTSPOTFIDELIO/ understands also the same parameters as /AuthBy HOTSPOT/ and /AuthBy FIDELIO/. For more information, see Section 3.83. <AuthBy HOTSPOT> on page 296 and Section 3.84. <AuthBy FIDELIO> on page 301. <AuthBy HOTSPOTFIDELIO> supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.
For a configuration sample, see files goodies/README.hotspot-fidelio and goodies/hotspot-fidelio.cfg. The sample configuration provides also an example of dynamically changing user sessions when they exceed their parameters, such as prepaid quota limits.

Figure 3. AuthBy HOTSPOTFIDELIO with dynamic authorization

3.85.1. BlockDuration

Specifies a number of seconds a prepaid block of time will last for, from the time it is first purchased. Defaults to 86400 (1 day).

3.85.2. BlockPrice

Specifies a number of cents a prepaid block of time costs. Defaults to 900 cents ($9.00). This cost will be posted to Opera whenever a new block is purchased.

3.85.3. PostSendQuery

This optional string defines the exact form of the insert query that is used to insert posting records.

3.85.4. PostSendQueryParam

This optional string array enables the use of SQL bind variables with PostSendQuery. Set PostSendQuery using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective PostSendQueryParam. Here is an example of using the SQL bind variables:

```
PostSendQuery INSERT INTO posts (roomNumber, guestNumber, macAddress, postNumber, posted, cost) VALUES (?, ?, ?, ?, ?, ?)
PostSendQueryParam %0
PostSendQueryParam %1
PostSendQueryParam %2
PostSendQueryParam %3
PostSendQueryParam %4
PostSendQueryParam %5
```

The same query without the SQL bind variables looks this:

```
PostSendQuery INSERT INTO posts (roomNumber, guestNumber, macAddress, postNumber, posted, cost) VALUES (%0, %1, %2, %3, %4, %5)
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.
3. Configuring Radiator

3.85.5. PostAnswerQuery

This optional string defines the exact form of the insert query that is used to insert Posting Answer (PA) data.

3.85.6. PostAnswerQueryParam

This optional string array enables the use of SQL bind variables with PostAnswerQuery. Set PostAnswerQuery using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective PostAnswerQueryParams. Here is an example of using the SQL bind variables:

```
PostAnswerQuery INSERT INTO postacks (roomNumber, postNumber, transactionNumber, received) 
  values (?, ?, ?, ?)
PostAnswerQueryParam %0
PostAnswerQueryParam %1
PostAnswerQueryParam %2
PostAnswerQueryParam %3
```

The same query without the SQL bind variables looks this:

```
PostAnswerQuery INSERT INTO postacks (roomNumber, postNumber, transactionNumber, received) 
  values (%0, %1, %2, %3)
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.86. <AuthBy FIDELIOHOTSPOT>

This extension of <AuthBy FIDELIO> provides an easy way to integrate WiFi hotspots and captive portals with Opera hotel Property Management System from Micros Fidelio [http://www.micros-fidelio.eu/].

It uses an SQL database to keep track of prepaid access time blocks for Opera guests. It authenticates new sessions with the guest's room number and guest number (as with <AuthBy FIDELIO>), creates new prepaid blocks (and posts the charge to Opera), and keeps track of the remaining time left in each prepaid block. Time-limited prepaid plans are also supported.

<AuthBy FIDELIOHOTSPOT> understands also the same parameters as <AuthBy SQL> and <AuthBy FIDELIO>. For more information, see Section 3.40. <AuthBy SQL> on page 170 and Section 3.84. <AuthBy FIDELIO> on page 301. <AuthBy FIDELIOHOTSPOT> supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

For a configuration sample, see a configuration sample file goodies/fidelio-hotspot.cfg

Migrating to AuthBy HOTSPOTFIDELIO

This module is superseded by <AuthBy HOTSPOTFIDELIO> starting with Radiator 4.22. See Section 3.85. <AuthBy HOTSPOTFIDELIO> on page 305 for more information and sample configuration.

To migrate your current configuration, see configuration samples for <AuthBy HOTSPOTFIDELIO> and the notes below:

- ConfirmationQuery and ConfirmationQueryParam configuration parameters are deprecated
- Change ConfirmUpgradeOrRenew configuration parameter to ConfirmSubscription
- GetServiceQuery configuration parameter has been deprecated. Configure to use ServiceDatabase instead
- GetCurrentServiceQuery configuration parameter has been deprecated. Configure to use ServiceDatabase instead
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- AddSessionQuery configuration parameter has been deprecated. Configure to use ServiceDatabase and SessionDatabase instead.
- GetSessionQuery configuration parameter has been deprecated. Configure to use ServiceDatabase and SessionDatabase instead.
- UpdateSessionQuery configuration parameter has been deprecated. Configure to use ServiceDatabase and SessionDatabase instead.

### 3.86.1. BlockDuration

Specifies a number of seconds a prepaid block of time will last for, from the time it is first purchased. Defaults to 86400 (1 day).

### 3.86.2. BlockPrice

Specifies a number of cents a prepaid block of time costs. Defaults to 900 cents ($9.00). This cost will be posted to Opera whenever a new block is purchased.

### 3.86.3. ServiceAttribute

This string specifies the RADIUS attribute that is used to select the desires prepaid service or plan.

You can create a menu into Mikrotik login page, see an example:

```html
<tr><td>Service:</td><td>
<select name="radius0-9048">
<option value="Mikrotik-Service=free">best effort (free)</option>
<option value="Mikrotik-Service=premium">premium ($5)</option>
</select></td></tr>
```

`name="radius0-9048"` is OSC-AVPAIR, this is listed in Radiator dictionary. Use the following parameter setting in Radiator configuration file:

```
ServiceAttribute OSC-AVPAIR
```

### 3.86.4. ServiceAttributePrefix

This optional string specifies the prefix in `ServiceAttribute`. For more information, see Section 3.86.3. ServiceAttribute on page 308. Use this parameter if there is a possibility to have several `ServiceAttribute` instances and they must be separated to be able to choose the correct one. Here is an example about using `ServiceAttributePrefix`:

```
ServiceAttributePrefix Mikrotik-Service=
```

### 3.86.5. ConfirmUpgradeOrRenew

This flag defines if the system asks a confirmation for an upgrade or renewal charge. This is disabled by default, and the upgrade or renewal of the current payment plan is processed automatically.

### 3.86.6. ConfirmationMessage

This string specifies the message that is shown to the guest when asking a confirmation for upgrade or renewal recharge. To show the message, include the following example into Mikrotik login page:

```html
$(if error)<br /><div style="color: #FF8080; font-size: 14px">$(error)</div><br>$(endif)
```

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Then add the ConfirmationMessage to your Radiator configuration:

```
ConfirmationMessage "You are going to upgrade or renew your plan, please login again to confirm the charge"
```

### 3.86.7. ConfirmationQuery

This string is an optional parameter. It defines the exact form of the query that is used to add the upgrade or renewal confirmation record to the database.

### 3.86.8. ConfirmationQueryParam

This optional string array enables the use of SQL bind variables with ConfirmationQuery. Set ConfirmationQuery using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective ConfirmationQueryParams. Here is an example of using the SQL bind variables:

```
ConfirmationQuery UPDATE sessions SET confirmation_requested=1 WHERE roomNumber=? AND guestNumber=? AND macAddress=?
ConfirmationQueryParam %0
ConfirmationQueryParam %1
ConfirmationQueryParam %2
```

The same query without the SQL bind variables looks this:

```
ConfirmationQuery UPDATE sessions SET confirmation_requested=1 WHERE roomNumber=%0 AND guestNumber=%1 AND macAddress=%2
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

### 3.86.9. PostSendQuery

This optional string defines the exact form of the insert query that is used to insert posting records.

### 3.86.10. PostSendQueryParam

This optional string array enables the use of SQL bind variables with PostSendQuery. Set PostSendQuery using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective PostSendQueryParams. Here is an example of using the SQL bind variables:

```
PostSendQuery INSERT INTO posts (roomNumber, guestNumber, macAddress, postNumber, posted, cost) VALUES (?, ?, ?, ?, ?, ?)
PostSendQueryParam %0
PostSendQueryParam %1
PostSendQueryParam %2
PostSendQueryParam %3
PostSendQueryParam %4
PostSendQueryParam %5
```

The same query without the SQL bind variables looks this:

```
PostSendQuery INSERT INTO posts (roomNumber, guestNumber, macAddress, postNumber, posted, cost) VALUES (%0, %1, %2, %3, %4, %5)
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.
### 3.86.11. PostAnswerQuery

This optional string defines the exact form of the insert query that is used to insert Posting Answer (PA) data.

### 3.86.12. PostAnswerQueryParam

This optional string array enables the use of SQL bind variables with `PostAnswerQuery`. Set `PostAnswerQuery` using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective `PostAnswerQueryParam`s. Here is an example of using the SQL bind variables:

```sql
PostAnswerQuery INSERT INTO postacks (roomNumber, postNumber, transactionNumber, received) values (?, ?, ?, ?)
PostAnswerQueryParam %0
PostAnswerQueryParam %1
PostAnswerQueryParam %2
PostAnswerQueryParam %3
```

The same query without the SQL bind variables looks this:

```sql
PostAnswerQuery INSERT INTO postacks (roomNumber, postNumber, transactionNumber, received) values (%0, %1, %2, %3)
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

### 3.86.13. GetServiceQuery

This optional string defines the exact form of the query that is used to fetch information, such as price, duration, or reply attributes, about the service. `%0` denotes the value of a RADIUS attribute denoted by `ServiceAttribute`.

### 3.86.14. GetServiceQueryParam

This optional string array enables the use of SQL bind variables with `GetServiceQuery`. Set `GetServiceQuery` using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective `GetServiceQueryParam`s. Here is an example of using the SQL bind variables:

```sql
GetServiceQuery SELECT price, duration, replyattributes FROM services WHERE serviceclass=?
GetServiceQueryParam %0
```

The same query without the SQL bind variables looks this:

```sql
GetServiceQuery SELECT price, duration, replyattributes FROM services WHERE serviceclass=%0
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

### 3.86.15. GetCurrentServiceQuery

This optional string defines the exact form of the query that is used to fetch information about the prepaid service and the user's current session.

### 3.86.16. GetCurrentServiceQueryParam

This optional string array enables the use of SQL bind variables with `GetCurrentServiceQuery`. Set `GetCurrentServiceQuery` using the SQL bind variables or without them. If you use the SQL bind variables,
you must specify all query parameters with respective `GetCurrentServiceQueryParams`. Here is an example of using the SQL bind variables:

```sql
SELECT expiry, replyattributes, price, sessions.serviceclass, confirmation_requested
FROM sessions LEFT JOIN services ON sessions.serviceclass = services.serviceclass
WHERE roomNumber = ? AND guestNumber = ? AND macAddress = ?
```

The same query without the SQL bind variables looks this:

```sql
SELECT expiry, replyattributes, price, sessions.serviceclass, confirmation_requested
FROM sessions LEFT JOIN services ON sessions.serviceclass = services.serviceclass
WHERE roomNumber = %0 AND guestNumber = %1 AND macAddress = %2
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

### 3.86.17. AddSessionQuery

This optional string defines the exact form of the query that is used to add information about the current prepaid or postpaid session.

### 3.86.18. AddSessionQueryParam

This optional string array enables the use of SQL bind variables with `AddSessionQuery`. Set `AddSessionQuery` using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective `AddSessionQueryParams`. Here is an example of using the SQL bind variables:

```sql
INSERT INTO sessions (roomNumber, guestNumber, macAddress, serviceclass, expiry) VALUES (?, ?, ?, ?, ?)
```

The same query without the SQL bind variables looks this:

```sql
INSERT INTO sessions (roomNumber, guestNumber, macAddress, serviceclass, expiry) VALUES (%0, %1, %2, %3, %4)
```

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

### 3.86.19. GetSessionQuery

This optional string defines the exact form of the query that is used to fetch information about the current postpaid session.

### 3.86.20. GetSessionQueryParam

This optional string array enables the use of SQL bind variables with `GetSessionQuery`. Set `GetSessionQuery` using the SQL bind variables or without them. If you use the SQL bind variables, you must specify all query parameters with respective `GetSessionQueryParams`. Here is an example of using the SQL bind variables:
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GetSessionQuery SELECT expiry FROM sessions WHERE roomNumber=? AND guestNumber=?
   AND macAddress=?
GetSessionQueryParam %0
GetSessionQueryParam %1
GetSessionQueryParam %2

The same query without the SQL bind variables looks this:

GetSessionQuery SELECT expiry FROM sessions WHERE roomNumber=%0 AND guestNumber=%1
   AND macAddress=%2

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.86.21. UpdateSessionQuery

This optional string defines the exact form of the query that is used to update information about the current
prepaid or postpaid session.

3.86.22. UpdateSessionQueryParam

This optional string array enables the use of SQL bind variables with UpdateSessionQuery. Set
UpdateSessionQuery using the SQL bind variables or without them. If you use the SQL bind variables, you
must specify all query parameters with respective UpdateSessionQueryParam. Here is an example of using
the SQL bind variables:

UpdateSessionQuery UPDATE sessions SET serviceclass=?, expiry=?, confirmation_requested=0
   WHERE roomNumber=? AND guestNumber=? AND macAddress=?
UpdateSessionQueryParam %3
UpdateSessionQueryParam %4
UpdateSessionQueryParam %0
UpdateSessionQueryParam %1
UpdateSessionQueryParam %2

The same query without the SQL bind variables looks this:

UpdateSessionQuery UPDATE sessions SET serviceclass=%3, expiry=%4,confirmation_requested=0
   WHERE roomNumber=%0 AND guestNumber=%1 AND macAddress=%2

For more information about SQL bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.87. <AuthBy PRESENCESQL>

<AuthBy PRESENCESQL> authenticates users from an SQL database and records presence (current user
location) to an SQL database. Implements a special form of RADIUS Access-Request that allows user presence
data to be retrieved by suitably authorised devices.

This module can be used with telephone and VOIP systems to automatically route telephone calls according to
the user's current location.

A sample configuration file and documentation can be found in goodies/presencesql.cfg in your
distribution.

3.88. <AuthBy HANDLER>

This clause allows requests to be redirected to a Handler based on the Handler's Identifier. This allows rapid
selection of a Handler from amongst many Handlers using a hash-based match, instead of relying on the normal
linear search that is used to find `<Handler>` clauses. This can be useful in special cases where there are many Handlers, and where a PreHandlerHook is able to identify the correct Handler to use.

When `<AuthBy HANDLER>` runs, it uses the HandlerId to create the name of the desired Handler to use. The named Handler is found based on its Identifier, and the request is redirected to that Handler.

### 3.88.1. HandlerId

This optional parameter specifies how to derive the Identifier of the Handler to use to handle requests. When a request is received by AuthBy HANDLER, this string will be used to derive a Handler Identifier. If a Handler with that Identifier is found, the request will be redespatched to that Handler. Special characters are supported. Defaults to "handler%{ Request:Called-Station-Id}”.

### 3.89. `<AuthBy WIMAX>`

This clause handles requests from a WiMAX system. It handles, authentication, accounting and DHCP server key distribution. It acts as a Home AAA (HAAA) as per WiMAX End-to-End Network Systems Architecture Stage 2-3 Release 1.1.0 and NWG_R1.1.0-Stage-3.pdf. Answers requests from NAS, HA and DHCP servers.

AuthBy WIMAX requires an SQL database to hold user details (including password), and to cache various keys. WiMAX users must be added to the SQL database before they can be authenticated.

Several types of reply attribute are handled specially by AuthBy WIMAX. If the attribute is present in a reply (perhaps from a user's reply attributes or profile), they will be converted from text format to the binary format required by WiMAX devices.

- **WiMAX-Packet-Flow-Descriptor**
  
  A WiMAX packet flow descriptor. Example:

  ```
  Packet-Data-Flow-ID=01,Service-Data-Flow-ID=1,Direction=Bi-Directional,Transport-Type=IPv4-CS,Activation-Trigger="Activate",Uplink-QoS-ID=1,Downlink-QoS-ID=2
  ```

- **WiMAX-QoS-Descriptor**
  
  A WiMAX QOS descriptor. Example:

  ```
  QoS-ID=1,Media-Flow-Type=Robust-Browser,Schedule-Type=BESTEFFORT,Traffic-Priority=0,Maximum-Sustained-Traffic-Rate=128000
  ```

Sample configuration file, including explanation of supported parameters is available in `goodies/wimax.cfg`. Sample database schema appears in `goodies/wimax.sql` in your Radiator distribution.

### 3.89.1. KeyLifetime

This optional parameter specifies the lifetime for all mobility keys in seconds. Defaults to 3600 (1 hour).

### 3.89.2. HAPassword

This optional parameter specifies the PAP password required for access by a WiMAX HA (Home Agent). If not defined, HA does not have to present a password before its requests are satisfied. If HAPassword is defined, the HA must present a PAP password with an exact match, and the HA must be configured to send this password, otherwise its requests will be REJECTed. Not all HAs are able to send a password with requests to the HAAA, so use of this parameter depends on your HA. Defaults to undefined.
3.89.3. ProfileHotlining

This optional parameter indicates whether to provide profile-based hotlining. If set, and the user has a Hotline Profile ID, the SQL database will be consulted for the Hotline profile, and the contents of the hotline profile id will be returned. Defaults to not set.

3.89.4. RulebasedHotlining

This optional parameter indicates whether to provide rule-based hotlining. If set, and the user has a Hotline Profile ID, the SQL database will be consulted for the Hotline profile, and the contents of the hotline NAS-Filter-Rule will be returned. Defaults to not set.

3.89.5. HTTPRedirectionHotlining

This optional parameter indicates whether to provide HTTP Redirection-based hotlining. If set, and the user has a Hotline Profile ID, the SQL database will be consulted for the Hotline profile, and the contents of the hotline HTTP-Redirection-Rule will be returned. Defaults to not set.

3.89.6. IPRedirectionHotlining

This optional parameter indicates whether to provide IP Redirection-based hotlining. If set, and the user has a Hotline Profile ID, the SQL database will be consulted for the Hotline profile, and the contents of the hotline IP-Redirection-Rule will be returned. Defaults to not set.

3.89.7. MSKInMPPEKeys

Forces the MSK to be encoded in MS-MPPE-Send-Key and MS-MPPE-Recv-Key, as well as the usual WiMAX-MSK reply attributes. This is required by some non-compliant clients, such as some Alcatel-Lucent devices.

3.89.8. GetCachedKeyQuery

SQL query to get the cached keys for a given AAA-Session-ID. Defaults to:

```sql
select sessionid, mip_rk, mip_spi, fa_rk from device_session
where sessionid=?
```

3.89.9. InsertSessionQuery

SQL query to create a new session for a given AAA-Session-ID. Defaults to:

```sql
```

3.89.10. UpdateSessionQuery

SQL query to update a session for a given AAA-Session-ID. Defaults to:

```sql
update device_session set outer_nai=?, nai=?, cui=?, mip_rk=?, mip_spi=?, fa_rk=?, key_expires=? where sessionid=?
```

3.89.11. GetHotlineProfileQuery

SQL query to get hotlining parameters. Defaults to:

```sql
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3.89.12. GetQosProfileQuery

SQL query to get QOS parameters. Defaults to:

```sql
select globalscname, scname, scheduletype, priority, maxsusrate,
minresrate, maxburst, jitter, maxlatency, reducedresources,
flowtype, grantinterval, sdusize, unsolpollinginterval
from qosprofile where id=?
```

3.90. <AuthBy SQLYUBIKEY>

Yubikeys are small USB tokens for one-time password authentication. They are produced by Yubico and are relatively inexpensive. Much of the surrounding technology and sample code is open source. They can support one factor or 2 factor authentication, but not challenge-response. For more information, see Yubico website [https://www.yubico.com/](https://www.yubico.com/)

A Yubikey produces a unique one-time password each time the little button on it is pressed. The interesting thing is that the Yubikey acts like a USB keyboard, so the onetime-password is automatically typed into wherever the keyboard cursor is placed. This means that the user does not have to type in their token code by hand, as with many other tokens. It also means that it can work easily with many existing wired and wireless authentication methods, supplicants, web pages, Radius clients and other applications. The keys work on Windows, Linux, macOS and other platforms.

Each Yubikey has a secret AES key programmed into it in the factory. This secret key can be used to authenticate the key against any of the public services provided by Yubico. In order to use a Yubikey in a 3rd party authentication service such as Radiator, it is necessary to reprogram each token with a new (known) AES secret key, and to record that same key in the Radiator database. See goodies/yubikey.txt for more information about that process.

Yubico provide a number of sample open source programs for managing and authenticating Yubikeys. A typical one is the Yubico Java Server, a YubiKey OTP validation server in Java. This is a Tomcat application which provides an HTTP based web service API for authenticating Yubikeys. It looks up the secret key in a MySQL database and checks whether a Yubikey one-time password is correct.

Radiator now ships with the `<AuthBy SQLYUBIKEY>` module and a sample configuration file in goodies/yubikey.cfg. It supports RADIUS PAP, EAP-One-Time-Password and EAP-Generic-Token-Card protocols.

RAdmin from Open System Consultants also supports Yubikeys, and provides an easy-to-use web-based tool for administering users and Yubikey tokens, including importing, allocating and deallocating tokens to users. 2 factor authentication is also supported in RAdmin. For more information, see RAdmin website [http://www.open.com.au/radmin/](http://www.open.com.au/radmin/).

The design of the `<AuthBy SQLYUBIKEY>` module allows it to be configured to work with a wide range of database schemas, but by default it works with the same schema that comes with the Yubico Java Server mentioned above. This means that you can provide web services API based authentication and Radius authentication for Yubikeys from the one token database.

`<AuthBy SQLYUBIKEY>` can be optionally configured to support or require 2 factor authentication if the token database also contains a static password for each user. In this case, the user types their static password first, followed by a colon (""'), followed by the output from the one-time password token. The user is only authenticated if both the static password and the one-time password are correct. `<AuthBy SQLYUBIKEY>` supports replay attack detection: any attempt to use the same one-time password twice in a row will fail. For example, if the user's static password was 'fred', the resulting password would be something like: 
Radiator does not come with any tools for managing the Yubikey token database. Use RAdmin (for more information, see RAdmin [https://www.open.com.au/radmin/]) or use one of the tools provided by Yubico. It is relatively easy to integrate this with almost any existing user database.

The example configuration file goodies/yubikey.cfg in the Radiator distribution shows the main configuration options. It will work by default with the database schema provided with Yubico Java Server, but can be customised for many other SQL database schemas. It assumes the token ID and secret are in the database in Hex (no spaces) format, and that there is a one-to-one mapping between Yubikeys and users. Other formats and multiple key or multiple user mappings can be supported with custom SQL query parameters.

**Tip**
Radiator can also authenticate Yubikeys against the Yubikey Validation Server. For more information, see Section 3.91. `<AuthBy YUBIKEYVALIDATIONSERVER>` on page 317. Another possibility is to use the Yubikey PAM module and AuthBy PAM.

```<AuthBy SQLYUBIKEY>` supports EAP-OTP and EAP_GTC for use with various EAP compatible devices.

`<AuthBy SQLYUBIKEY>` requires the Auth-Yubikey_Decrypter-0.05 module from CPAN website [http://www.cpan.org/] and the Crypt::Rijndael module, also available from CPAN.

`<AuthBy SQLYUBIKEY>` supports the same parameters as `<AuthBy xxxxxx>`. For more information, see Section 3.31. `<AuthBy xxxxxx>` on page 147. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

### 3.90.1. AuthSelect

Specifies an SQL query that will be used to fetch Yubikey data from the database. Special characters are permitted, and %0 is replaced with the quoted user name, the Token ID in Base64 format in %1, the Token ID in hex format in %2 and the Token ID in modhex format in %3. The result field 0 (secret) is the base64 encoded AES secret for the key. It must be present for the authentication to succeed. All others fields are optional. If field 1 (active) is defined must be 1 else the authentication is rejected. Field 2 (userId) is not currently used. Field 3 (counter) is the key use counter. If defined, it will be used to detect replay attacks, and must be updated by UpdateQuery. Field 4 (session_use) is the session_use counter. Field 5 is currently ignored. The static password field (field 6) contains the users correct static password in any of the formats supported by Radiator including plaintext, {SHA}, {crypt}, {MD5}, {rcrypt}, {mysql}, {mssql}, {ntpassword}, {dechpwd}, {NS-MTA-MD5}, {clear} etc. TranslatePasswordHook is also supported.

The default works with the sample Yubikey database created by db_schema.sql from the YubiKey Validation Server. The default is:

```AuthSelect select secret, active, userId, counter, low, high, NULL from yubikeys where userId=%0```

which assumes that there is a one-to-one mapping between Yubikeys and users. It also assumes the Token ID and AES secret are in Hex (no spaces). You could support multiple tokens per user or multiple user per token with a custom AuthSelect like:

```AuthSelect select secret, active, userId, counter, low, high, NULL from yubikeys where tokenId=%1 and userId=%0```
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3.90.2. UpdateQuery

Specifies SQL query that will be used to store Yubikey token data back to the database after authentication. Special characters are permitted, and %0 is replaced with the new session counter, %1 with the new session_use counter, %2 with 0 (this column not currently used), %3 with the quoted user name, %4 with the quoted token ID in Base64, %5 with the current time (seconds in the unix epoch), %6 with the token ID in Hex and %7 with the token ID in modhex. The default works with the sample Yubikey database created by db_schema.sql from the YubiKey Validation Server. The default is:

```
UpdateQuery update yubikeys set accessed=current_timestamp(), counter=%0, low=%1, high=%2 where userId=%3
```

which assumes that there is a one-to-one mapping between Yubikeys and users. You could support multiple tokens per user or multiple user per token with a custom UpdateQuery like:

```
UpdateQuery update yubikeys set accessed=current_timestamp(), counter=%0, low=%1, high=%2 where tokenId=%4 and userId=%3
```

3.90.3. Require2Factor

Forces all authentications to require 2 factor authentication. In 2 factor authentication, the user is required to enter (as their password) both their static password (also called their PIN) followed by the one-time-password from the Yubikey.

3.90.4. CheckSecretId

If CheckSecretId is set, then check that the secretId fetched from the database matches the secretId encoded in the submitted Yubikey OTP. This increases the security of the Yubikey OTP and is recommended best practice.

3.91. <AuthBy YUBIKEYVALIDATIONSERVER>

This module authenticates YubiKey tokens (yubico.com) against YubiCloud validation service or locally hosted YubiKey Validation Server. This allows flexibility in deciding which validation service or server to use and where to plug in a YubiHSM. This module does not require any YubiKey specific modules because all required work is done by the validation server and possibly by YubiHSM. PyHSM validation server allows using Radiator with YubiHSM (Hardware Security Module) for storing the YubiKey secrets.

Yubico's Validation Server (YK-VAL) and YubiCloud API versions 1.0 and 2.0 are supported. For YubiCloud you should set APIVersion to 2.0 and ClientID to the value assigned to you by Yubico. Configuring APIKey is optional but recommended especially when ValidationServerURL is set to http instead of https. If you run a self hosted YK-VAL, set APIVersion, ClientID and APIKey to match the server configuration.

Yubico's PyHSM validation server and its one line response format is also supported. Yubico's PyHSM validation server yhsm-val supports Yubico OTP, OATH-HOTP and OATH-TOTP.

See a sample configuration file goodies/yubikey-validationserver.cfg for two-factor, single factor and EAP configuration examples.

AuthBy YUBIKEYVALIDATIONSERVER understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.91.1. ValidationServerURL

The URL for Yubikey Validation server. OTP protocol specific part will be appended to the ValidationServerURL. Defaults to http://127.0.0.1:8003/yhsm/validate which is compatible with Yubico's PyHSM validation server yhsm-val.
HTTPS requires LWP::Protocol::https Perl module. If it's not installed, Radiator will log an error without connecting to the server.

```bash
# Use Yubico's service over HTTPS
ValidationServerURL https://api.yubico.com/wsapi/2.0/verify?
```

### 3.91.2. OTPProtocol

This is a comma separated list of OTP protocols Radiator is allowed to support. The possible values are:

- YubicoOTP
- OATH-HOTP
- OATH-TOTP

OATH protocols **OATH-HOTP** and **OATH-TOTP** are only supported by PyHSM validation server. Default value is **YubicoOTP**.

```bash
# We use PyHSM validation server and can support HOTP too
OTPProtocol YubicoOTP, OATH-HOTP
```

### 3.91.3. APIVersion

This is a comma separated list of OTP protocols Radiator is allowed to support. The possible values are:

- `yk-ksm`
- `1.0`
- `2.0`

For YubiCloud you should set **APIVersion** to **2.0** and **ClientID** to the value assigned by Yubico. **APIVersion** defaults to **yk-ksm** which requires PyHSM validation server `yk-val` that runs with `--short-otp` parameter.

```bash
# YubiCloud supports version 2.0 API
APIVersion 2.0
```

### 3.91.4. ClientID

ClientID is required for signed requests and responses. Yubico allocates this for YubiCloud users and seems to always require it when using YubiCloud validation servers.

There is no default value.

```bash
# Value allocated to us by Yubico
ClientID 1
```

### 3.91.5. APIKey

APIKey is required for signing requests and responses. It is allocated for a **ClientID** and specified in Base64 format. When this parameter is non-empty, requests are signed and a valid signature is required in responses. Special formatting characters are allowed.

There is no default value.

```bash
# Value allocated to us by Yubico
```
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3.91.6. OTPCharset

`OTPCharset` allows limiting and changing the characters allowed in OTPs. Defaults to `0-9cbdefghijklnrtuv` which allows OATH and Yubico OTPs. The value of the parameter is a Perl character set specification. See your Perl reference manual for details about how to construct Perl character set specifications. Note that some special characters must be escaped with a backslash.

```bash
# Allow Yubico OTPs only
OTPCharset cbdefghijklnrtuv
```

**Note**

If you need to support non-standard keyboard layouts, such as Dvorak, you may need to change `OTPCharset`.

3.91.7. Timeout

Connection timeout in seconds. Defaults to 3.

3.91.8. SSLVerify

May be used to control how the Yubikey Validation Server's certificate will be verified. May be one of "none" or "require".

3.91.9. SSLCAPath

When verifying the XML Yubikey Validation Server's certificate, set this to the pathname of the directory containing CA certificates. These certificates must all be in PEM format. The directory in must contain certificates named using the hash value of the certificates' subject names.

3.91.10. SSLCAFile

Use this option to locate the file containing the certificates of the trusted certificate authorities. Thus, you can verify that the server certificate has been signed by a reputable certificate authority. Special characters are permitted.

Here is an example of using `SSLCAFile`:

```bash
SSLCAFile %D/certificates/demoCA/cacert.pem
```

3.92. `<AuthBy SQLHOTP>`

This module supports authentication using HOTP (RFC 4226) authentication. HOTP is an open specification for event-based one time passwords, developed by OATH [https://openauthentication.org/].

HOTP is an event-based authentication protocol, and is designed for use in time-based 2 factor tokens and other similar authentication processes. It uses the well-known SHA-1 hash function, along with a secret key and an incrementing counter. The specification is completely open and free and is the result of community collaboration with OATH.

The `<AuthBy SQLHOTP>` authentication module detects replay and brute-force attacks. It supports optional PIN/static password for 2 factor authentication when the user prefixes their static password before the HOTP
one-time password. It requires Digest::HMAC::SHA1, which is part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

The secret key, current counter and others are stored in a SQL database. Any database supported by Radiator can be used. A sample configuration file and SQL schema for MySQL are supplied in the goodies/ directory of your Radiator distribution.

<AuthBy SQLHOTP> supports the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

3.92.1. AuthSelect

AuthSelect is an SQL query that fetches HOTP data from the SQL database. It is passed the user name in %0. It is expected to return (secret, active, userId, counter, staticpassword) Field 0 (secret) is the HEX encoded secret key for the token. It must be present for the authentication to succeed (Mandatory). Fields 1 and 2 are the counter high and low parts respectively (Mandatory). All following fields are optional:

- If field 3 (active) is defined is must be 1 else the authentication is rejected.
- Field 4 (pin) is the users static PIN It will be checked if the user specifies a static password or if Require2Factor is set.
- Field 5 (digits) is the number of digits in the users HOTP code. If NULL the value of DefaultDigits will be used.
- Field 6 (bad_logins) counts the number of consecutive authentication failures. If defined it will be used to detect brute force attacks and must be updated by UpdateQuery.
- Field 7 (last_time_accessed) is the unix timestamp of the last authentication attempt. It is used to detect brute force attacks.

The default works with the sample database schema provided in goodies/hotp.sql. The default is:

```sql
select secret, counter_high, counter_low, active, pin, digits, bad_logins, unix_timestamp(accessed) from hotpkeys where username=%0
```

3.92.2. UpdateQuery

UpdateQuery is an SQL query that updates the HOTP data in the SQL database. After a successful authentication it will be passed the new authentication counter high in %0, new authentication counter low in %1, bad login count in %2, the user name in %3. The default works with the sample database schema provided in goodies/hotp.sql. The default is:

```sql
update hotpkeys set accessed=now(), counter_high=%0, counter_low=%1, bad_logins=%2 where username=%3
```

3.92.3. Require2Factor

If Require2Factor is set, then the user must provide their static password as a prefix to their HOTP one-time password. The correct static password is retrieved from 4th field returned by AuthSelect. If this flag is not set, but the user provides a static password prefix, then the static password will be checked anyway.

3.92.4. DefaultDigits

DefaultDigits specifies the number of HOTP digits to use if the user record does not define digits. Defaults to 6.
### 3.92.5. MaxBadLogins

MaxBadLogins specifies how many consecutive bad PINs or bad HOTP codes will be tolerated in the last BadLoginWindow seconds. If more than MaxBadLogins bad authentication attempts (according to field 5 from AuthSelect occurs and if the last one is within the last BadLoginWindow seconds (according to field 6 from AuthSelect), the authentication attempt will be rejected. The user must wait at least BadLoginWindow seconds before attempting to authenticate again. MaxBadLogins defaults to 10.

### 3.92.6. BadLoginWindow

Period of time in seconds that the user will be locked out after MaxBadLogins have occurred.

### 3.92.7. ResyncWindow

ResyncWindow Maximum number of missing authentications that will be tolerated for counter resynchronisation. Defaults to 20.

### 3.93. <AuthBy SQLTOTP>

This module supports authentication using TOTP (RFC 6238) authentication. TOTP is an open specification for time-based one time passwords, developed by UATH [https://openauthentication.org/](https://openauthentication.org/)

TOTP is a time-based authentication protocol, and is designed for use in time-based 2 factor tokens and other similar authentication processes. It uses the well-known SHA-1, SHA-256 or SHA-512 hash function, along with a secret key and a timestamp. The specification is completely open and free and is the result of community collaboration with OATH.

The `<AuthBy SQLTOTP>` authentication module detects replay and brute-force attacks. It supports optional PIN/static password for 2 factor authentication when the user prefixes their static password before the TOTP one-time password.

The secret key, PIN and such are stored in a SQL database. Any database supported by Radiator can be used. A sample configuration file and SQL schema for MySQL are supplied in the goodies directory of your Radiator distribution.

Tip

Correct operation of time based authentication tokens such as TOTP requires accurate synchronisation of the clocks on the client and Radiator server computers.

`<AuthBy SQLTOTP>` supports the same parameters as `<AuthBy xxxxxx>`. For more information, see Section 3.31. `<AuthBy xxxxxx>` on page 147. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

### 3.93.1. AuthSelect

AuthSelect is an SQL query that fetches TOTP data from the SQL database. It is passed the user name in %0. It is expected to return (secret, active, userId, counter, staticpassword). Field 0 (secret) is the HEX encoded secret key for the token. It must be present for the authentication to succeed (Mandatory).

- If field 1 (active) is defined is must be 1 else the authentication is rejected.
- Field 2 (pin) is the user’s static PIN. It will be checked if the user specifies a static password or if Require2Factor is set.
• Field 3 (digits) is the number of digits in the user's TOTP code. If NULL the value of DefaultDigits will be used.

• Field 4 (bad_logins) counts the number of consecutive authentication failures. If defined it will be used to detect brute force attacks and must be updated by UpdateQuery.

• Field 5 (last_time_accessed) is the unix timestamp of the last authentication attempt. It is used to detect brute force attacks.

• Field 6 is the last TOTP timestep validated, which should be updated automatically by UpdateQuery.

• Optional field 7 (algorithm) is the SHA algorithm which defaults to SHA1 if the value is NULL or empty.

• Optional field 8 (timestep) is the user's time step which defaults to the TimeStep configuration parameter if the value is 0 or NULL.

• Optional field 9 (timestep_origin) is the Unix epoch time of the first time step which defaults to TimeStepOrigin configuration parameter if the value is NULL.

The default works with the sample database schema provided in goodies/totp.sql. The default is:

```
select secret, active, pin, digits, bad_logins, unix_timestamp(accessed), last_timestep from totpkeys where username=%0
```

### 3.93.2. UpdateQuery

UpdateQuery is an SQL query that updates the TOTP data in the SQL database. After a successful authentication it will be passed the bad login count in %0, the user name in %1. The default works with the sample database schema provided in goodies/totp.sql. The default is:

```
update totpkeys set accessed=now(), bad_logins=%0 where username=%1
```

### 3.93.3. Require2Factor

If Require2Factor is set, then the user must provide their static password as a prefix to their HOTP one-time password. The correct static password is retrieved from 4th field returned by AuthSelect. If this flag is not set, but the user provides a static password prefix, then the static password will be checked anyway.

### 3.93.4. DefaultDigits

DefaultDigits specifies the number of HOTP digits to use if the user record does not define digits. Defaults to 6.

### 3.93.5. MaxBadLogins

MaxBadLogins specifies how many consecutive bad PINs or bad HOTP codes will be tolerated in the last BadLoginWindow seconds. If more than MaxBadLogins bad authentication attempts (according to field 5 from AuthSelect occurs and if the last one is within the last BadLoginWindow seconds (according to field 6 from AuthSelect), the authentication attempt will be rejected. The user must wait at least BadLoginWindow seconds before attempting to authenticate again. MaxBadLogins defaults to 10.

### 3.93.6. BadLoginWindow

Period of time in seconds that the user will be locked out after MaxBadLogins have occurred.

### 3.93.7. DelayWindow

DelayWindow is the maximum number of timeslots transmission delay that can be permitted between the client and server. Defaults to 1 (the value recommended by the TOTP specification).
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3.93.8. TimeStep

TimeStep is the size of the time step in seconds to use if the user record does not define time step. Defaults to 30 seconds (the value recommended by the TOTP specification).

3.93.9. TimeStepOrigin

TimeStepOrigin the Unix epoch time of the first time step to use if the user record does not define the origin. Defaults to 0 seconds (Jan 1, 1970) the value recommended by the TOTP specification.

3.94. <AuthBy SQLAUTHBY>

This clause does an SQL lookup for each incoming request to determine the actual Radiator AuthBy Clause to use to handle the request. If the resulting Radiator clause has not previously been used, it is created using parameters retrieved from SQL and the request is given to it for authentication or other handling. If the resulting Radiator clause has been used previously, it is reused and the request is sent to it.

Any database supported by Radiator can be used. A sample configuration file is supplied in the goodies/ directory of your Radiator distribution.

<AuthBy SQLAUTHBY> supports the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

3.94.1. AuthBySelect

AuthBySelect is the SQL query used to retrieve AuthBy clause configuration parameters based on the user's realm. The clause is cached for reuse. You can use AuthBySelectParam to bind variables to the AuthBySelect query. %0 is replaced with SQL quoted realm when no AuthBySelectParam are configured.

The default value is:

```
AuthBySelect select HOST, PORT, AUTHDN, AUTHPASSWORD, BASEDN, USERNAMEATTR, PASSWORDATTR, HOLDSERVERCONNECTION from RADSQLAUTHBY where TARGETNAME=%0
```

This is suitable for an AuthBy LDAP2 clause.

3.94.2. AuthBySelectParam

This optional parameter specifies a bind variable to be used with AuthBySelect. Unquoted realm is available as %0. For more information, see Section 3.8.1. SQL bind variables on page 45.

Here is an example of using AuthBySelectParam:

```
AuthBySelect select HOST, PORT, AUTHDN, AUTHPASSWORD, BASEDN, USERNAMEATTR, PASSWORDATTR, HOLDSERVERCONNECTION from RADSQLAUTHBY where TARGETNAME=?
AuthBySelectParam %0
```

3.94.3. Class

This parameter defines the type of Radiator AuthBy clause to create. The class name is the type of AuthBy clause to create. For example

```
Class LDAP2
```

will cause <AuthBy SQLAUTHBY> to create clauses of type <AuthBy LDAP2>. Defaults to ‘LDAP2’.
3.94.4. DefaultParam

DefaultParam sets a default value for any clause parameter, which may be overridden with a column from the SQL query using ParamColumnDef.

<table>
<thead>
<tr>
<th>DefaultParam RewriteUsername s/^[^@]+.*/$1/</th>
</tr>
</thead>
<tbody>
<tr>
<td>DefaultParam Version 3</td>
</tr>
</tbody>
</table>

3.94.5. ParamColumnDef

Maps the columns returned by AuthBySelect to parameter names in the target clause. If non-NULL, each will override the corresponding default value given by DefaultParam.

<table>
<thead>
<tr>
<th>ParamColumnDef 0,Host</th>
</tr>
</thead>
<tbody>
<tr>
<td>ParamColumnDef 1,Port</td>
</tr>
<tr>
<td>ParamColumnDef 2,AuthDN</td>
</tr>
<tr>
<td>ParamColumnDef 3,AuthPassword</td>
</tr>
</tbody>
</table>

3.95. <AuthBy HEIMDALDIGEST>

This clause authenticates users against Heimdal Kerberos, using the kdigest program part of Heimdal Kerberos. For more information, see Heimdal website [http://www.h5l.org/].

Works with RADIUS-PAP, EAP-MD5, EAP-MSCHAPV2 (and therefore TTLS-PAP, TTLS-EAP-MD5, PEAP-EAP-MD5, PEAP-EAP-MSCHAPV2, TTLS-EAPMSCHAPV2).

Other types of authentication cannot be supported by Heimdal for technical reasons.

AuthBy KRB5 for a module that can work with any Kerberos, but is limited to PAP and TTLS-PAP. For more information, see Section 3.72. <AuthBy KRB5> on page 270

See goodies/heimdaldigest.cfg for an example configuration file. See goodies/heimdal.txt for guidance and help in setting up a simple Heimdal system for testing.

<AuthBy HEIMDALDIGEST> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.95.1. KdigestPath

The path to the executable Heimdal kdigest program. This program will be run externally by AuthBy HEIMDALDIGEST to authenticate each password.

Defaults to /usr/libexec/kdigest.

| KdigestPath /usr/heimdal/lib/kdigest |

3.95.2. KdigestSuffix

String that will be added to the end of each user name before authenticating with kdigest. Defaults to empty string. See also default_realm in krb5.conf, which will be used if user name does not contain a Kerberos realm.

| KdigestSuffix @MYCOMPANY.COM |

3.95.3. KdigestRealm

String specifying the Kerberos realm that will be used to authenticate each user. Used to specify --kerberos-realm= to kdigest. Defaults to undefined.
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3.96. <AuthBy SIP2>

This clause authenticates users with 3M Standard Interchange Protocol 2 as used in 3Ms Automated Circulation Systems (ACS) for book libraries. AuthBy SIP2 supports TCPIP connection to 3M ACS systems, and authenticates against library patron name and password.

Works with EAP-GTC and PAP and therefore with e.g. EAP-TTLS/PAP. See goodies/sip2.cfg for an example configuration file.

**Tip**

SIP2 is not related to Session Initiation Protocol (SIP) used for Voice Over IP and other multimedia applications.

<!-- Insert code here -->

<AuthBy SIP2> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147.

3.96.1. Port

Port specifies the TCP port name or number of the ACS server. Defaults to 6001.

3.96.2. Host

Host specifies the name or address of the ACS server. Defaults to localhost.

3.96.3. Delimiter

The field delimiter ACS server uses. Defaults to "|".

3.96.4. Timeout

Timeout interval in seconds that Radiator will wait for when trying to contact the SIP2 server. Defaults to 3.

3.96.5. Retries

This is an integer that specifies the number of times Radiator tries to send a request and wait for the reply from the SIP2 server before disconnecting and initiating possible failure backoff. The default value is 3.

If the SIP2 server returns its desired reply count and this reply count is smaller than the Retries value, the server's desired value is used.

3.96.6. FailureBackoffTime

This is an optional integer that specifies for how long time a failed SIP2 server is marked as failed. If no reply is received from the requested SIP2 server after all retries are used, the server is marked as failed. It is not connected again until FailureBackoffTime has been expired. The unit is seconds and the default value is 0, which means that the server is never marked as failed and always expected to be working.

3.96.7. LoginUserID

User ID that Radiator will use to log into the ACS server. If this is defined as an empty string, then the login phase will not be performed. You need to be sure that this matches what the SIP2 server expects from clients. Many servers do not require a login phase. Defaults to ‘scclient’.
# LoginUserID is empty to skip the login phase
LoginUserID

## 3.96.8. LoginPassword

Password that Radiator will use to log into the ACS server. Defaults to ‘clientpwd’.

LoginPassword clientpwd

## 3.96.9. LocationCode

Location code that Radiator will use to log into the ACS server. Defaults to ‘Radiator’.

## 3.96.10. TerminalPassword

Terminal Password that Radiator will use to log into the ACS server. Not all installations require this.

TerminalPassword terminal password

## 3.96.11. SendChecksum

This optional flag tells Radiator to send checksums in every request sent to ACS. This must agree with the configuration of the ACS and defaults to off.

# This ACS requires sending checksums
SendChecksum

## 3.96.12. VerifyChecksum

Tells Radiator to verify checksums sent by ACS are present and correct. This must agree with the configuration of the ACS and defaults to off.

# We want to verify the checksums this ACS sends
VerifyChecksum

## 3.96.13. SIP2Hook

Perl hook that is run for each request handled by SIP2. This hook can be used for further authorisation checks. The hook is passed the following arguments:

- Reference to the current AuthBy SIP2 object
- Response received from the ACS
- Reference to the current request

The hook return value must be one of:

- `$main::ACCEPT`
- `$main::REJECT`
- `$main::IGNORE`
- `$main::CHALLENGE`
- `$main::REJECT_IMMEDIATE`
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**Note**
When the optional parameter NoCheckPassword is enabled, the hook return value determines the authentication result. See goodies/sip2hook.pl for an example.

SIP2Hook file:"%D/sip2hook.pl"

### 3.97. `<AuthBy DUO>`

This clause authenticates users against two-factor authentication provided by Duo Security Auth API. `<AuthBy DUO>` requires Perl modules `HTTP::Async` 0.19 or later and `Net::HTTPS::NB`. For more information, see Duo website [https://duo.com/]

To get started you need to sign up for a Duo account and create a new Auth API integration. Duo Security will then generate your API Hostname, integration key and secret key which are used to set up Radiator configuration.

See goodies/duo.cfg for an example configuration file and examples of how to combine the password and password factor (see Section 3.97.2. DefaultFactor on page 327) for controlling how two-factor authentication is done. See goodies/duosim.cgi for setting up a partial authentication API simulator for testing.

`<AuthBy DUO>` understands also the same parameters as `<AuthBy xxxxxx>`. For more information, see Section 3.31. `<AuthBy xxxxxx>` on page 147.

#### 3.97.1. Hostname, SecretKey and IntegrationKey

API Hostname, secret key, and integration key are assigned by Duo. These are mandatory parameters and there are no default values. SecretKey and IntegrationKey support special formatting characters. The formatting is done once during the module activation.

Hostname api-aabbcczz.duosecurity.com

SecretKey aaaaabbbbbccccddedddeeeeffffggghhhhiiiiijjjjj

IntegrationKey kkkllllllmmmmnnnoooo

#### 3.97.2. DefaultFactor

If the user does not specify a valid password or factor, this will be the factor requested from Duo. May be one of "push", "sms", "phone", "auto". Defaults to "auto".

DefaultFactor push

#### 3.97.3. PreAuth

This optional flag specifies whether a pre-authentication is done for the user. Default is to do pre-authentication.

Duo security Auth API `/preauth` endpoint determines if the user is authorised to log in and returns the available authentication factors for the authorised user.

```bash
# Turn off pre-authentication
PreAuth no
```
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3.97.4. Address

Address specifies what details in the incoming request will be used in the 'Address' field sent to Duo. The contents of the field will show up in the Duo logs. It does not actually have to be an address (which in any case is not usually available until after authentication is complete), and the default of Calling-Station-Id might be a sensible option.

Address %{Calling-Station-Id}

3.97.5. SSLVerify, SSLCAFile and SSLCAPath

The SSL* parameters allow controlling how the Duo server's certificate is verified. By default no SSL* parameters are set and the system defaults are used. SSLVerify, SSLCAFile and SSLCAPath behave as described in <AuthBy IMAP>. For more information, see Section 3.62. <AuthBy IMAP> on page 244.

3.97.6. SSLVerifyCNName and SSLVerifyCNScheme

SSLVerifyCNName sets the name which is used when verifying the hostname against the certificate presented by Duo's server. SSLVerifyCNScheme controls how the verification is done, for example, if wildcards are allowed. For more information, see IO::Socket::SSL [http://search.cpan.org/perldoc/IO::Socket::SSL].

The following allow wildcard certificate name *.duosecurity.com to match.

SSLVerifyCNName duosecurity.com
SSLVerifyCNScheme http

3.97.7. SSLCertificateVerifyHook

Further certificate checks can be added with a custom hook. For more information, see SSL_verifycn_name [http://search.cpan.org/~sullr/IO-Socket-SSL-2.036/lib/IO/Socket/SSL.pod#SSL_verifycn_name]. The hook should return 0 or 1 for fail and pass respectively. The hook is called once for each certificate in the certificate chain.

The following arguments are passed to the hook:

- $_[0] is a true or false value indicating what OpenSSL’s view of the cert.
- $_[1] is a C-style memory address of the certificate store.
- $_[2] is a string containing certificate's issuer and owner.
- $_[3] is a string containing any errors encountered or 0 if there were no errors.
- $_[4] is a C-style memory address of current certificate in the chain.

3.97.8. PollTimerInterval

Number of seconds between checking for replies from the Duo Auth API server. Defaults to 1 second.

3.97.9. CheckTimerInterval

Number of seconds between checking that the Duo Auth API server is alive and responding. When set to 0, checks are disabled. Defaults to 5 seconds.

# Use one minute alive check interval
CheckTimerInterval 60
3.97.10. Slots

Specifies the maximum number of simultaneous requests outstanding to the Auth API server, and the maximum number of HTTP connections to the server. If more than this number of requests are waiting, then subsequent requests will be queued and sent after a reply a received from an outstanding request. Defaults to 20.

3.97.11. Timeout

Specifies the maximum number of seconds to wait for the start of a reply from the Auth API server. The Auth API server can take up to 60 seconds to reply. Default is 100 seconds. You should not need to change this.

3.97.12. MaxRequestTime

Specifies the maximum number of seconds to wait for a complete reply from the Auth API server. The Auth API server can take up to 60 seconds to reply. Default is 120 seconds. You should not need to change this.

3.97.13. Failmode

This optional parameter specifies whether to reject, accept, or ignore authentication when Duo API is not available or Duo API call times out. Default is to ignore. The possible values are:

- accept
- ignore
- reject

```
# Reject, instead of ignore, when timeout occurs
Failmode reject
```

3.97.14. ProxyHost

Specifies the name of a HTTP proxy to use to contact the Auth API server. The default is not to use any proxy.

3.97.15. ProxyPort

Specifies the port on the ProxyHost to use to contact the Auth API server.

3.97.16. EndpointPrefix

The prefix for the Auth API. Defaults to /auth/v2. You should not need to change this. See goodies/duo.cfg for how to set EndpointPrefix when using the Auth API simulator duosim.cgi.

3.97.17. Protocol

The protocol to use to connect to the Auth API server. Defaults to https. Usually there is no need to change this.

3.98. <AuthBy DIAMETER>

<AuthBy DIAMETER> converts and forwards all RADIUS authentication and accounting messages to another (possibly remote) DIAMETER server. The DIAMETER replies are converted back to RADIUS messages and returned to the requesting client which might be a remote client or this Radiator instance itself.

The default for <AuthBy DIAMETER> is to advertise values 0 and 1 (Diameter common message and NASREQ) with Auth-Application-Id. Value 3 (Diameter base accounting) is advertised with Acct-Application-Id.
See goodies/diameter-authby.cfg for an example configuration file.

<AuthBy DIAMETER> understands also the same parameters as <AuthBy xxxxxx>. For more information, see Section 3.31. <AuthBy xxxxxx> on page 147. <AuthBy DIAMETER> supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

3.98.1. Peer

Name or IP address of DIAMETER peer this AuthBy DIAMETER should connect to.

Note
Currently only one Peer is supported.

3.98.2. SCTPPeer

This parameter specifies one host name or address of an SCTP peer to connect to. An address can be an IPv4 or IPv6 address. Multiple SCTPPeer parameters are supported. When SCTPPeer is defined, it is used instead of Host or Peer parameters. Special formatting characters are supported. If SCTP multihoming is not supported, connection is attempted to each peer at a time.

When SCTP multihoming is supported, connection is attempted to all peers at once. In this case, all addresses defined with SCTPPeer must be either IPv4 or IPv6 addresses

Here is an example of using SCTPPeer:

```
# Peer has multiple IPv6 addresses
SCTPPeer 2001:db8:1500:1::a100
SCTPPeer 2001:db8:1500:2::a100
```

3.98.3. Port

This optional parameter specifies port name or number of the Diameter peer. Defaults to 3868, the official IANA port number for Diameter. May be a numeric port number or symbolic port/service name.

3.98.4. DestinationHost

If DestinationHost is unset, no Destination-Host attribute is added to Diameter messages. Setting DestinationHost is optional and there is no default value. Special formatting characters are supported. Formatting is done when the configuration is loaded and <AuthBy DIAMETER> clause is activated.

3.98.5. DestinationRealm

This optional parameter sets the Destination-Realm attribute in the Diameter messages sent to the peer. Destination-Realm is first taken from User-Name's realm part. If there is no realm, then DestinationRealm configuration parameter is used. The default is testdestinationrealm. Special formatting characters are supported. Formatting is done when the configuration is loaded and <AuthBy DIAMETER> clause is activated.

3.98.6. OriginHost

This parameter specifies the name that AuthBy DIAMETER will use to identify itself to Diameter peer it connects to. It is sets the value of the Origin-Realm attribute in the Diameter messages sent to the peer. OriginHost is not optional an must be specified in the AuthBy DIAMETER clause. Diameter peers may use OriginHost to determine whether they have connected to the correct peer, so it may be critical that it
be configured correctly. OriginHost defaults to the hostname of the server Radiator is running on. Special formatting characters are supported. Formatting is done when the configuration is loaded and AuthBy DIAMETER clause is activated.

### 3.98.7. OriginRealm

This parameter specifies the name of the user Realm that AuthBy DIAMETER is willing to handle. It is sets the value of the Origin-Realm attribute in the Diameter messages sent to the peer. OriginRealm is not optional an must be specified in the AuthBy DIAMETER clause. OriginRealm defaults to ‘testoriginrealm’. Special formatting characters are supported. Formatting is done when the configuration is loaded and AuthBy DIAMETER clause is activated.

### 3.98.8. PostDiaToRadiusConversionHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PostDiaToRadiusConversionHook is called after an incoming Diameter request has been converted to its equivalent RADIUS request, allowing you to alter or add to attribute conversions etc. It is passed references to the incoming Diameter request and the converted RADIUS request.

### 3.98.9. PostRadiusToDiaConversionHook

This optional parameter allows you to define a Perl function that will be called during packet processing. PostRadiusToDiaConversionHook is called after an RADIUS reply has been converted to its equivalent Diameter reply, prior to being sent back to the Diameter client. It is passed references to the RADIUS reply and the converted Diameter reply.

### 3.98.10. EAP_ApplicationId

`EAP_ApplicationId` defines the Diameter message's Application-ID value and Auth-Application-Id AVP value for the converted RADIUS EAP requests. The default is to convert RADIUS EAP authentication to Diameter EAP application. This parameter allows, for example, converting RADIUS EAP-AKA to Diameter 3GPP SWm. `EAP_ApplicationId` defaults to value Diameter-EAP. For more information, see configuration sample goodies/diameter-authby.cfg

```bash
# We can convert EAP-AKA to SWm
EAP_ApplicationId 3GPP SWm
```

### 3.98.11. Protocol

This optional parameter specifies which Stream protocol will be used to carry Diameter. Options are ‘tcp’ for TCP/IP or ‘sctp’ for SCTP (Stream Control Transmission Protocol). Defaults to ‘tcp’. Not all hosts are able to support ‘sctp’ consult your vendor. The protocol setting must be the same as that being used by the Diameter server.

```bash
Protocol sctp
```

### 3.98.12. AuthApplicationIds

This optional parameter allows you to define the Auth Application Ids announced in CER. Defaults to ‘0, 1, 5’ (i.e. DIAMETER BASE, NASREQ and Diameter-EAP).

```bash
AuthApplicationIds 0, 1
```
3.98.13. AcctApplicationIds

This optional parameter allows you to define the Acct Application Ids announced in CER. Defaults to ‘3’ (i.e. BASE_ACCOUNTING).

```
AcctApplicationIds 3
```

3.98.14. SupportedVendorIds

This optional parameter allows you to define the Supported Vendor Ids announced in CER. There is no default and no Supported-Vendor-Id is announced by default. Keyword "DictVendors" is an alias group for all vendors in the default dictionary and the dictionary file configured with DiameterDictionaryFile.

```
# Tell the peer we support all the vendors in our
# default and DiameterDictionaryFile dictionaries
SupportedVendorIds DictVendors
```

3.98.15. LocalAddress and LocalPort

These parameters control the address and optionally the port number used for the client source port, although this is usually not necessary. LocalPort is a string, it can be a port number or name. It binds the local port if LocalAddress is defined. If LocalPort is not specified or if it is set to 0, a port number is allocated in the usual way.

When SCTP multihoming is supported, multiple comma separated addresses can be configured. All addresses defined with LocalAddress must be either IPv4 or IPv6 addresses.

```
LocalAddress 203.63.154.29
LocalPort 12345
```

3.98.16. ReconnectTimeout

This optional parameter specifies the number of seconds to wait before attempting to reconnect a failed, dropped or disconnected Diameter connection. It also specifies the timeout for the initial connect.

3.99. <AuthBy RATELIMIT>

AuthBy RATELIMIT allows to limit the maximum number of requests per second that will be served. When the rate is exceeded, the requests will be ignored by default.

3.99.1. MaxRate

Number of requests per second that will be accepted. Defaults to 0 which means no limit.

3.99.2. MaxRateResult

Result to use when MaxRate is exceeded. Possible values are ACCEPT, REJECT, IGNORE and CHALLENGE. Defaults to IGNORE.

3.100. <AuthBy GOSSIP>

<AuthBy GOSSIP> module supports authentication and authorisation against a Gossip backend, such as GossipUDP and GossipREDIS. For more information, see Section 3.135. <GossipUDP> on page 402 and Section 3.134. <GossipRedis> on page 400. <AuthBy GOSSIP> is currently experimental and will be documented later.
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3.100. Gossip

This defines the Gossip module to use for backend queries.

```xml
<GossipUDP>
    Identifier gossip-udp
    # GossipUDP parameters
</GossipUDP>

<AuthBy GOSSIP>
    # Use GossipUDP for authentication
    Gossip gossip-udp
    # AuthBy GOSSIP parameters
</AuthBy>
```

3.101. <AuthBy DYNAUTH>

<AuthBy DYNAUTH> builds RFC 5716 Disconnect-Request and CoA-Request messages and dispatches them to Handlers. The dispatched dynauth requests can be matched with <Handler DynAuthRequest=1>. This Handler typically uses <AuthBy RADIUSBYATTR> for forwarding the newly built dynauth requests to the NAS based on the dynauth request contents. The dynauth responses will be handled by <AuthBy DYNAUTH>.

<AuthBy DYNAUTH> can optionally register itself with Gossip to receive requests from, for example, remote management to send dynauth messages pertaining to the online users. <AuthBy DYNAUTH> works with <SessionDatabase REDIS> to share session information between Radiator instances and user management. For more information about Gossip and <SessionDatabase REDIS>, see Section 11. Using Gossip framework on page 466 and Section 3.18. <SessionDatabase REDIS> on page 112.

<AuthBy DYNAUTH> is currently experimental and will be documented later.

3.101.1. NasAddrAttribute

This is a list of attributes in request that contains NAS IP address to which dynauth Radius requests are sent. Value of last present attribute is used. Special formatting characters are supported when configured as NasAddrAttribute value, formatted with %0 replaced by NAS IP address.

```xml
# NAS-IP-Address can be used to reach our NASes for dynauth
NasAddrAttribute NAS-IP-Address
```

3.101.2. SessionCheck

This is a list of session attributes to check. The format is: `SessionCheck sessionattribute,comparator,value[,formatted]`. Supported comparators are `eq`, `ne`, `ge`, and `le`.

```xml
# See that the user still has quota
SessionCheck user_quota,ne,0
```

3.101.3. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- Client clause

  `PreHandlerHook` is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.
• AuthBy clause

The functionality depends on the used EAP authentication type:

– PEAP, EAP-TTLS, EAP-FAST

PreHandlerHook specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.

– LEAP

If EAP_LEAP_MSCHAP_Convert flag is set, PreHandlerHook specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

– EAP-MSCHAPv2

If EAP_PEAP_MSCHAP_Convert flag is set, PreHandlerHook specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

– EAP-GTC

If EAP_GTC_PAP_Convert flag is set, PreHandlerHook specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

• AuthBy DYNAUTH clause

PreHandlerHook is called for each request created by the clause before the request is passed to a Realm or Handler clause.

• ServerRADSEC clause

PreHandlerHook is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

• ServerDIAMETER clause

PreHandlerHook is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

• ServerTACACSPLUS clause

PreHandlerHook is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's PreHandlerHook is run before ServerTACASPLUS's PreHandlerHook. Global and per-Client user name rewriting and other processing is done before the hooks are run.

A reference to the request is passed as the only argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (\) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

PreHandlerHook can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using PreHandlerHook:

```perl
# Fake a new attribute into the request
PreHandlerHook sub { ${$_[0]}->add_attr('test-attr', '
  'test-value');}
```
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3.102. <AuthBy RADIUSBYATTR>

/AuthBy RADIUSBYATTR> sends a RADIUS message to remote RADIUS peers based on the attributes defined in the message. This AuthBy can be used for proxying to RADIUS servers or sending RFC 5176 dynauth requests to RADIUS clients. The dynauth requests are typically created by <AuthBy DYNAUTH>. For more information, see Section 3.101. <AuthBy DYNAUTH> on page 333.

/AuthBy RADIUSBYATTR> is a subclass of <AuthBy RADIUS> and handles retransmissions automatically.

/AuthBy RADIUSBYATTR> is currently experimental and not fully documented.

3.102.1. HostsInfoAttribute

This attribute contains Host information in a request. The default is the pseudo-attribute RadiusHosts. If the attribute name is empty, HostParamDef values are used instead. For more information, see Section 3.102.2. HostParamDef on page 335. Format for the attribute value is below. The value must be on one line:

```
host1,secret,authport,acctport,dynauthport,dynauthsecret;
host2,secret,authport,acctport,dynauthport,dynauthsecret
```

Here is an example of using HostsInfoAttribute:

```
# Get the next hop host info from HostParmDef parameters
HostsInfoAttribute
```

3.102.2. HostParamDef

This is a list of parameter definitions for Radius Hosts. Format is: HostParamDef hostkeyword,radiusattributename[,defaultvalue]

```
# Set some parameters for sending from pseudo attributes in the request
HostParamDef Retries,x-retries,1
HostParamDef RetryTimeout,x-retry-timeout,2
```

3.102.3. <Host xxxxxxx> within <AuthBy RADIUSBYATTR>

This clause can be used to specify the name and details of RADIUS peers inside <AuthBy RADIUSBYATTR>. The <Host xxxxxxx> clause further allows you to customise details for individual peers. <AuthBy RADIUSBYATTR> permits one or more Host clauses.

In the <Host xxxxxxx> clause header, the xxxxxxx is the Host name or IP address of the remote RADIUS peer to proxy to. The Host name can contain special formatting characters, which are resolved at startup. Here is an example of using Host clause within <AuthBy RADIUSBYATTR>:

```
<AuthBy RADIUSBYATTR>
  <Host server1.test.com>
    Secret xyzzy
    AuthPort 1645
    AcctPort 1646
  </Host>
  <Host server2.test.com>
    Secret xyzzy
    AuthPort 1645
    AcctPort 1646
  </Host>
</AuthBy>
```
The following parameters can be used within a Host clause. They have the same meaning and default values as the parameter of the same name in the enclosing `<AuthBy RADIUSBYATTR>`:

- Secret on page 186
- AuthPort on page 186
- AcctPort on page 187
- Retries on page 187
- RetryTimeout on page 187
- UseOldAscendPasswords on page 195
- UseExtendedIds on page 194
- ServerHasBrokenPortNumbers on page 195
- ServerHasBrokenAddresses on page 195
- IgnoreReplySignature on page 196
- FailureBackoffTime on page 189
- MaxFailedRequests on page 189
- MaxFailedGraceTime on page 189
- LocalAddress on page 190
- OutPort on page 187

### 3.102.3.1. DynauthPort

This string defines the destination port to which RADIUS dynamic authorisation requests are sent to. This can be overridden for an individual host inside its Host clause. This parameter has no default value.

### 3.102.3.2. DynAuthSecret

This string defines the shared secret that is used for encrypting RADIUS dynamic authorisation requests that are sent to this host. The default value is the host's Secret.

### 3.103. `<AuthBy RADIATORPROXY>`

`<AuthBy RADIATORPROXY>` supports sending specially labelled RADIUS packets to a Radiator load balancer for forwarding to the actual destination NAS. This module can be used together with `<AuthBy DYNAUTH>`, and currently supports only RFC 5176 dynamic authorisation requests that need to originate from Radiator and be sent by the LB towards the NAS. For more information about `<AuthBy DYNAUTH>`, see Section 3.101. `<AuthBy DYNAUTH>` on page 333. Gossip framework is supported for learning the LB addresses and dynauth ports. For more information, see Section 11. Using Gossip framework on page 466.

`<AuthBy RADIATORPROXY>` is a subclass of `<AuthBy RADIUSBYATTR>` and automatically handles retransmissions. For more information, see Section 3.102. `<AuthBy RADIUSBYATTR>` on page 335.

`<AuthBy RADIATORPROXY>` is currently experimental and not yet fully documented.

### 3.103.1. DynAuthPort

This defines the default destination port to which send RADIUS dynamic authorisation requests. The default value is **3799**.

Here is an example of using `DynAuthPort`: 

```
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# This NAS does not use RFC 5176 defined port
DynAuthPort 1700

3.104. `<AuthBy RATELIMITSOURCE>`

Using `<AuthBy RATELIMITSOURCE>` allows you to limit the maximum number of requests that are served for a source.

The request sources can be divided into 2 separate policer groups, thus there are 2 separate parameters for the request handling parameters. Using 2 policer groups allows you to, for example, set limit for a single source or for number of sources.

See goodies/ratelimitsource.cfg for an example configuration.

3.104.1. SourceKey1

This string defines the format of first level policer key. The default value is `%{Request:Calling-Station-Id}:%n`.

3.104.2. SourceKey2

This string defines the format of second level policer key. The default value is `%{Client:Identifier}`.

3.104.3. MaxRate1

This integer defines the allowed maximum rate for first level policer. The default value is 10.

3.104.4. MaxRate2

This integer defines the allowed maximum rate for second level policer. The default value is 2000.

3.104.5. Policer1_Size

This integer defines the number of first level policer counters. The default value is 1000.

3.104.6. Policer2_Size

This integer defines the number of second level policer counters. The default value is 100.

3.104.7. TimeWindow1

This integer defines the time window for first level policer. The default value is 2.

3.104.8. TimeWindow2

This integer defines the time window for second level policer. The default value is 10.

3.104.9. MaxRateResult

This string defines the result that is used when `MaxRate1` or `MaxRate2` is exceeded. The allowed values are:

- ACCEPT
- REJECT
- IGNORE
The values are not case-sensitive. The default value is \texttt{IGNORE}, which ignores the request.

\textbf{3.105. <AuthLog xxxxxx>}

This module marks the beginning of an AuthLog clause, which defines how to log authentication failures and successes. The xxxxxx is the name of a specific AuthLog module. This section lists the parameters all AuthLogs use. AuthLogs can also use other parameters that are specific for that AuthLog. AuthLog clauses can be defined at the top level or within a Realm or Handler clause.

You can have more than one AuthLog clause for a Realm or Handler. This makes the Realm or Handler log to each AuthLog method in turn.

\textbf{3.105.1. Identifier}

This parameter specifies an optional symbolic name that can be used to refer to the logger from somewhere else:

\begin{verbatim}
<AuthLog FILE>
    Identifier logger1
    ...
</AuthLog>
<Handler>
    AuthLog logger1
    ...
</Handler>
\end{verbatim}

\textbf{3.105.2. LogSuccess}

This parameter indicates whether authentication successes are to be logged. They are not logged by default.

Here is an example of using \texttt{LogSuccess}:

\begin{verbatim}
# Change success logging to be on
LogSuccess 1
\end{verbatim}

\textbf{3.105.3. LogFailure}

This parameter indicates whether authentication failures are to be logged. They are logged by default.

Here is an example of using \texttt{LogFailure}:

\begin{verbatim}
# Change failure logging to be off
LogFailure 0
\end{verbatim}

\textbf{3.105.4. LogIgnore}

This is a flag parameter. When it is set, ignored authentication attempts are logged. An authentication is typically ignored when the user database fails or Radiator cannot return an accept or reject for some other reason. Proxied requests that return an immediate ignore are not logged because a reply with the final result is expected later. \texttt{LogIgnore} is not set by default.
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3.106. `<AuthLog FILE>`

This clause logs the authentication successes and failures to a flat file. You can define as many `<AuthLog FILE>` clauses as you need to at the top level or within the Realm or Handler clauses. Each clause can specify different logging conditions and a different log file.

Here is an example of using `<AuthLog FILE>`:

```plaintext
# This auth logger logs both success and failure to a file. It also log authentications that are ignored.
<AuthLog FILE>
   Identifier myauthlogger
   Filename %L/authlog
   LogSuccess 1
   LogFailure 1
   LogIgnore 1
</AuthLog>
<Realm DEFAULT>
   <AuthBy FILE>
      Filename %D/users
   </AuthBy>
   # Log authentication results to a file
   AuthLog myauthlogger
</Realm>
```

`<AuthLog FILE>` understands also the same parameters as all AuthLogs. For more information, see Section 3.105. `<AuthLog xxxxxx>` on page 338.

### 3.106.1. Filename

This optional parameter specifies the name of the file where authentication log messages are to be written. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. The default value is `%L/password.log`. Special character %0 is replaced by the result of the authentication and %1 by the reason string.

If the Filename parameter starts with a vertical bar character ('|'), the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output is appended to the named file:

```plaintext
# Pipe to my-log-prog
Filename |/usr/local/bin/my-log-prog
```

### 3.106.2. SuccessFormat

This optional parameter specifies the format that is to be used to log authentication successes in Filename when LogFormatHook is not defined. You can use any of the special characters. For more information about special characters, see Section 3.3. Special formatters on page 19. %0 is replaced by the message severity level, %1 by the reason string (usually an empty string for success), and %2 by the tracing identifier. The default is `%l: %U: %P: OK`. This logs time stamp in long format, current User-Name, decoded password and text OK.
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CAUTION
The default SuccessFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, SuccessFormat that does not include the %P (decoded password) special character is preferable.

3.106.3. FailureFormat

This optional parameter specifies the format that is to be used to log authentication failures in Filename when LogFormatHook is not defined. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. Also %0 is replaced by the message severity level, %1 by the reason string and %2 by the tracing identifier. The default value is %l:%U:%P:FAIL.
This logs time stamp in long format, current User-Name, decoded password and text FAIL.

CAUTION
The default FailureFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, FailureFormat that does not include the %P (decoded password) special character is preferable.

3.106.4. IgnoreFormat

This optional parameter specifies the format that is to be used to log ignored authentication requests in Filename when LogFormatHook is not defined. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. Also %0 is replaced by the message severity level, %1 by the reason string and %2 by the tracing identifier. The default value is %l:%U:%P:IGNORE.
This logs time stamp in long format, current User-Name, decoded password and text IGNORE.

CAUTION
The default IgnoreFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, IgnoreFormat that does not include the %P (decoded password) special character is preferable.

3.106.5. LogFormatHook

This specifies an optional Perl hook that runs for each log message when defined. The hook must return the formatted log message. By default no hook is defined and SuccessFormat and FailureFormat are used for formatting. The hook parameters are the message severity level, the reason string, a reference to the current request a tracing identifier string.

Here is an example of using LogFormatHook:

```perl
# This auth logger logs both success and failure to a file in JSON format. The JSON Perl module must be installed.
<AuthLog FILE>
  Identifier myauthlogger-json
  Filename %L/authlog.json
  LogFormatHook sub { Radius::LogFormat::format_authlog_json($_); }
  LogSuccess 1
```

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LogFailure 1
</AuthLog>

For more examples, see goodies/logformat.cfg.

Note
Consider installing JSON::XS for higher performance JSON encoding.

3.107. <AuthLog SQL>

The clause indicates to log authentication successes and failures to an SQL database. You can define as many <AuthLog SQL> clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log database.

<AuthLog SQL> supports the same parameters as all <AuthBy xxxxxx>. For more information, see Section 3.105. <AuthLog xxxxxx> on page 338. It supports also all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

3.107.1. SuccessQuery

This optional parameter specifies the SQL query that will be used to log authentication successes if LogSuccess is enabled (LogSuccess is not enabled by default). There is no default. If SuccessQuery is not defined (which is the default), no logging of authentication successes will occur. In the query, special formatting characters are permitted:

- %0 is replaced with the message severity level.
- %1 is replaced with the quoted reason message (which is usually empty for successes).
- %2 is replaced with the SQL quoted User-Name.
- %3 is replaced with the SQL quoted decoded plaintext password (if any).
- %4 is replaced with the SQL quoted original user name from the incoming request (before any RewriteUsername rules were applied)
- %5 is replaced with tracing identifier.

3.107.2. SuccessQueryParam

This optional parameter specifies a bind variable to be used with SuccessQuery. For more information, see Section 3.8.1. SQL bind variables on page 45.

3.107.3. FailureQuery

This optional parameter specifies the SQL query that is used to log authentication failures if LogFailure is enabled (LogFailure is enabled by default). There is no default. If FailureQuery is not defined (which is the default), no logging of authentication failures occur. In the query, special formatting characters are permitted.

- %0 is replaced with the message severity level.
- %1 is replaced with the quoted reason message.
- %2 is replaced with the SQL quoted User-Name.
- %3 is replaced with the SQL quoted decoded plaintext password (if any).
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- %4 is replaced with the SQL quoted original user name from the incoming request (before any RewriteUsername rules were applied).
- %5 is replaced with tracing identifier.

3.107.4. FailureQueryParam

This optional parameter specifies a bind variable to be used with FailureQuery. For more information, see Section 3.8.1. SQL bind variables on page 45.

3.107.5. IgnoreQuery

This optional string specifies the SQL query that is used to log ignored authentication attempts if LogIgnore is enabled. LogIgnore is not enabled by default. IgnoreQuery has no default value. If it is not defined, authentication ignores are not logged. In the query, special formatting characters are permitted:

- %0 is replaced with the message severity level.
- %1 is replaced with the quoted reason message (which is usually empty for successes).
- %2 is replaced with the SQL quoted User-Name.
- %3 is replaced with the SQL quoted decoded plaintext password (if any).
- %4 is replaced with the SQL quoted original user name from the incoming request (before any RewriteUsername rules were applied).

3.107.6. IgnoreQueryParam

This optional string array parameter specifies a bind variables to be used with IgnoreQuery. For more information on bind variables, see Section 3.8.1. SQL bind variables on page 45.

If you specify one or more IgnoreQueryParam s, they are used in order to replace parameters named with a question mark in IgnoreQuery. The query is cached by the SQL server for future reuse. Only the first QueryCacheSize queries are cached.

3.108. <AuthLog SYSLOG>

This clause indicates to log authentication successes and failures to the syslog logging facility. You can define as many <AuthLog SYSLOG> clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log database. This module was contributed by Carlos Canau (Carlos.Canau@KPNQwest.pt).

<AuthLog SYSLOG> understands also the same parameters as all AuthLogs. For more information, see Section 3.105. <AuthLog xxxxxx> on page 338.

3.108.1. Facility

The name of the syslog facility that will be logged to. The default is ‘user’.

```
# Log to the syslog facility called 'radius'
Facility radius
```

3.108.2. Priority

The syslog priority level that will be used for each log message. Default is ‘info’
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3.108.3. SuccessFormat

This optional parameter specifies the format that is to be used to log authentication successes in Filename when LogFormatHook is not defined. You can use any of the special characters. For more information about special characters, see Section 3.3. Special formatters on page 19. %0 is replaced by the message severity level, %1 by the reason string (usually an empty string for success), and %2 by the tracing identifier. The default is %l: %U: %P: OK. This logs time stamp in long format, current User-Name, decoded password and text OK.

CAUTION
The default SuccessFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, SuccessFormat that does not include the %P (decoded password) special character is preferable.

3.108.4. FailureFormat

This optional parameter specifies the format that is to be used to log authentication failures in Filename when LogFormatHook is not defined. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. Also %0 is replaced by the message severity level, %1 by the reason string and %2 by the tracing identifier. The default value is %l: %U: %P: FAIL. This logs time stamp in long format, current User-Name, decoded password and text FAIL.

CAUTION
The default FailureFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, FailureFormat that does not include the %P (decoded password) special character is preferable.

3.108.5. IgnoreFormat

This optional parameter specifies the format that is to be used to log ignored authentication requests in Filename when LogFormatHook is not defined. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. Also %0 is replaced by the message severity level, %1 by the reason string and %2 by the tracing identifier. The default value is %l: %U: %P: IGNORE. This logs time stamp in long format, current User-Name, decoded password and text IGNORE.

CAUTION
The default IgnoreFormat logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, IgnoreFormat that does not include the %P (decoded password) special character is preferable.

3.108.6. LogSock

This optional parameter specifies what type of socket to use to connect to the syslog server. Allowable values are native, eventlog, unix, inet, tcp, udp, stream, pipe, console. The option inet means to try tcp first, then udp. The default is to use the Sys::Syslog default of “native, tcp, udp, unix, pipe, stream, console”.

CAUTION
The default LogSock logs the plaintext password entered by the user. Some organisations prefer that user passwords are not logged. In that case, LogSock that does not include the %P (decoded password) special character is preferable.
CAUTION
Due to limitations in the Sys::Syslog Perl module, if you have multiple Auth- Log SYSLOG or Log SYSLOG clauses and if any one has LogSock defined, they must all have LogSock defined.

3.108.7. LogPath
When LogSock is set to unix or stream or pipe, this optional parameter specifies the syslog path. Defaults to _PATH_LOG macro (if your system defines it).

LogPath /run/mysyslog/log.sock

3.108.8. LogHost
When LogSock is set to tcp or udp or inet, this optional parameter specifies the name or address of the syslog host. Defaults to the local host. Special characters are supported.

# Log to a remote host via syslog over udp:
LogSock udp
LogHost your.syslog.host.com

3.108.9. LogOpt
This optional parameter allows control over the syslog options passed to Sys::Syslog::openlog. LogOpt is a comma separated list of words from the set:

- cons
- ndelay
- nofatal
- nowait
- perror
- pid

as described in the Perl Sys::Syslog documentation.
Defaults to pid. Special characters are supported.

LogOpt pid,perror

3.108.10. LogIdent
This optional parameter specifies an alternative ident name to be used for logging. Defaults to the executable name used to run radiusd. Special characters are supported.

3.108.11. LogPort
This optional parameter specifies an alternative TCP or UDP destination port on the syslog host. There is no default, which means Sys::Syslog chooses the port.
CAUTION
Requires Sys::Syslog 0.28 or later.

LogPort 5514

3.108.12. MaxMessageLength
This optional parameter specifies a maximum message length (in characters) for each message to be logged. If specified, each log message is truncated to the specified number of characters prior to logging. Defaults to 0, which means no truncation.

3.109. <AuthLog EVENTLOG>
This clause logs authentication successes and failures to Microsoft Windows Event Log. There is an example configuration available in goodies/eventlog.cfg.

<AuthLog EVENTLOG> understands also the same parameters as all AuthLogs. For more information, see Section 3.105. <AuthLog xxxxxx> on page 338.

Note
<AuthLog EVENTLOG> is only available when Radiator is running on Windows

3.109.1. SuccessFormat
This optional parameter specifies the format that is to be used to log authentication successes. You can use any of the special characters. For more information about special characters, see Section 3.3. Special formatters on page 19. The default value is Access-Accept for user %U.

3.109.2. FailureFormat
This optional parameter specifies the format that is to be used to log authentication failures. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. The default value is Access-Reject for user %U.

3.109.3. IgnoreFormat
This string defines the format of an ignore message. You can use any special characters. For more information, see Section 3.3. Special formatters on page 19. The default value is Ignore for user %U.

3.110. <AcctLog xxxxxx>
This section lists the parameters that are common for all AcctLog modules. Apart from these common parameters, AcctLog modules have parameters that are specific to that AcctLog module. AcctLog modules define how to log accounting data. You can define AcctLog clauses at the top level or within a specific Realm or Handler clause.

For AcctLog examples, see goodies/logformat.cfg file in the Radiator distribution.
3.110.1. LogFormatHook

This defines the Perl hook that is run for each log message. It is not set by default. For LogFormatHook examples, see goodies/logformat.cfg file in the Radiator distribution.

3.111. <AcctLog EVENTLOG>

This clause logs accounting requests to Microsoft Windows Event Log. You can define as many AcctLog EVENTLOG clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log file.

Note

AcctLog EVENTLOG is only available when Radiator is running on Windows

3.111.1. LogFormat

This string defines the format for success messages. You can use any special characters. For more information, see Section 3.3. Special formatters on page 19. The bind variables are replaced as follows:

- %0: the result
- %1: the reason string, usually this is empty if successful
- %2: the tracing identifier string

The default value is:

```
LogFormat Accounting for user %n, \
    Accounting-Session-Id: %{Acct-Session-Id}, \
    Framed-IP-Address: %{Framed-IP-Address}, \
    Calling-Station-Id: %{Calling-Station-Id}
```

3.112. <AcctLog FILE>

This clause logs accounting requests to a flat file. You can define as many <AcctLog FILE> clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log file.

<AcctLog FILE> supports all the common AcctLog configuration parameters. For more information about the AcctLog configuration parameters, see Section 3.110. <AcctLog xxxxxx> on page 345.

3.112.1. LogFormat

This string defines the format for success messages. You can use any special characters. For more information, see Section 3.3. Special formatters on page 19. The bind variables are replaced as follows:

- %0: the result
- %1: the reason string, usually this is empty if successful
- %2: the tracing identifier string

The default value is:

```
LogFormat %l:%n:%{Acct-Session-Id}:%{Framed-IP-Address}:%{Calling-Station-Id}
```
3.112.2. OutputFormat

This optional string parameter defines the format for the log messages. Currently supported values are `text` and `json`. Default value is `text`.

**Tip**

For the best JSON encoding performance, check your Perl installation includes `JSON::XS` or `Cpanel::JSON::XS`.

For extensive customisation of JSON and other formats, see `LogFormatHook` and `Radius::LogFormat` module.

```perl
# We have switched from LogFormatHook to OutputFormat
#LogFormatHook sub { Radius::LogFormat::format_acctlog_json(@_); }  
OutputFormat json
```

3.112.3. AcctLogOutputDef

This optional parameter allows you to change the way Radiator formats accounting log JSON output by mapping RADIUS attributes to JSON fields. Multi-valued RADIUS attributes are added as a JSON array. When this parameter is not defined, all RADIUS attributes are encoded. The general format is:

```perl
AcctLogOutputDef jsonattributename[,radiusattributename]
```

If `radiusattributename` is omitted, `jsonattributename` is used as RADIUS attribute name. Special variables, such as `%n`, can also be used in `radiusattributename`. Note that in this case `%` must be the first character in the `radiusattributename`.

For extensive customisation of JSON and other formats, see `LogFormatHook` and `Radius::LogFormat` module. For a configuration sample, see `goodies/logformat.cfg` file in the Radiator distribution.

```perl
# Use JSON and define what we want in the JSON output  
OutputFormat json
# Use RADIUS attribute as JSON field name  
AcctLogOutputDef Connect-Info  
# Map attribute to JSON field  
AcctLogOutputDef Custom-Event-Timestamp, Event-Timestamp  
# Use special variables  
AcctLogOutputDef Custom-Original-Username, %u  
AcctLogOutputDef Custom-User-Name, %n
```

3.112.4. Filename

This optional parameter specifies the name of the file where the accounting log messages are written. You can use any special characters. For more information, see Section 3.3. Special formatters on page 19. The default value is `%L/accounting.log`. 
3. Configuring Radiator

3.113. <AcctLog SQL>

This clause logs accounting requests to an SQL database. You can define as many AcctLog SQL clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log file.

<AcctLog SQL> supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

For an AcctLog SQL configuration sample, see goodies/sql.cfg file in the Radiator distribution.

3.113.1. LogQuery

This string defines the SQL query that logs the authentication successes. It is an optional parameter and has no default value. You can use special characters. For more information, see Section 3.3. Special formatters on page 19. If it is not defined, accounting is not logged at all.

The bind variables are replaced as follows:

- %0: the result
- %1: the quoted reason string, usually this is empty if successful
- %2: the SQL-quoted User-Name
- %3: the SQL-quoted original user name from the incoming request (before any RewriteUsername rules were applied)
- %4: the tracing identifier string

3.113.2. LogQueryParam

This string array enables the use of bound variables, if they are supported by the SQL server, and query caching. This is an optional parameter. When one or more LogQueryParameters are defined, they are used to replace parameter names with question marks in LogQuery and the query is cached in the SQL server for future reuse. Only the first QueryCacheSize is cached.

3.114. <AcctLog SYSLOG>

This clause logs accounting requests to the syslog logging facility. You can define as many AcctLog SYSLOG clauses as you wish at the top level or within Realm or Handler clauses. Each clause can specify different logging conditions and a different log file.

3.114.1. Facility

This string defines the name of the SYSLOG facility, which is used for logging in. The default value is user.

3.114.2. Priority

This string defines the SYSLOG priority level, which is used for each log message. The default value is info.

3.114.3. LogFormat

This string defines the format for success messages. You can use any special characters. For more information, see Section 3.3. Special formatters on page 19. The bind variables are replaced as follows:

- %0: the result
- %1: the reason string, usually this is empty if successful
3. Configuring Radiator

- %2: the tracing identifier string

The default value is:

```
LogFormat %l:%n:%{Acct-Session-Id}:%{Framed-IP-Address}:%{Calling-Station-Id}
```

### 3.114.4. LogSock

This string defines the type of socket that is used to connect to the SYSLOG server. This is an optional parameter. The possible values are:

- `unix`
  
  This is the default value.

- `inet`
  
  This means that TCP is tried first and if it does not work, then UDP.

- `tcp`
  - `udp`

The default is to use the `Sys::Syslog` default of tcp, udp, unix, stream, console.

### 3.114.5. LogPath

When LogSock is set to unix or stream or pipe, this optional parameter specifies the syslog path. Defaults to `_PATH_LOG` macro (if your system defines it).

```
LogPath /run/mysyslog/log.sock
```

### 3.114.6. LogPort

This string defines the used destination port for the SYSLOG server. This is an optional parameter.

### 3.114.7. LogIdent

This string defines the alternative identity name to be used for logging. This is an optional parameter. The default value is the executable name used to run radiusd. You can use special characters. For more information, see Section 3.3. Special formatters on page 19.

### 3.114.8. LogOpt

This string defines the alternative option set for `openlog(3)`. This is an optional parameter. The default value is `pid`. You can use special characters. For more information, see Section 3.3. Special formatters on page 19.

### 3.114.9. LogHost

When LogSock on page 349 is set to `tcp` or `udp`, this string defines the name or address of the SYSLOG host. This is an optional parameter. The default value is the local host. You can use special characters. For more information, see Section 3.3. Special formatters on page 19.

### 3.114.10. MaxMessageLength

This optional parameter specifies a maximum message length (in characters) for each message to be logged. If specified, each log message is truncated to the specified number of characters prior to logging. Defaults to 0, which means no truncation.
3. Configuring Radiator

3.115. <AddressAllocator SQL>

<AddressAllocator SQL> works in conjunction with <AuthBy DYNADDRESS> (see Section 3.55. <AuthBy DYNADDRESS> on page 227) to allocate IPv4 addresses and IPv6 prefixes from an SQL database. During deallocation, the address is marked as unused. Addresses that remain in use for more than DefaultLeasePeriod seconds are automatically reclaimed (this protects against lost Accounting Stop requests).

<AddressAllocator SQL> supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43.

The default FindQuery fetches the oldest unused address from the RADPOOL table. Change the allocation strategy by customising the SQL queries.

Starting from Radiator 4.14, you can define UpdateQuery to refresh address TIME_STAMP and EXPIRY when accounting Alive requests are received. This keeps the addresses from being automatically reclaimed while they are periodically updated by Alive requests.

The table definition of a sample RADPOOL table for a range of SQL databases can be found in the goodies/*.sql files in the Radiator distribution.

<AddressAllocator SQL> uses the PoolHint to determine which pool to use. It uses the pool hint in the SQL select statement that is used to find an available address. It does an exact match on the POOL column of the RADPOOL table.

When an address is allocated for a user, it is 'leased' to the user for a fixed period. It is available exclusively for that user until either they terminate their session (when an Accounting Stop is received) or until the lease expires. The purpose of this is to protect against 'lost' Accounting Stops such as might occur with poor network connectivity, or a crashed NAS. However it also means that you should set the lease period to be longer than the longest legitimate session time, otherwise users may find their addresses being reallocated to another user.

Since Radiator 4.14 you can use shorter lease period if accounting Alive messages are used and UpdateQuery is configured.

Starting with Radiator 4.18, you can use asynchronous SQL queries with some database servers. See AsynchronousSQL on page 49 and goodies/addressallocator.sql for the details.

The default lease period is 1 day, and you can control this with DefaultLeasePeriod. Every LeaseReclaimInterval seconds, expired leases are reclaimed and made available for allocation again.

Acct-Status-Type values Accounting-On and Accounting-Off are by default accepted and replied to with no other action. You can configure AddressAllocator SQL with DeallocateByNASQuery to, for example, release all leases for the NAS when Accounting-On or Accounting-Off is received.

<AddressAllocator SQL> makes the following allocation variables available for replies. These names can be used in MapAttribute in <AuthBy DYNADDRESS>.

- yiaddr, the allocated IPv4 address or IPv6 prefix from the YIADDR column of the RADPOOL table
- subnetmask, the IPv4 subnet mask or IPv6 mask length from the SUBNETMASK column of the RADPOOL table
- dnsserver, the DNS server address from the DNSSERVER column of the RADPOOL table

<AddressAllocator SQL> can also optionally populate the RADPOOL table at startup, by defining <AddressPool xxxxxxx> clauses inside the <AddressAllocator SQL> clause.

3.115.1. Identifier

This mandatory parameter specifies an symbolic name for this AddressAllocator clause. It must exactly match the Allocator parameter in an AuthBy DYNADDRESS in order for it to be used to allocate addresses.
3. Configuring Radiator

### Identifier mySQLallocator

3.115.2. DefaultLeasePeriod

This optional parameter defines how long the default lease period is in seconds. The default is 86400 seconds (24 hours).

```bash
# We have long sessions, set the lease to be 2 days
DefaultLeasePeriod 172800
```

3.115.3. LeaseReclaimInterval

This optional parameter defines how often expired leases are looked for. Every LeaseReclaimInterval seconds, Address Allocator SQL checks the RADPOOL table for expired leases, using the ReclaimQuery. If expired leases are found, they are marked as available again. The default is 86400 seconds (24 hours).

```bash
# Look for expired leases every hour
LeaseReclaimInterval 3600
```

3.115.4. FindQuery

This optional parameter allows you to define a custom SQL query to find an available address or prefix. The default is:

```sql
select TIME_STAMP, YIADDR, SUBNETMASK, DNSSERVER from RADPOOL where POOL='%0' and STATE=0 order by TIME_STAMP
```

The variables are replaced as follows:

- `%0` by the pool hint
- `%1` by the user name
- `%2` with the lease expiry time
- `%3` by SQL quoted NasId value

Use the following example to allocate an IPv6 prefix from the range assigned to the user's NAS. The pool has been previously initialised with NAS_IDs belonging to known NASs.

```bash
# Our NASes all send NAS-IPv6-Address, e.g. 2001:db8:2::2
NasId %{NAS-IPv6-Address}
FindQuery select TIME_STAMP, YIADDR, SUBNETMASK, DNSSERVER from RADPOOL
where POOL='%0' and STATE=0 and NAS_ID=%3 order by TIME_STAMP
```

3.115.5. FindQueryBindVar

This optional parameter specifies a bind variable to be used with FindQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.
3. Configuring Radiator

3.115.6. AllocateQuery

This optional parameter allows you to define a custom SQL query to allocate an address or prefix that was found with FindQuery. The default is:

```
update RADPOOL set STATE=1, TIME_STAMP=%0, EXPIRY=%1, USERNAME=%2
    where YIADDR='%3' and STATE=0 and TIME_STAMP %4
```

The variables are replaced as follows:

- %0 by the current time in Unix epoch seconds
- %1 by the lease expiry time (the current time + the lease period)
- %2 by the user name
- %3 by the address or prefix
- %4 by a timestamp comparison operator
- %5 by the SQL quoted NasId

If the AllocateQuery is an empty string, the query is not executed. This can be useful if the FindQuery does all the allocation work.

3.115.7. AllocateQueryBindVar

This optional parameter specifies a bind variable to be used with AllocateQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.8. UpdateQuery

This optional parameter allows you to define a custom SQL query to update the address or prefix when accounting Alive requests are received. There is no default.

```
UpdateQuery update RADPOOL set TIME_STAMP=?, EXPIRY=? where YIADDR=?
UpdateQueryBindVar %t
UpdateQueryBindVar %0
UpdateQueryBindVar %1
```

The variables are replaced as follows:

- %0 by the lease expiry time (the current time + the lease period)
- %1 by the address
- %2 by the SQL quoted NasId

If the UpdateQuery is an empty string, the query is not executed.

3.115.9. UpdateQueryBindVar

This optional parameter specifies a bind variable to be used with UpdateQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.10. CheckPoolQuery

This optional parameter allows you to define a custom SQL query to check whether an address or prefix exists in the pool. The default is:

```
select STATE from RADPOOL where YIADDR='%0'
```
3. Configuring Radiator

%0 is replaced by the address.

If CheckPoolQuery is set to an empty string, no pool checking is done at startup. Delay the start of pool check with DelayedPoolCheckTime. For more information, see Section 3.115.22. DelayedPoolCheckTime on page 355.

3.115.11. CheckPoolQueryBindVar

This optional parameter specifies a bind variable to be used with CheckPoolQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.12. AddAddressQuery

This optional parameter allows you to define a custom SQL query to add an address to the pool if it is not found by CheckPoolQuery. The default is:

```
insert into RADPOOL (STATE, TIME_STAMP, POOL, YIADDR, SUBNETMASK, DNSSERVER)
values (0, %t, %0, '%1', '%2', '%3')
```

The variables are replaced as follows:

- %t by the current time in Unix epoch seconds
- %0 by the pool name
- %1 by the address
- %2 by the subnet mask
- %3 by the DNS server address
- %4 by the pool's PoolGroup
- %5 by the pool's Priority
- %6 by the pool's NasIdentifier

If AddAddressQuery is set to an empty string, addresses are not automatically added to the pool.

3.115.13. AddAddressQueryBindVar

This optional parameter specifies a bind variable to be used with AddAddressQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.14. DeallocateQuery

This optional parameter allows you to define a custom SQL query to deallocate a previously allocated address. If the DeallocateQuery is an empty string, no deallocation query is executed. The default value is:

```
update RADPOOL set STATE=0,TIME_STAMP=%t where YIADDR='%0'
```

%0 is replaced the address and %1 by the SQL quoted NasId.

3.115.15. DeallocateQueryBindVar

This optional parameter specifies a bind variable to be used with DeallocateQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.
3.115.16. DeallocateByNASQuery

This optional parameter allows you to define a custom SQL query to deallocate all previously allocated addresses for a NAS. If the DeallocateByNASQuery is an empty string or not defined, no deallocation query is executed. This query is not defined by default currently. %0 is replaced by the SQL quoted NasId.

```
# Process Accounting-On and Accounting-Off
DeallocateByNASQuery update RADPOOL set STATE=0, TIME_STAMP=%t where NAS_ID=%0
```

3.115.17. DeallocateByNASQueryBindVar

This optional parameter specifies a bind variable to be used with DeallocateByNASQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.18. ReclaimQuery

This optional parameter allows you to define a custom SQL query to reclaim an address whose lease has expired. If the ReclaimQuery is an empty string, no reclaim query will be executed. Defaults to

```
update RADPOOL set STATE=0 where STATE!=0 and EXPIRY < %0
```

%0 is replaced by the current time in Unix epoch seconds. By default reclaim query runs immediately when AddressAllocator SQL module is loaded. You can delay the start of reclaim check with DelayedPoolCheckTime. For more information, see Section 3.115.22. DelayedPoolCheckTime on page 355.

3.115.19. ReclaimQueryBindVar

This optional parameter specifies a bind variable to be used with ReclaimQuery. For more information about bind variables, see Section 3.8.1. SQL bind variables on page 45.

3.115.20. NoAddressHook

NoAddressHook is called when there are no addresses left or the allocation fails because of too many simultaneous tries.

NoAddressHook is passed with the following arguments:

- Reference to the current request object
- Reference to the current reply object
- Reference to current authentication result
- Reference to a string variable holding the reason for a reject
- String variable holding value of pool hint

To change the type of reply, change the third argument from $main::REJECT to the desired value.

3.115.21. NasId

NasId defines the name of attribute in request or other value typically used for NAS_ID column. It is available as SQL quoted special value for the AddressAllocator SQL queries. The default is %{NAS-Identifier}.

```
# Our NASes use IPv6 addresses
NasId %{NAS-IPv6-Address}
```
3. Configuring Radiator

3.115.22. DelayedPoolCheckTime

This parameter defines time in seconds Radiator delays checking address pools when AddressAllocatorSQL is activated. This is not set by default, which mean Radiator checks the pool immediately when AddressAllocator SQL loaded during the configuration. During the pool check CheckPoolQuery and ReclaimQuery are run to update the pool state. For more information, see Section 3.115.10. CheckPoolQuery on page 352 and Section 3.115.18. ReclaimQuery on page 354.

```
# Postpone the check. Do it when the config has been loaded
DelayedPoolCheckTime 1
```

3.115.23. AddressPool

The AddressPool clause allows you to define which address pools are available. When Radiator is started, each AddressPool ensures there is an entry for each of its addresses and prefixes in the RADPOOL table.

AddressPool is a simple alternative for maintaining the contents of the RADPOOL table through other method. You can use another method for initialising and maintaining the RADPOOL table, in this case it is not necessary to have any AddressPool clauses.

AddressPool defines a range of available addresses or prefixes. Each address or prefix in the range has the same Subnet mask and DNS Server address. The Subnetmask and the DNS server address specify the values to use if an address or prefix is allocated from a range. The default for Subnetmask is 255.255.255.255. There is no default for DNSServer.

IPv4 address ranges can be specified either as lower and upper addresses (inclusive) within a class C block or as a CIDR block. IPv6 prefix ranges are specified as a CIDR block.

The step size between consecutive addresses is controlled with the Step parameter, which defaults to 1. Step of other than 1 can be useful where you need to allocate subnets of more than one address, rather than individual host addresses.

Advanced configuration for address pools is supported with optional parameters PoolGroup and Priority. A PoolGroup defines a name to group multiple pools with different priorities set by Priority. These parameters are available for AddAddressQuery (for more information, see Section 3.115.6. AllocateQuery on page 352) and the values inserted in SQL can later be used by customised allocation queries and procedures.

The following example defines two pools of addresses. The first pool is called ‘pool1’. It contains addresses in the ranges 192.1.1.1 to 192.1.1.50 (inclusive) and 192.1.1.60 to 192.1.1.120 (inclusive) and the entire 192.1.2.0 class C block. The IP Subnet mask for each address is 255.255.255.255. The second pool is called ‘pool2’ and contains addresses in the range 192.2.2.62 to 192.2.2.99 (inclusive). The third pool is called ‘pool3’ and contains 256 IPv6 prefixes with prefix length of 64 bits.

PoolGroup, PoolPriority and NasIdentifier are made available for AddAddressQuery (for more information, see Section 3.115.12. AddAddressQuery on page 353) and can later be used by FindQuery (for more information, see Section 3.115.4. FindQuery on page 351) and other queries that need to up suitable addresses.

```
<AddressAllocator SQL>
    ..... 
    # Defines the addresses that we are prepared
    # to allocate:
    <AddressPool pool1>
        Subnetmask 255.255.255.0
        DNSServer 10.1.1.1
        Range 192.1.1.1 192.1.1.50
        Range 192.1.1.60 192.1.1.120
```
3. Configuring Radiator

```xml
Range 192.1.2.0/24
</AddressPool>
<AddressPool pool2>
  Subnetmask 255.255.255.127
  Range 192.2.2.62 192.2.2.99
</AddressPool>
<AddressPool pool3>
  Subnetmask /56
  Range 2001:db8:100::/48
  #PoolGroup group1
  #PoolPriority 1
  NasIdentifier 2001:db8:2::2
</AddressPool>
</AddressAllocator>
```

### 3.116. `<AddressAllocator DHCP>`

AddressAllocator DHCP works in conjunction with `<AuthBy DYNADDRESS>` (see Section 3.55. `<AuthBy DYNADDRESS>` on page 227) and a DHCP server to dynamically allocate IP addresses.

AddressAllocator DHCP has been tested with a number of DHCP servers, however it works best with the latest versions of the DHCP server from the Internet Software Consortium (ISC) that support the Subnet Selection Option. For more information, see ISC website [http://www.isc.org/](http://www.isc.org/).

The RFC 3011 Subnet Selection Option allows server-to-server operation such as that supported by Radiator.

---

**Tip**

The PoolHint supplied in the AuthBy DYNADDRESS clause must be a subnet definition that is understood by the DHCP server for the purposes of address allocation.

---

AddressAllocator DHCP makes the following allocation variables available for replies. These names can be used in MapAttribute in AuthBy DYNADDRESS.

- yiaddr, the allocated IP address from DHCP
- subnetmask, the subnet mask from DHCP
- dnsserver, the DNS server address from DHCP

An example AddressAllocator DHCP configuration file can be found in the distribution in the file `goodies/addressallocatordhcp.cfg`.

---

**CAUTION**

Because AddressAllocator DHCP binds to the DHCP server address, it is not possible to run the DHCP server on the same host as Radiator.

Because the DHCP address allocator binds to port 67, Radiator must be run as root, or at least with root privileges.
3. Configuring Radiator

3.116.1. Identifier

This mandatory parameter specifies a symbolic name for this AddressAllocator clause. It must exactly match the Allocator parameter in an AuthBy DYNADDRESS in order for it to be used to allocate addresses.

<table>
<thead>
<tr>
<th>Identifier</th>
<th>DHCPallocator</th>
</tr>
</thead>
</table>

3.116.2. Host

The host name or IP address of the DHCP server. The address may be either a single host address or a broadcast address. If a broadcast address is specified, Radiator will allocate an address from the first DHCP host to answer a discover request.

<table>
<thead>
<tr>
<th>Host</th>
<th>1.2.3.4</th>
</tr>
</thead>
</table>

3.116.3. Port

The DHCP port number on the DHCP host. Defaults to port 67.

<table>
<thead>
<tr>
<th>Port</th>
<th>67</th>
</tr>
</thead>
</table>

3.116.4. LocalAddress

The local IP address to bind to. Defaults to the main IP address of the Radiator host.

<table>
<thead>
<tr>
<th>LocalAddress</th>
<th>1.1.1.1</th>
</tr>
</thead>
</table>

3.116.5. DHCPClientIdentifier

The Client Identifier to be used by the DHCP server to track allocations. Defaults to the user name in the current request.

<table>
<thead>
<tr>
<th>DHCPClientIdentifier</th>
<th>%{User-Name}</th>
</tr>
</thead>
</table>

3.116.6. DefaultLease

Specifies the default lease period requested. Defaults to one day (86400 seconds).

<table>
<thead>
<tr>
<th>DefaultLease</th>
<th>86400</th>
</tr>
</thead>
</table>

3.116.7. TimeoutMinimum

The DHCP RFC specifies timeout and retry behaviour while attempting to contact a DHCP server. The TimeoutMinimum specifies the initial timeout in seconds. Defaults to 2 seconds.

<table>
<thead>
<tr>
<th>TimeoutMinimum</th>
<th>4</th>
</tr>
</thead>
</table>

3.116.8. TimeoutMaximum

The TimeoutMaximum specifies how long to keep retrying a request in seconds. Defaults to 16 seconds.

<table>
<thead>
<tr>
<th>TimeoutMaximum</th>
<th>64</th>
</tr>
</thead>
</table>
3.116.9. TimeoutFactor

The TimeoutFactor indicates how to recalculate the timeout for each attempt. Defaults to multiplying the timeout by 2 for each attempt.

| TimeoutFactor 2 |

3.116.10. ServerPort

Specifies the local DHCP server port. Defaults to port 67.

| ServerPort 67 |

3.116.11. Synchronous

Normally DHCP requests are processed asynchronously. This optional parameter can be used to make the requests synchronous.

| Synchronous |

3.116.12. SubnetSelectionOption

This is an optional integer parameter that is used to enable the DHCP "Subnet Selection Option". The official RFC option number is 118 which is used as the default if this parameter does not specify other value. Early versions of the ISC DHCP server used option 211.

If the SubnetSelectionOption parameter is not defined, no Subnet Selection Option is added and any PoolHint value provided is used in the giaddr field in the DHCP request, instead of LocalAddress.

Here are examples of using SubnetSelectionOption:

```
# This sets the value to 211.
SubnetSelectionOption 211

# If the parameter is set but no value is defined, 118 is used.
SubnetSelectionOption

# Do not add any Subnet Selection Option.
#SubnetSelectionOption
```

3.116.13. UserClass

This optional parameter can be used to specify a User Class to be passed to the DHCP server to assist with address allocation. Any text and/or Radiator special characters are permitted. Refer to the DHCP server documentation for further details regarding the use of classes.

| UserClass %{Client:Identifier} |


ClientHardwareAddress is an attribute in the incoming address which contains the hex encoded MAC address of the client. If present, it will be used as CHADDR in the DHCP request. If not present, and fake CHADDR based on the request XID will be used. The DHCP server may use this when allocating an address for the client. The MAC address can contain extraneous characters such as ‘.’ or ‘:’ as long as it contains the 12 hex characters (case insensitive) of the MAC address. Special characters are permitted.
# Use contents of an attribute to tell the DHCP server the hardware address of the client
ClientHardwareAddress %{Unisphere-Dhcp-Mac-Addr}

## 3.116.15. UseClassForAllocationInfo

When this optional parameter is set, information about the allocation is stored in reply attribute Class instead of in memory. Required for server farm where different farm members are likely to handle the allocation and deallocation. Defaults to off.

## 3.116.16. DHCPHostName

This string sets the value for DHCP option 12 "Host name". This has no default value and no Host Name is sent with DHCP request by default.

Here is an example of using `DHCPHostName`:

```
DHCPHostName Radiator-%{Calling-Station-Id}
```

## 3.116.17. DHCPVendorClass

This string parameter sets the value that is used for DHCP option 61 "Class Identifier", also known as "Vendor class identifier". This has no default value and no Class Identifier is sent with DHCP request by default.

Here is an example of using `DHCPVendorClass`:

```
DHCPVendorClass RadiatorAllocations
```

## 3.117. <AddressAllocator DHCPv6>

AddressAllocator DHCPv6 works in conjunction with `<AuthBy DYNADDRESS>` (see Section 3.55. `<AuthBy DYNADDRESS>` on page 227) and a DHCPv6 server to dynamically allocate IPv6 addresses, IPv6 delegated prefixes and to request other configuration information from the DHCPv6 server.

AddressAllocator DHCPv6 has been tested with a number of DHCPv6 servers, however it has been mostly tested the DHCP server from the Internet Software Consortium (ISC). For more information, see ISC website [http://www.isc.org/]. Version 4.3.3 or later is recommended.

AddressAllocator DHCPv6 makes the following allocation variables available for replies. The allocation variables names are case insensitive DHCPv6 option names without the leading ‘OPTION_’. These names can be by default used in MapAttribute in AuthBy DYNADDRESS.

- `iaaddr`, the allocated IPv6 address from DHCPv6
- `iaprefix`, the delegated IPv6 prefix from DHCPv6
- `dns_servers`, the DNS servers' IPv6 addresses from DHCPv6
- `serverid`, the SERVERID option in hex format from DHCPv6
- `clientid`, the CLIENTID option in hex format as replied by DHCPv6

An example AddressAllocator DHCPv6 configuration file can be found in the distribution in the file `goodies/addressallocator dhcpv6.cfg`.

An example ISC DHCP server configuration file can be found in the distribution in the file `goodies/addressallocator dhcpv6-dhcpd.conf`.
3. Configuring Radiator

CAUTION
Because AddressAllocator DHCPv6 binds to the DHCPv6 server address, it is not possible to run the DHCPv6 server on the same host as Radiator.

Note
PoolHint supplied in the AuthBy DYNADDRESS clause for the purposes of allocation is sent to the DHCPv6 server with OPTION_USER_CLASS. Some DHCPv6 servers may not be able to use this option. For this reason PoolHint is also sent with OPTION_CLIENTID. For more information, see Section 3.117.8. DHCPClientIdentifier on page 361.

Because the DHCPv6 address allocator binds to DHCPv6 client port 546, Radiator must be run as root, or at least with suitable privileges.

3.117.1. Identifier

This mandatory parameter specifies a symbolic name for this AddressAllocator clause. It must exactly match the Allocator parameter in an AuthBy DYNADDRESS in order for it to be used to allocate addresses.

| Identifier       | dhcpv6allocator |

3.117.2. Host

The host name or IP address of the DHCP server. Hostname of the DHCP server to use. Defaults to All_DHCP_Relay_Agents_and_Servers (ff02::1:2). Radiator will allocate an address from the first DHCPv6 server to answer a solicit request.

```
# Use ALL_DHCP_Servers address
Host ff05::1:3
```

3.117.3. Port

The UDP port number on the DHCPv6 server. Defaults to port 547.

```
Port 67
```

3.117.4. ClientPort

The local UDP port number to send DHCPv6 messages from. Defaults to port 546.

```
Port 68
```

3.117.5. LocalAddress

The local IP address to bind to. Defaults to the IPv6 wildcard address. Consider using interface's link-local address.
3. Configuring Radiator

**Note**

You can always use the link-local address of the interface for LocalAddress. Using link-local address is preferred and limits the set of addresses Radiator listens on to the smallest number of possibilities. The default value for LocalAddress is ::, the IPv6 wildcard address.

On Linux and macOS, you can configure `LocalAddress ::`. On Windows, you need to set LocalAddress to the link-local address of the interface Radiator shares with the DHCPv6 server. Using global address may also work on all operating systems.

```
LocalAddress fe80::dead:beff:feef:1234
```

### 3.117.6. InterfaceName

**InterfaceName** defines the interface for sending DHCPv6 requests. There is no default.

InterfaceName currently works only on Linux. On Linux, InterfaceName value must be the interface shared with the DHCPv6 server.

InterfaceName or InterfaceIndex is needed to select the correct interface for link-local communication with the DHCPv6 server.

```
InterfaceName eth0
```

### 3.117.7. InterfaceIndex

On macOS and Windows you need to set InterfaceIndex. On macOS, the interface index numbering typically follows `ifconfig -a` output with the first interface having index number 1. On Windows, run `netstat -nr` to display the interface index numbers.

InterfaceName or InterfaceIndex is needed to select the correct interface for link-local communication with the DHCPv6 server.

```
InterfaceIndex 4
```

### 3.117.8. DHCPClientIdentifier

The Client Identifier to be used by the DHCPv6 server to track allocations. Sent by Radiator with `OPTION_CLIENTID`. Defaults to the user name in the current request followed by PoolHint: `%{User-Name}-%{Reply:PoolHint}`.

```
DHCPClientIdentifier %{User-Name}-pool-%{Reply:PoolHint}
```

### 3.117.9. DefaultLease

Specifies the default lease period requested. If SessionTimeout is set by a previous AuthBy then that is used as the expiry time. Defaults to one day (86400 seconds).

```
DefaultLease 86400
```

### 3.117.10. Synchronous

Normally DHCPv6 requests are processed asynchronously. This optional parameter can be used to make the requests synchronous.
3. Configuring Radiator

3.117.11. UserClass

This optional parameter can be used to specify a User Class to be passed to the DHCP server to assist with address allocation. Any text and/or Radiator special characters are permitted. Refer to the DHCP server documentation for further details regarding the use of classes.

UserClass %{Client:Identifier}

3.117.12. AllocateDoneHook

AllocateDoneHook provides access to the received DHPCPv6 reply and allows modifying the results after Radiator has processed them, but before they are passed to AuthBy DYNADDRESS and made available for MapAttribute. The option values are in their native format. See the relevant RFCs for the details.

---

**Note**

This example requires domain_list is specified with MapAttribute. Radiator will not otherwise request OPTION_DOMAIN_LIST from DHCPv6.

```perl
# Domain list is in RFC 1035 format. Format it later.
AllocateDoneHook sub { my $result = $_[0]; my $reply = $_[1]; 
  my @o = $reply->option($Radius::DHCPv6::OPTION_DOMAIN_LIST); 
  $result->{domain_list} = $o[1] if $o[0]; }
```

3.118. <Resolver>

<Resolver> provides DNS and name resolution services for the <AuthBy DNSROAM> clause. For more information, see Section 3.78. <AuthBy DNSROAM> on page 286. Use <Resolver> only if you use <AuthBy DNSROAM> in your configuration. Other AuthBys do not require using <Resolver>.

<AuthBy DNSROAM> uses <Resolver> to do NAPTR, SRV, A, and AAAA lookups on a DNS name server in order to discover the name, address, and other possible attributes, such as protocol and whether to use TLS encryption, of a server that is used to handle requests for a certain Realm.

By default, <Resolver> consults DNS using the standard resolver configuration for your host. On Unix or Linux systems, it finds the resolver details by consulting /etc/resolv.conf, $HOME/.resolv.conf or ~/.resolv.conf. You can override these defaults and specify the used DNS name server, search path, and other options by using parameters in the Resolver clause.

<Resolver> requires the Net::DNS Perl module. Depending on the Net::DNS and Perl version, it may require the Socket6 module and the IO::Socket::INET6 module if you want to consult a DNS server via IPv6. So if there are problems with DNS queries over IPv6, try installing Socket6. These are all available as source from CPAN, or possibly as pre-built packages for your operating system or Perl distribution. For more information, see Section 2.1.2. CPAN on page 3.

<Resolver> uses the following algorithm to discover server names and addresses for a given Realm:

1. Look for NAPTR records for the Realm.

2. For each found NAPTR record, examine the Service field and use it to determine the transport protocol and TLS requirements for the server. The Service field starts with ’AAA’ for insecure and ’AAAS’ for TLS secured. The Service field contains ’+RADSECS’ for RadSec over SCTP, ’+RADSECT’ for RadSec
over TCP or `+RADIUS` for RADIUS protocol over UDP. The most common Service field is `AAAS +RADSECT` for TLS secured RadSec over TCP.

3. If the NAPTR has the `S` flag, look for SRV records for the name. For each SRV record found, note the Port number and look for A and AAAA records corresponding to the name in the SRV record.

4. If the NAPTR has the `A` flag, look for A and AAAA records for the name.

5. If no NAPTR records are found and DirectAddressLookup is enabled, look for A and AAAA records based directly on the realm name. For example, if the realm is `examplerealm.edu`, it looks for records such as `'_radsec._tcp.examplerealm.edu'`, `'_radsec._sctp.examplerealm.edu'` and `'_radius._udp.examplerealm.edu'`.

6. All A and AAAA records found are ordered according to their Order and Preference fields. The most preferable server address is used as the target server address, along with any other server attributes discovered from DNS. If no SRV records was found for the address, the DNSROAM configured Port is used.

For example, if the user name is fred@example.com, the Realm is `example.com`, and DNS contains the following records:

```
example.com.IN NAPTR 50 50 "s" "AAAS+RADSECT" "_radsec._tcp.example.com.
_radsec._tcp.example.com. IN SRV 0 10 2083 radsec.example.com.
radsec.example.com. IN AAAA 2001::202:44ff:fe0a:f704
```

In the previous example, the selected target is a RadSec server on port 2083 at IPv6 address 2001::202:44ff:fe0a:f704. The connection is made over TCP/IP, and TLS encryption is used. This complete specification of the realm is the most flexible and is recommended.

More concise DNS configurations are possible, too:

```
example.com. IN NAPTR 50 50 "a" "AAAS+RADSECS" "radsec.example.com.
radsec.example.com. IN AAAA 2001::202:44ff:fe0a:f704
```

In this case, the selected target is a RadSec server at IPv6 address 2001::202:44ff:fe0a:f704. The connection is made over SCTP, and TLS encryption is used. The port used is the default Port configured into <AuthBy DNSROAM>.

The DNS can contain just this record:

```
_radius._udp.example.com. IN A 203.63.154.10
```

In this case, the selected target is a RADIUS server at IPv4 address 203.63.154.10. The connection is made over UDP. The Port and Secret used are the defaults configured into <AuthBy DNSROAM>.

---

**Tip**

The simplest Resolver clause you can have is:

```
<Resolver>
</Resolver>
```

This definition gets all its configuration from `/etc/resolv.conf` or the equivalent on your platform.
3.118.1. Nameservers

This optional parameter specifies the name or address of one or more DNS Name Servers passed to Net::DNS. Nameservers with IPv6 addresses are supported if your system supports IPv6. Defaults to the value of nameserver in resolv.conf. For more information, see Section 3.118. <Resolver> on page 362.

Note

Current Net::DNS implementations appear not to use multiple nameservers with the bgsend method Radiator uses. Only the first server is used for the query.

```bash
# Look first on one server and then another if it times out:
Nameservers 203.63.154.100
Nameservers 203.63.154.101
```

3.118.2. Debug

This optional flag enables debugging within the Net::DNS module. It will print to stdout the details of all DNS requests sent and replies received. Defaults to no debugging.

```bash
# Enable debug logging in Net::DNS:
Debug
```

3.118.3. Recurse

This optional flag enables recursive DNS lookups. Defaults to no recurse.

3.118.4. TCPTimeout

This optional flag specifies the timeout (in seconds) for DNS lookups over TCP connections. Defaults to 5 seconds.

3.118.5. UDPTimeout

This optional flag specifies the timeout (in seconds) for DNS lookups over UDP connections. Defaults to 5 seconds.

3.118.6. TCPPersistent

Note

This parameter is obsolete since Radiator 4.20. Multiple outstanding queries are not supported by Net::DNS when using persistent sockets.

This optional flag tells Net::DNS to keep a TCP socket open for each host:port to which it connects. This is useful if you are using TCP and need to make a lot of queries to the same nameserver. The default value is false.
3.118.7. UDPPersistent

**Note**

This parameter is obsolete since Radiator 4.20 Multiple outstanding queries are not supported by Net::DND when using persistent sockets.

This optional flag tells Net::DNS to keep a single UDP socket open for all DNS queries. This is useful if you are using UDP and need to make a lot of queries to the same nameserver. The default value is false.

3.118.8. GetIPV4

This optional flag specifies whether Resolver will attempt to find an IPv4 (A) address for any names it discovers. Defaults to true.

3.118.9. GetIPV6

This optional flag specifies whether Resolver will attempt to find an IPv6 (AAAA) address for any names it discovers. Defaults to true.

3.118.10. GetRadius

This optional parameter specifies whether Resolver is required to attempt to discover RADIUS servers from

- NAPTR records of type AAA with +RADIUS
- IPv4 (A) or IPv6 (AAAA) records for `_radius._udp.realmname`

Defaults to true.

3.118.11. GetRadSec

This optional parameter specifies whether Resolver is required to attempt to discover RADSEC servers from

- NAPTR records of type AAA or AAAS with +RADSECS or +RADSECT or
- IPv4 (A) or IPv6 (AAAA) records for `_radsec._sctp.realmname`
- IPv4 (A) or IPv6 (AAAA) records for `_radsec._tcp.realmname`

Defaults to true.

3.118.12. DirectAddressLookup

If DirectAddressLookup is enabled, and if there are no NAPTR records for the requested Realm, Resolver will attempt lookups of A and AAAA records for `_radsec._sctp.<REALM>`, `_radsec._tcp.<REALM>` and `_radius._udp.<REALM>` Enabled by default.

3.118.13. NAPTR-Pattern

NAPTR-Pattern is an optional parameter that specifies a regexp that will be used to match the contents of NAPTR records during Resolver service discovery.

If NAPTR-Pattern is defined and matches a NAPTR DNS record, it will be used to determine the protocol and transport to be used. The regexp is expected to match 2 substrings. The first is the protocol and can be 'radsec' or 'radius'. The second is the transport to use, and can be 'tls', 'tcp' or 'udp'.

3.118.14. **NegativeCacheTtl**

This optional value specifies how long a negative lookup (i.e., failure to resolve the realm) will be cached until another lookup will be made. Defaults to 21600 seconds (6 hours).

3.118.15. **FailureBackoffTime**

If the lookup failed to discover any results and there was a timeout when waiting for the nameserver, this optional value specifies how long Radiator will wait before another lookup will be made. This will give the target server time to become available without resorting to potentially long NegativeCacheTtl. Defaults to 3 seconds.

3.119. **<ServerDIAMETER>**

This clause tells Radiator to act as a Diameter to RADIUS gateway.

Diameter is an AAA protocol described in RFC 6733 (and others). It provides for TCP/IP or SCTP transport and TLS encryption. It makes specific provision for carrying RADIUS compatible requests and defines Diameter to RADIUS gateways. ServerDIAMETER implements such a Diameter to RADIUS gateway.

Incoming Diameter requests are converted as far as possible into RADIUS requests and then dispatched internally within Radiator. A Realm or Handler can be configured to handle the request either locally or proxy it (as a RADIUS request) to another RADIUS server. RADIUS replies are sent back to the originating Diameter peer. Handlers may use the Client-Identifier to match requests received by a particular `<ServerDIAMETER>` clause.

By default, `<ServerDIAMETER>` listens for connections from Diameter peers on TCP port 3868. By default it does not require TLS encryption of the Diameter connection. `<ServerDIAMETER>` never contacts a Diameter peer by itself: it always acts only as a Diameter server.

By default, `<ServerDIAMETER>` uses a hardwired internal dictionary to translate Diameter requests into readable parameters. You can use the global configuration parameter DiameterDictionaryFile to alter the hardwired internal dictionary.

`<ServerDIAMETER>` supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

3.119.1. **Port**

This optional parameter specifies which network port ServerDIAMETER will listen on for connections from Diameter peers. Defaults to 3868, the official IANA port number for Diameter. May be a numeric port number or symbolic port/service name.

3.119.2. **BindAddress**

This optional parameter specifies one or more network interface addresses to listen for incoming connections. It is only useful if you are running Radiator on a multi-homed host (a host that has more than one network address). The default value is the global `BindAddress`, which defaults to 0.0.0.0. It listens to all networks connected to the host. For more information, see Section 3.7. Global parameters on page 27.

Using this parameter, you can run multiple instances of Radiator on the one computer, where each instance listens to connections directed to a different host address. `BindAddress` can include special formatting characters, and multiple comma separated IPv4 and IPv6 addresses.

When SCTP multi-homing is supported, all addresses defined with `BindAddress` must be either IPv4 or IPv6 addresses. Radiator binds all addresses to one listen socket instead of creating multiple listen sockets.

Here is an example of using `BindAddress`: 
3. Configuring Radiator

# Only listen on one IPv4 address and the IPv6 loopback
BindAddress 203.63.154.1, ::1

3.119.3. MaxBufferSize

This optional advanced parameter specifies the maximum number of octets that are output buffered. The default value is **10000**. 0 means no output buffering. This advanced parameter usually does not need adjusting.

3.119.4. Protocol

This optional parameter specifies which Stream protocol will be used to carry Diameter. Options are 'tcp' for TCP/IP or 'sctp' for SCTP (Stream Control Transmission Protocol). Defaults to 'tcp'. Not all hosts are able to support 'sctp': consult your vendor. The protocol setting must be the same as that being used by connecting Diameter peers.

```
Protocol sctp
```

**Tip**

On modern Linux hosts, SCTP support is in a loadable module, and can be enabled with:

```
modprobe sctp
```

3.119.5. ReadTimeout

This optional parameter specifies the maximum time to wait for incoming Diameter connections to complete their initial handshaking. Defaults to 10 seconds. If a Diameter CER message is not received from the peer by ServerDIAMETER within this time period, the connection will be shut down.

3.119.6. OriginHost

This parameter specifies the name that <ServerDIAMETER> uses to identify itself to any connecting Diameter peers. It is sent to the peer in the Diameter CER message. It is not optional and must be specified in the <ServerDIAMETER> clause. Diameter peers may use OriginHost to determine whether they have connected to the correct peer, so it may be critical that it be configured correctly. Special formatting characters are supported.

3.119.7. OriginRealm

This parameter specifies the name of the user Realm that <ServerDIAMETER> is willing to handle. It is sent to connecting Diameter peers in the CER message, and the peer uses it to determine which requests are routed to this <ServerDIAMETER>. It is not optional an must be specified in the <ServerDIAMETER> clause. Special formatting characters are supported.

3.119.8. ProductName

This optional parameter is used to identify the product name of this Diameter peer. It is sent to connecting Diameter peers in the CER message. It defaults to 'Radiator'.

3.119.9. AddToRequest

This optional parameter is used to add extra RADIUS attributes to the RADIUS request generated from each incoming Diameter request. It can be used to tag requests arriving from ServerDIAMETER for special handling within Radiator or in remote RADIUS servers.
3. Configuring Radiator

AddToRequest NAS-Identifier=DIAMETER

3.119.10. DefaultRealm

This optional parameter can be used to specify a default realm to use for received Diameter requests that have a user name that does not include a realm. If the incoming user name does not have a realm (i.e. there is no @something following the user name) and if DefaultRealm is specified, the User-Name in the resulting RADIUS request will have @defaultrealm appended to it. The realm can then be used to trigger a specific <Realm> or <Handler> clause. This is useful if you operate a number of Diameter peers for different customer groups and where some or all of your customers log in without specifying a realm.

```plaintext
# Realmless logins to this NAS will be treated
# as if they are for realm open.com.au
<ServerDIAMETER>
  OriginHost ....
  DefaultRealm open.com.au
</ServerDIAMETER>
<Realm open.com.au>
  ......
</Realm>
```

3.119.11. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- **Client clause**

  *PreHandlerHook* is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.

- **AuthBy clause**

  The functionality depends on the used EAP authentication type:

  - **PEAP, EAP-TTLS, EAP-FAST**

    *PreHandlerHook* specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.

  - **LEAP**

    If *EAP_LEAP_MSCHAP_Convert* flag is set, *PreHandlerHook* specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

  - **EAP-MSCHAPv2**

    If *EAP_PEAP_MSCHAP_Convert* flag is set, *PreHandlerHook* specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

  - **EAP-GTC**

    If *EAP_GTC_PAP_Convert* flag is set, *PreHandlerHook* specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- **AuthBy DYNAUTH clause**

  *PreHandlerHook* is called for each request created by the clause before the request is passed to a Realm or Handler clause.
3. Configuring Radiator

- **ServerRADSEC clause**
  
  *PreHandlerHook* is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

- **ServerDIAMETER clause**

  *PreHandlerHook* is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

- **ServerTACACSPLUS clause**

  *PreHandlerHook* is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's *PrehandlerHook* is run before ServerTACASPLUS's *PreHandlerHook*.

  Global and per-Client user name rewriting and other processing is done before the hooks are run.

  A reference to the request is passed as the only argument.

  The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (\) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

  *PreHandlerHook* can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using *PreHandlerHook*:

  ```perl
  # Fake a new attribute into the request
  PreHandlerHook sub { ${$_[0]}->add_attr('test-attr', 'test-value');}
  ```

3.119.12. **SupportedVendorIds**

This optional parameter allows you to define the Supported Vendor Ids announced in CER. There is no default and no Supported-Vendor-Id is announced by default. Keyword "DictVendors" is an alias group for all vendors in the default dictionary and the dictionary file configured with DiameterDictionaryFile.

```perl
# Tell the peer we support all the vendors in our
# default and DiameterDictionaryFile dictionaries
SupportedVendorIds DictVendors
```

3.119.13. **ConvertCommand**

This optional parameter defines a conversion from Diameter Command Code to RADIUS Code. Currently the only conversion available is converting STR to Accounting-Request with Acct-Status-Type set to Stop. By default no optional conversions are done. Any unknown ConvertCommand conversions are logged, and later ignored, when this module is loaded.

```perl
# Specify one ConvertCommand for each conversion
ConvertCommand STR,Accounting-Request
```

3.119.14. **AuthApplicationIds**

This optional parameter allows you to define the Auth Application Ids announced in CER. Defaults to '0, 1, 5' (i.e. DIAMETER BASE, NASREQ and Diameter-EAP).

```perl
AuthApplicationIds 0, 1
```
3. Configuring Radiator

3.119.15. AcctApplicationIds

This optional parameter allows you to define the Acct Application Ids announced in CER. Defaults to ‘3’ (i.e. BASE_ACCOUNTING).

```
AcctApplicationIds 3
```

3.119.16. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with PacketTrace set off or 0.

`PacketTrace` is available for the following clauses:

- Client
- Handler
- Realm
- AuthBy
- ServerDIAMETER
- ServerRADSEC
- ServerTACACSPLUS

Here is an example of using `PacketTrace`:

```
# Debug any packets that pass through here
PacketTrace
```

3.119.17. PostDiaToRadiusConversionHook

This optional parameter allows you to define a Perl function that will be called during packet processing. `PostDiaToRadiusConversionHook` is called after an incoming Diameter request has been converted to its equivalent RADIUS request, allowing you to alter or add to attribute conversions etc. It is passed references to the incoming Diameter request and the converted RADIUS request.

3.119.18. PostRadiusToDiaConversionHook

This optional parameter allows you to define a Perl function that will be called during packet processing. `PostRadiusToDiaConversionHook` is called after an RADIUS reply has been converted to its equivalent Diameter reply, prior to being sent back to the Diameter client. It is passed references to the RADIUS reply and the converted Diameter reply.

3.120. <ServerTACACSPLUS>

This clause tells Radiator to act as a TACACS+ server as well as a RADIUS server.

TACACS+ is an older Authentication, Authorisation and Accounting (AAA) protocol developed by Cisco and supported by some Cisco devices. It uses TCP connections between the client (usually some kind of router) and the TACACS+ server. Newer Cisco devices generally support both RADIUS and TACACS+ or just RADIUS. Some older Cisco devices only support TACACS+. In addition, there are some Cisco security facilities that are only available through TACACS+.
The `<ServerTACACSPLUS>` clause handles TACACS+ AAA requests in the following way:

- Incoming TACACS+ requests are decrypted using the `TACACSPLUSKey` or `Secret` from a matching Client clause. The search function looks for a matching Client using this order of preference:
  1. Exact IP address
  2. CIDR address
  3. DEFAULT Client clause

  **Note**
  Radiator 4.13 and earlier looked for DEFAULT Client clause before CIDR match.

When the Client search has finished, the decryption key is chosen using this order of preference:

1. If a Client is found and its `TACACSPLUSKey` is defined, it is used as the key.
2. If `<ServerTACACSPLUS> Key` is defined, it is used as the key.
3. If a Client was found, and its `Secret` is defined, it is used as the key.
4. If there still is no key found, a warning is logged and TACACS+ message decryption fails.

- TACACS+ authentication requests are converted into RADIUS Access-Request requests. TACACS+ ASCII, PAP, CHAP and MSCHAP are supported, and the resulting passwords are converted into the appropriate RADIUS attributes. The `action`, `priv_lvl`, `authen_type`, and `service` values in the TACACS+ authentication request are converted to `OSC-TACACS-Action`, `OSC-TACACS-Privilege-Level`, `OSC-TACACS-Authen-Type`, and `OSC-TACACS-Service` RADIUS attributes. The RADIUS Access-Request is dispatched to a matching `<Realm>` or `<Handler>` clause, which serve the request locally any of the Radiator AuthBy clauses or proxy the request to another RADIUS server.

- TACACS+ authorisation requests are approved subject to any `AuthorizeGroupAttr` reply items from the previous RADIUS Access-Accept and `AuthorizeGroup` parameters from the configuration file. In addition, any cisco-avpair reply items from the previous RADIUS Access-Accept are used as authorisation attribute-value pairs. TACACS+ authorisation requests can optionally be converted to RADIUS Access-Requests.

- TACACS+ accounting requests are converted into RADIUS Accounting-Requests.

- Global `RewriteUsername` rules are applied. For more information, see Section 3.7.29. `RewriteUsername` on page 35. Client `RewriteUsername` can also be used. See below for more information about how `<ServerTACACSPLUS>` uses Client clauses.

- The converted RADIUS requests are dispatched to a matching `<Realm>` or `<Handler>` clause, using the same rules as RADIUS requests.

**Tip**
By default, Radiator requires that the user has previously authenticated with this Radiator instance before accepting any TACACS+ authorisation requests. The authentication reply provides the authorisation information Radiator needs to handle the subsequent TACACS+ authorisation requests. If the optional parameter `AllowAuthorizeOnly` is enabled, Radiator requests authorisation information even if the user has not previously authenticated with this Radiator instance. For more information, see Section 3.120.13. `AllowAuthorizeOnly` on page 378.
Tip
If `<Server TACACSPLUS>` is used to authenticate administrator access to a Cisco device, you need to add specific authorisation attributes to allow administrative access. For example, to get administrative access to a Cisco Aironet wireless Access Point requires that the authorisation include a TACACS+ attribute-value pair like:

```
aironet:admin-capability=ident+admin
```

You can achieve this by having a suitable cisco-avpair reply item for the relevant user in your Radiator database:

```
ciscouser User-Password=fred
cisco-avpair="aironet:admin-capability=ident+admin"
```

You can also achieve this by having an AuthorizationAdd parameter in your `<Server TACACSPLUS>` clause:

```
AuthorizationAdd aironet:admin-capability=ident+admin
```

This example enables only some levels of administrative access (ident and admin). See your Cisco device documentation for more details.

Tip
Devices from other vendors than Cisco, such as Juniper, may also accept cisco-avpair attributes.

`<Server TACACSPLUS>` can be used with any Radiator authentication method that understands plain text passwords, such as FILE, SQL, LDAP, DBFILE, and also with any method that challenge the user for additional authentication data, such as DIGIPASS, ACE, OPIE, OTP, INTERNAL.

Tip
You can use the TACACS+ test client `goodies/tacacsplustest` in your distribution to send test TACACS+ requests.

During request processing, `<Server TACACSPLUS>` looks for a Client clause that matches the origin of the TACACS+ request, as described above. If found, a number of parameters from the Client clause are used during processing:

- TACACSPUSKey
- Secret
- RewriteUsername
- StripFromRequest
- AddToRequest
- AddToRequestIfNotExist
- PreHandlerHook
- DefaultRealm (overrides DefaultRealm in `<Server TACACSPLUS>`)

3. Configuring Radiator

3.120. Key

This parameter specifies the default shared secret to be used to decrypt Tacacs+ messages. When a new connection from a Tacacs+ client is received, Server TACACSPLUS tries to find a Key to use for decrypting that connection. It looks in the following places for a Key until it finds one that has been defined:

- EncryptedTACACSPLUSKey parameter is preferred over TACACSPLUSKey parameter of a matching Client clause
- EncryptedKey
- This Key parameter
- EncryptedSecret parameter is preferred over Secret parameter of a matching Client clause

The search for the matching Client clause is done in the following order (Caution: this is slightly different to the order for RADIUS clients):

- Exact IP address match
- DEFAULT clause
- CIDR Address match

**Note**

EncryptedTACACSPLUSKey and EncryptedSecret are currently experimental and will be documented later.

**Tip**

This search order means you can use the Secret parameter in Clients loaded by <ClientListSQL> to specify per-client Tacacs+ keys, provided you do not specify Key in the <Server TACACSPLUS> clause.

**Tip**

If all your Tacacs+ devices use the same key, use this Key parameter. If some or all of your Tacacs+ devices use different keys, define a Client and TACACSPLUSKey for each differing one and set this Key as the default for the rest. If some Tacacs+ clients are also RADIUS clients, define a Client clause for each one, specifying the RADIUS secret in Secret, and the Tacacs+ key in TACACSPLUSKey.

```
Key mysecret
```

3.120.2. EncryptedKey

This parameter specifies the default shared secret to be used to decrypt Tacacs+ messages. When a new connection from a Tacacs+ client is received, Server TACACSPLUS tries to find a Key to use for decrypting that connection. EncryptedKey is in encrypted format and is preferred over Key. For more information, see Section 3.120.1. Key on page 373.

EncryptedKey is currently experimental and will be fully documented later.
3. Configuring Radiator

### 3.120.3. Port

This optional parameter specifies which TCP port the server will listen on for incoming Tacacs+ connections. Defaults to 49 (which generally requires root or other privileged access). Any valid port number or service name can be used.

Port 1024

### 3.120.4. BindAddress

This optional parameter specifies one or more network interface addresses to listen for incoming Tacacs+ connections on. It is only useful if you are running Radiator on a multi-homed host (i.e. a host that has more than one network address). Defaults to the global BindAddress, which defaults to 0.0.0.0 (i.e. listens on all networks connected to the host). For more information, see Section 3.7.9. BindAddress on page 31.

Using this parameter, you can run multiple instances of Radiator on the one computer, where each Radiator listens to Tacacs+ connections directed to a different host address. BindAddress can include special formatting characters, and multiple comma separated IPv4 and IPv6 addresses.

# Only listen on one IPv4 address and the IPv6 loopback
BindAddress 203.63.154.1, ::1

### 3.120.5. AuthorizationReplace

This optional parameter specifies Tacacs+ authorisation attribute-value pairs that are to replace those suggested by the Tacacs+ client. It effectively overrides the default authorisation that the client would use.

You can have as many AuthorizationReplace parameters as you wish, one for each Tacacs+ authorisation attribute-value pair:

AuthorizationReplace service=aironet
AuthorizationReplace protocol=shell
AuthorizationReplace aironet:admin-capability=ident+admin

### 3.120.6. AuthorizationAdd

This optional parameter specifies Tacacs+ authorisation attribute-value pairs that are to be added to those suggested by the Tacacs+ client. It effectively increases the default authorisation that the client would use.

You can have as many AuthorizationAdd parameters as you wish, one for each Tacacs+ authorisation attribute-value pair:

AuthorizationAdd aironet:admin-capability=ident+admin

### 3.120.7. AddToRequest

This optional parameter adds any number of RADIUS attributes to the RADIUS requests generated by ServerTACACSPLUS. It can be used to tag requests arriving from Tacacs+ for special handling within Radiator or in remote RADIUS servers.

AddToRequest NAS-Identifier=TACACS
3. Configuring Radiator

3.120.8. AuthorizationTimeout

This optional parameter changes the timeout period for handling a complete TACACS+ conversation, including the authentication any subsequent authorisation requests. Defaults to 600 seconds. If the timeout expires, further authorisations for an earlier authentication will not be valid, and will be rejected.

3.120.9. DefaultRealm

This optional parameter can be used to specify a default realm to use for received TACACS requests that have a user name that does not include a realm. If the incoming user name does not have a realm (i.e. there is no @something following the user name) and if DefaultRealm is specified, the User-Name in the resulting RADIUS request will have @defaultrealm appended to it. The realm can then be used to trigger a specific <Realm> or <Handler> clause. This is useful if you operate a number of TACACS clients for different customer groups and where some or all of your customers log in without specifying a realm.

Tip
You can override this on a per-client basis by setting DefaultRealm in the Client clause.

```plaintext
# Realmless logins to this NAS will be treated
# as if they are for realm open.com.au
<ServerTACACSPLUS>
    Key ....
    DefaultRealm open.com.au
</ServerTACACSPLUS>
<Realm open.com.au>
    ....
</Realm>
```

3.120.10. GroupMemberAttr

When AuthorizeGroup is use to specify TACACS+ user privileges, GroupMemberAttr specifies the name of the RADIUS reply attribute in the Access-Accept that is expected to contain the name of the TACACS+ users privilege group. This group name will then be used by AuthorizeGroup to determine which privileges can be extended to that user. If there is no such attribute in the Access-Accept, the TACACS+ group name for the user will be assumed to be 'DEFAULT'. If GroupMemberAttr is not defined in the configuration file, then all TACACS+ users will be assumed to have a TACACS+ group name of 'DEFAULT'.

The RADIUS attribute named by GroupMemberAttr may be a real RADIUS attribute received from a remote RADIUS server (in the case where the remote RADIUS server provides the authentication of TACACS+ requests). Or it could be pseudo RADIUS attribute added to the reply by an AuthBy internal to the current Radiator server.

```plaintext
# Name of the pseudo attribute containing the TACACS group name
# in RADIUS Access-Accepts:
GroupMemberAttr tacacsgroup
```

3.120.11. AuthorizeGroup

Some TACACS+ clients request per-command authorisation of commands from the TACACS+ server. When this occurs, one or more AuthorizeGroup parameters can be used to specify privilege levels, permitted TACACS commands, and TACACS restrictions for various TACACS+ privilege groups. If no
AuthorizeGroup parameters are specified in the Radiator configuration file, all TACACS+ commands are authorised by <Server TACSCPLUS>.

You must have a thorough and complete understanding of TACACS+ command authorisation and how to configure your TACACS+ client for command authorisation before attempting to configure privilege control with AuthorizeGroup.

The general format of the AuthorizeGroup parameter is this:

```
AuthorizeGroup <groupname> <permit|permitreplace|deny> pattern1 pattern2 ... {attr1=val attr2=val ...} {extra_check1=val extra_check2="val 2" ...}
```

If any extra checks exist, they are also evaluated for a match. Currently supported extra checks are:

- peeraddr
- Client-Identifier
- Any real attribute from Access-Accept
- Any pseudo attribute from Access-Accept

Each AuthorizeGroup parameter specifies a privilege rule for a TACACS+ privilege group. You can specify zero or more AuthorizeGroup parameters for each privilege group that is used in your organisation. The AuthorizeGroup parameters are considered for a group in the order in which they are given in the Radiator configuration file.

When a TACACS authorisation request is received, the list of AuthorizeGroup rules is searched for rules matching the group name identified by the GroupMemberAttr attribute. For more information, see Section 3.120.10. GroupMemberAttr on page 375. Each rule is examined in order until a matching rule is found. The patterns are used to do the matching. Each pattern is a Perl Regular Expression (regexp). Pattern1 is matched against the first TACACS+ request argument (usually service=xyz), pattern2 is matched against the second TACACS+ request argument and so on. If every pattern matches its TACACS+ argument, then the rule matches.

**Tip**
For example service=shell is a single request argument. The pattern to match two values for service is service=(shell|exec).

If the first matching rule is deny, the authorisation is denied.

If the first matching rule is permit, the request is authorised, and the list of reply attr=val entries are sent back to the TACACS+ client to be added to the user's command arguments.

If the first matching rule is permitreplace, the request is authorised, and the list of reply attr=val entries are sent back to the TACACS+ client and are used to replace the user's requested command arguments.

**Tip**
Some Cisco devices have authorisation for optional roles with the * character. This is not a wildcard character, but indicates the following is optional. For example, the following rule automatically selects the right roles depending on the shell:contextname in the authorisation request. Only the set of roles corresponding to the requested contextname is returned.

```
AuthorizeGroup group1 permit service=shell \
```
To provide per-user privilege control for TACACS+ users:

1. Divide your TACACS+ users into groups where all the members in the group have the same privileges.
2. Assign a unique name to each group.
3. Choose a RADIUS Reply attribute that will contain the group name for each user. Set this attribute name in `GroupMemberAttr`.
4. Arrange for each user to have their specific group name (from step 1) in their RADIUS Reply attribute selected in the previous step.
5. Add one or more `AuthorizeGroup` parameters specifying the privileges for all of the possible group names from step 1 above.
6. Configure your TACACS+ client to perform per-command authorisation with its TACACS+ server.
7. Test that your TACACS+ client enforces the correct privileges specified in step 5 for each user group.

**Example**

This example uses two TACACS groups. Group1 is only permitted to do show commands but group2 is allowed to do anything. Group1 is allowed to start a PPP IP session, which gets an inacl of 101 and an outacl of 102.

```plaintext
AuthorizeGroup group1 permit service=shell cmd=show cmd-arg=.*
AuthorizeGroup group1 permit service=ppp protocol=ip {inacl=101 outacl=102}
AuthorizeGroup group1 deny .*
AuthorizeGroup group2 permit .*
```

**Example**

This example uses extra checks to allow or deny `show` commands for `group1`. Users coming from client that connects from 127.0.0.1 are explicitly permitted. Users coming from client that has identifier `Some-TACACSPLUS-client` are explicitly denied. The rest of the users are permitted.

```plaintext
AuthorizeGroup group1 permit service=shell cmd=show cmd-arg=.* () \ {peeraddr=127.0.0.1}
AuthorizeGroup group1 deny service=shell cmd=show cmd-arg=.* () \ {Client-Identifier="Some-TACACSPLUS-client"}
AuthorizeGroup group1 permit service=shell cmd=show cmd-arg=.*
```

**Example**

As an alternative to controlling individual command authorisation, you can set a privilege level for the user when they start their exec session. Thereafter, the router limits which command the user can use, depending on the priv-lvl. 0 is the lowest, and permits disable, enable, exit, help, and logout. priv-lvl=1 is the non-privileged
user. priv-lvl=15 is the highest privilege level, the level after going into enable mode. Here users in group 3 get a priv-lvl of 15. The start of a session sends the args 'service=shell cmd*'.

AuthorizeGroup group3 permit service=shell cmd\* {priv-lvl=15}

For more examples, see goodies/tacacsplusserver.cfg.

### 3.120.12. AuthorizeGroupAttr

If this parameter is specified, it specifies the name of an attribute in Access-Accept that will contain per-command authorisation patterns for authorising TACACS+ commands for this user. Multiple attributes are supported with each attribute containing one pattern. The format is the same as the AuthorizeGroup parameter above excluding the group name. These patterns are processed before any configured-in AuthorizeGroup parameters.

As an example, a users file to grant group1 member ‘mikem’ an additional right to use ping command would look like below. The Radiator <ServerTACACSPLUS> clause is configured with GroupMemberAttr OSC-Group-Identifier and AuthorizeGroupAttr OSC-Authorize-Group.

```
mikem User-Password=fred
   OSC-Group-Identifier = group1,
   OSC-Authorize-Group = "permit service=shell cmd=ping"
```

### 3.120.13. AllowAuthorizeOnly

When enabled, this parameter allows Radiator to create a RADIUS Access-Request with Service-Type attribute set to Authorize-Only when TACACS+ authorisation request is received but Radiator has no previous information about the user's authorisation. This can happen if the TACACS+ client does not use TACACS + for authentication, has authenticated against another TACACS+ server, Radiator has been reloaded, or AuthorizationTimeout has expired. This is disabled by default.

For example, Cisco 'aaa new model' allows non-TACACS+ authentication with TACACS+ based accounting and authorisation: you can authenticate with local user name, Radius, or kerberos and then do command authorisation over TACACS+.

The default for Radiator is to require TACACS+ authentication first to create the authorisation context before being able to do command authorisation. If AllowAuthorizeOnly is enabled, this is not requires.

Before enabling this option, we recommend considering if it is acceptable to trust the TACACS+ client authentication and allow Radiator to do command authorisation without any previous knowledge about the users' authentication.

### 3.120.14. UsernamePrompt

This optional parameter sets the prompt that ServerTACSPPLUS will use to prompt the client for a user name when the Tacacs authen-type of ASCII is used. Defaults to ‘Username: ‘.

### 3.120.15. PasswordPrompt

This optional parameter sets the prompt that ServerTACSPPLUS will use to prompt the client for a password when the Tacacs authen-type of ASCII is used. Defaults to ‘Password: ‘.

### 3.120.16. IdleTimeout

If a TACACS+ client stays connected for more than this number of seconds without sending any requests it will be disconnected. Defaults to 180 seconds. A Value of 0 means no idle timeout will apply, and clients can stay connected forever.
3.120.17. AuthenticationStartHook

Specifies a Perl hook to run when a TACACS+ Authentication Start is received. It can be used for special processing of TACACS+ Start requests. If the hook returns an empty list, normal processing of the request will continue else no further processing will be done and the hook is expected to handle the request.

The hook is passed the following arguments:

- Pointer to the current Server TACACSPLUS clause
- Pointer to the temporary RADIUS request that has been constructed to represent the TACACSPLUS authentication request
- The action attribute from the incoming TACACSPLUS request. This describes the authentication action to be performed. One of $Radius::Tacacsplus::TAC_PLUS_- AUTHEN_*.
- The authen_type attribute from the incoming TACACSPLUS request. The type of authentication that is being performed. One of $Radius::Tacacsplus::TAC_PLUS_- AUTHEN_TYPE_*.
- The priv_lvl attribute from the incoming TACACSPLUS request. This indicates the privilege level that the user is authenticating as. One of $Radius::Tacacsplus::TAC_PLUS_PRIV_LVL_*.
- The service attribute from the incoming TACACSPLUS request. This is the service requesting the authentication. One of $Radius::Tacacsplus::TAC_PLUS_AUTHEN_SVC_*.

3.120.18. AuthenticationContinueHook

Specifies a Perl hook to run when a TACACS+ Authentication Continue is received. It can be used for special processing of TACACS+ Continue requests. If the hook returns an empty list, normal processing of the request will continue else no further processing will be done and the hook is expected to handle the request.

The hook is passed the following arguments:

- Pointer to the current Server TACACSPLUS clause
- The body of the request a received in the incoming TACACSPLUS CONTINUE request. Contains the undecoded flags and fields from the request.
- $Radius::Tacacsplus::TAC_PLUS_AUTHEN_SVC_*.

3.120.19. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- Client clause
  
  PreHandlerHook is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.

- AuthBy clause
  
  The functionality depends on the used EAP authentication type:
  
  - PEAP, EAP-TTLS, EAP-FAST
    
    PreHandlerHook specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.
  
  - LEAP
    
    If EAP_LEAP_Mschap_Convert flag is set, PreHandlerHook specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.
– EAP-MSCHAPv2

If `EAP_PEAPEACHAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

– EAP-GTC

If `EAP_GTC_PAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

• AuthBy DYNAUTH clause

`PreHandlerHook` is called for each request created by the clause before the request is passed to a Realm or Handler clause.

• ServerRADSEC clause

`PreHandlerHook` is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

• ServerDIAMETER clause

`PreHandlerHook` is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

• ServerTACASPLUS clause

`PreHandlerHook` is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's `PrehandeHook` is run before ServerTACASPLUS's `PreHandlerHook`. Global and per-Client user name rewriting and other processing is done before the hooks are run.

A reference to the request is passed as the only argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (\) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

`PreHandlerHook` can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using `PreHandlerHook`:

```perl
# Fake a new attribute into the request
PreHandlerHook sub { ${$_[0]}->add_attr('test-attr', 'test-value');}
```

3.120.20. SingleSession

This optional parameter tells the server to try to maintain a single TCP connection for all TACACS+ requests from the same client if the client permits. If this flag is set and if the TACACS+ client indicates a willingness to support single connections with the `TAC_PLUS_SINGLE_CONNECT_FLAG`, the TCP connection will not be closed by Radiator after each TACACS+ session. Defaults to 1.

Single sessions can be disabled regardless of client options by setting the SingleSession flag to 0.

**Note**

Default behaviour changed in 4.8. In versions of Radiator prior to 4.8, the default behaviour was to always try to keep the session open.
3.120.21. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with PacketTrace set off or 0.

PacketTrace is available for the following clauses:

- Client
- Handler
- Realm
- AuthBy
- ServerDIAMETER
- ServerRADSEC
- ServerTACACSPLUS

Here is an example of using PacketTrace:

```bash
# Debug any packets that pass through here
PacketTrace
```

3.120.22. DisconnectWhenIgnore

If the AuthBy returns IGNORE message because of an authentication backend database failure, DisconnectWhenIgnore flag parameter defines the server behaviour. When this is set, the server disconnects the client without returning TACACS+ error message before disconnecting. This may cause the client to continue with local authentication after the authentication backend failure.

---

**Note**

The client behaviour, when the TACACS+ error message is not sent, depends on its implementation.

---

3.120.23. ContextId

ContextId parameter specifies how to derive a lookup key for TACACS+ authentication context when authorizing TACACS+ requests. Context specific special characters supported are: TACACS+ client IP address (%0), TACACS+ client source TCP port (%1), TACACS+ user (%2), TACACS+ port (%3), TACACS+ rem_addr (%4). The default is fine for the most cases. Defaults to %2:%0.

```bash
# Base context lookup only on username
ContextId %2
```

3.120.24. GroupCacheFile

---

**CAUTION**

This option is deprecated and no longer does anything. AllowAuthorizeOnly replaces GroupCacheFile. For more information, see Section 3.120.13. AllowAuthorizeOnly on page 378.
3. Configuring Radiator

3.121. <ServerRADSEC>

This clause accepts RadSec (RFC 6614) connections from <AuthBy RADSEC> clauses in other Radiators and processes RADIUS requests sent over the RadSec connection in a similar way to how a Client clause received conventional UDP RADIUS requests. RadSec can be used to provide secure reliable proxying of RADIUS requests from one Radiator to another, even over insecure networks. For more information, see RadSec white paper [http://www.open.com.au/radiator/radsec-whitepaper.pdf].

Both <ServerRADSEC> and any <AuthBy RADSEC> clauses that connect to it must have the same Secret configured, otherwise they are not able to exchange RADIUS requests correctly, irrespective of whether any TLS or other configuration parameters are correct.

All valid RADIUS requests received by <ServerRADSEC> are dispatched to the first matching <Realm> or <Handler> clause, in the same way as the <Client> clause. The reply to any incoming request will be automatically delivered back to the original requesting <AuthBy RADSEC> client.

<ServerRADSEC> supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

When UseTLS is enabled, <AuthBy RADSEC> clients always expect to receive a TLS server certificate from <ServerRADSEC>. This means that if you enable UseTLS, you must configure a server certificate, otherwise <AuthBy RADSEC> is not able to establish a TLS encrypted connection to <ServerRADSEC>.

**Tip**

Operators can use a third party free or commercial Certificate Authority to generate private certificates for RadSec clients and servers.

**Tip**

For compliance with RFC 6614, ServerRADSEC defaults to a Secret of 'radsec', Transport of 'tcp', UseTLS enabled, and TLSRequireClientCert enabled.

When a RadSec client presents a certificate to the RadSec Server, the RadSec server performs a number of checks to validate the client certificate. The client certificate is checked for valid start and end dates, and also checks the chain of validity back to the issuing Certificate Authority, using the root certificates specified in TLS_CAFile or TLS_CAPath. If TLS_PolicyOID parameter is defined, the OIDs must be present in the certificate path. Also a client certificate is only accepted if at least one of the following conditions are true:

- The IP address of the client exactly matches a subjectAltName with type IPADD (IP Address) in the certificate. If subjectAltNameDNS is configured, its value is used to match the certificate's subjectAltName values with type DNS.
- The Subject in the certificate matches the pattern specified by the TLS_ExpectedPeerName parameter in this <ServerRADSEC> clause.

and

- If TLS_SubjectAltNameURI parameter is defined in the <ServerRADSEC> clause, the certificate must contain a subjectAltName of type URI that matches the TLS_SubjectAltNameURI regular expression.
- If TLS_CertificateFingerprint parameter is defined in the <AuthBy RADSEC> clause, the certificate's fingerprint must match at least one of the TLS_CertificateFingerprint options.
Note that the default `TLS_ExpectedPeerName` pattern is `.+`, which matches any Subject. This means than in the default configuration, `<ServerRADSEC>` accepts any client whose client certificate can be validated against a root certificate specified by `TLS_CAFile` or `TLS_CAPath`.

These certificate validation rules are consistent with RFC 2595.

### 3.121.1. Port

This optional parameter specifies which network port `<ServerRADSEC>` listens to for connections from RadSec clients. The default value is `2083`, the official IANA port number for RadSec. `Port` can be a numeric port number or symbolic port or service name.

### 3.121.2. BindAddress

This optional parameter specifies one or more network interface addresses to listen for incoming connections. It is only useful if you are running Radiator on a multi-homed host (a host that has more than one network address). The default value is the global `BindAddress`, which defaults to `0.0.0.0`. It listens to all networks connected to the host. For more information, see Section 3.7. Global parameters on page 27.

Using this parameter, you can run multiple instances of Radiator on the one computer, where each instance listens to connections directed to a different host address. `BindAddress` can include special formatting characters, and multiple comma separated IPv4 and IPv6 addresses.

When SCTP multihoming is supported, all addresses defined with `BindAddress` must be either IPv4 or IPv6 addresses. Radiator binds all addresses to one listen socket instead of creating multiple listen sockets.

Here is an example of using `BindAddress`:

```
# Only listen on one IPv4 address and the IPv6 loopback
BindAddress 203.63.154.1, ::1
```

### 3.121.3. MaxBufferSize

This optional advanced parameter specifies the maximum number of octets that are output buffered. The default value is `10000`. 0 means no output buffering. This advanced parameter usually does not need adjusting.

### 3.121.4. Secret

This parameter specifies the shared secret that will be used between this `<ServerRADSEC>` and `<AuthBy RADSEC>` clients that connect to it. The shared secret is used in the same way as `Secret` parameter in the `Client` clause: to encrypt passwords and generate message authenticators. The shared secret must be configured identically into `<ServerRADSEC>` and all `<AuthBy RADSEC>` clients that connect to it, regardless of whether TLS is enabled or not. An authentication error will occur if the shared secret is not correctly configured. For compliance with RFC 6614, the default value is `radsec`.

### 3.121.5. RewriteUsername

This is an optional parameter. It enables you to alter the username in authentication and accounting requests. For more details and examples, see Section 8. Rewriting user names on page 454.

### 3.121.6. StripFromRequest

This optional parameter strips the named RADIUS attributes from the RADIUS requests received by ServerRADSEC before passing them to any authentication modules. The value is a comma separated list of attribute names. `StripFromRequest` removes attributes from the request before `AddToRequest` adds any to the request. There is no default.
# Remove any NAS-IP-Address,NAS-Port attributes
StripFromRequest NAS-IP-Address,NAS-Port

3.121.7. AddToRequest

This optional parameter adds any number of RADIUS attributes to the RADIUS requests that <ServerRADSEC> receives. It can be used to tag requests arriving from RadSec for special handling within Radiator or in remote RADIUS servers.

Here is an example of using AddToRequest:

AddToRequest NAS-Identifier=RADSEC

3.121.8. AddToRequestIfNotExist

This string is an optional parameter. It adds attributes to the requests that <ServerRADSEC> receives. Unlike AddToRequest, an attribute is added only if it does not exist in the request already. The value is a comma-separated list of attribute-value pairs.

3.121.9. AllowInReject

This optional parameter specifies the only attributes that are permitted in an Access-Reject. This can be useful in Handlers with multiple AuthBys where the attributes added before a rejecting AuthBy need to be stripped from the resulting Access-Reject.

AllowInReject is not set by default and does not remove anything from Access-Rejects.

# Only permit a limited set of attributes in a reject.
AllowInReject Message-Authenticator, EAP-Message

3.121.10. DefaultRealm

This optional parameter can be used to specify a default realm to use for received RadSec requests that have a user name that does not include a realm. If the incoming user name does not have a realm (i.e. there is no @something following the user name) and if DefaultRealm is specified, the User-Name in the resulting RADIUS request will have @defaultrealm appended to it. The realm can then be used to trigger a specific <Realm> or <Handler> clause. This is useful if you operate a number of RadSec clients for different customer groups and where some or all of your customers log in without specifying a realm.

# Realmless logins to this NAS will be treated
# as if they are for realm open.com.au
<ServerRADSEC>
   Secret ....
   ..... 
   DefaultRealm open.com.au
</Client>
<Realm open.com.au>
   ..... 
</Realm>

3.121.11. Protocol

This optional parameter specifies which Stream protocol is used to carry RadSec. Options are tcp for TCP/IP or sctp for SCTP (Stream Control Transmission Protocol). The default value is tcp. Not all hosts are able to support sctp, consult your vendor. The protocol setting must be the same in each RadSec server and client.
3. Configuring Radiator

**Protocol sctp**

**Tip**
On modern Linux hosts, SCTP support is in a loadable module, and can be enabled with:

```
modprobe sctp
```

### 3.121.12. PreHandlerHook

This optional parameter allows you to define a Perl function that is called during packet processing. It can be configured within several types of clauses for which its functionality is slightly different:

- **Client clause**
  
  `PreHandlerHook` is called for each request after per-Client user name rewriting and duplicate rejection, and before the request is passed to a Realm or Handler clause.

- **AuthBy clause**

  The functionality depends on the used EAP authentication type:

  - **PEAP, EAP-TTLS, EAP-FAST**

    `PreHandlerHook` specifies a Perl hook to be called before the inner request is re-dispatched to a matching Realm or Handler.

  - **LEAP**

    If `EAP_LEAP_MSCHAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

  - **EAP-MSCHAPv2**

    If `EAP_PEAP_MSCHAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

  - **EAP-GTC**

    If `EAP_GTC_PAP_Convert` flag is set, `PreHandlerHook` specifies a Perl hook to be called before the converted request is re-dispatched to a matching Realm or Handler.

- **AuthBy DYNAUTH clause**

  `PreHandlerHook` is called for each request created by the clause before the request is passed to a Realm or Handler clause.

- **ServerRADSEC clause**

  `PreHandlerHook` is called for each request after global and per-ServerRADSEC user name rewriting and before the request is passed to a Realm or Handler clause.

- **ServerDIAMETER clause**

  `PreHandlerHook` is called for each request received by ServerDIAMETER before the request is passed to a Realm or Handler clause.

- **ServerTACACSPLUS clause**

  `PreHandlerHook` is called for each request after per-ServerTACACSPLUS user name rewriting and before the request is passed to a Realm or Handler clause.
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*PreHandlerHook* is called for each request before it is passed to a Realm or Handler clause. If a Client is found for the request, Client's *PrehandlerHook* is run before ServerTACACSPLUS's *PreHandlerHook*. Global and per-Client user name rewriting and other processing is done before the hooks are run.

A reference to the request is passed as the only argument.

The hook code is compiled by Perl when Radiator starts up. Compilation errors in your hook code are reported to the log file at start-up time. Runtime errors in your hook are also reported to the log file when your hook executes. Multiline hooks with trailing backslashes (\) are parsed by Radiator into one long line. Therefore, do not use trailing comments in your hook.

*PreHandlerHook* can be an arbitrarily complicated Perl function, that might run external processes, consult databases, change the contents of the current request or many other things. Here is an example of using *PreHandlerHook*:

```perl
# Fake a new attribute into the request
PreHandlerHook sub { ${$_[0]}->add_attr('test-attr', 'test-value');}
```

### 3.121.13. Identifier

This optional parameter can be used to match Client-Identifier check items in Handler and other clauses, so that you can trigger special behaviour for requests received by a particular ServerRADSEC clause.

### 3.121.14. PacketTrace

This optional flag forces all packets that pass through this module to be logged at trace level 5 until they have been completely processed. This is useful for logging packets that pass through this clause in more detail than other clauses during testing or debugging. The packet tracing stays in effect until it passes through another clause with *PacketTrace* set off or 0.

*PacketTrace* is available for the following clauses:

- **Client**
- **Handler**
- **Realm**
- **AuthBy**
- **ServerDIAMETER**
- **ServerRADSEC**
- **ServerTACACSPLUS**

Here is an example of using *PacketTrace*:

```perl
# Debug any packets that pass through here
PacketTrace
```

### 3.121.15. StatusServer

Normally, when a Status-Server request is received, Radiator replies with some statistics including the total number of requests handled, the current request rate and so on. You can control Status-Server response by setting *StatusServer* to one of the following values:

- **off**
3. Configuring Radiator

Status-Server requests are ignored.

- **minimal**
  
  Reply without any attributes.

- **default**
  
  Reply with statistics.

### 3.122. <ServerHTTP>

The `<ServerHTTP>` clause presents a HTTP interface that allows Radiator to be monitored, configured and reconfigured through a standard web browser. The Graphical User Interface (GUI) that it presents is designed to be easy to use and intuitive, and to allow access to the full range of detailed configuration options that are usually access directly by editing the configuration file.

The GUI presented by `<ServerHTTP>` is a useful alternative to the more traditional editing of the Radiator configuration file. Further it allows access to other useful information about the host that Radiator is running on, the details of the version of Perl installed, and details about the versions and modules of Radiator installed on that host.

The GUI presented by this interface is described in Section 5. Configuring Radiator with GUI on page 405.

`<ServerHTTP>` supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

**Authentication**

Any user attempting to connect to `<ServerHTTP>` is subject to authentication. If authentication does not succeed, then the user is unable to access any web pages. Once logged in, the information the user is permitted to see, and the actions the user is permitted to do are controlled by the user's Privilege Level. The authentication steps are:

1. Check all the clauses in the AuthBy list, if any, continuing until the AuthByPolicy is met.

2. If no AuthBy clause succeeds (or if there are no AuthBy clauses), authenticate against the hardwired User name and Password in this clause.

3. If the hardwired User name is not defined permit authentication as the user 'anonymous' without a password.

If the last AuthBy returns ACCEPT, the connection is accepted. If the last AuthBy returns IGNORE, or there are no AuthBys, then fall back to the hardwired User name and Password parameters is done.

**Note**

If you plan to use `<AuthBy RADIUS>`, you need to configure the AuthBy with the Synchronous parameter. Otherwise `<AuthBy RADIUS>` returns immediately with IGNORE.

An authentication lasts for the time period given by `SessionTimeout`, after which the user will be required to log in again.

The users Privilege Level is determined in the following way:

1. If the successful authentication was from an AuthBy clause, and the user had a Management- Policy-Id reply item, then the Privilege Level is given by the integer in the Management-Policy-Id.

2. Otherwise the Privilege Level is given by the DefaultPrivilegeLevel parameter.
Privilege Level

The information the user is permitted to see, and the actions the user is permitted to do are controlled by the user's Privilege Level. The Privilege Level is a number from 0 to 15, where 0 is the lowest privilege, (and which does not even permit logging in), and 15 is the highest, which allows all actions.

The Privilege Level is a bitmask obtained by adding together the following numbers:

- 1: Permission to view basic (non-security-critical) status only.
- 2: Permission to reset the server
- 4: Permission to edit and change the running configuration (but not save it)
- 8: Permission to save changes to the configuration file

For example, to grant privilege to view status and to reset the server, the Privilege Level should be set to 3 (1 + 2). To grant all privileges, the Privilege Level should be set to 15 (1 + 2 + 4 + 8).

CAUTION

Careless configuration of this clause can open security holes in your RADIUS host. In order to limit the possibility of security compromise, It is recommended that you:

1. Limit the clients that can connect with the Clients parameter.
2. Make sure the Radiator configuration file is only readable by root.
3. Consider making Radiator run as a non-privileged user.
4. Use secure user names and password to authenticate access to this server.
5. Enable SSL connections only with the UseSSL flag.
6. Disable this clause when not required.

3.122.1. Port

Port number to listen for connections. Service names or integer port numbers are permitted.

3.122.2. Username

Fallback username to log in as. If there is no Username and no AuthBy clauses, users will not be required to authenticate in order to use the web interface.

3.122.3. Password

Fallback password for Username. Password can be plaintext or any of the encrypted formats such as {crypt}......, {nthash}......, {SHA}......, {SSHA}......, {mysql}......, {mssql}......, {dechpwd}......, {MD5}......, {clear}.... etc.

3.122.4. AuthBy

List of AuthBy clauses to use to handle authentication for new web connections. Requests are processed by each AuthBy in order until AuthByPolicy is satisfied. If there are no AuthBy clauses, the fallback Username and Password will be used.

3.122.5. AuthByPolicy

Specifies whether and how to continue authenticating after each AuthBy.
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3.122.6. AuthLog
List of AuthLog clauses which will be used to log authentication of users logging in the Server HTTP interface.

3.122.7. AuditTrail
Optional filename where all editing and configuration changes will be logged. Special characters are supported.

3.122.8. LogMicroseconds
When logging, include microseconds in the time.

3.122.9. SessionTimeout
Maximum time in seconds a session is permitted to continue without logging in again.

3.122.10. LogMaxLines
Maximum number of recent log lines which will be displayed on the Log page.

3.122.11. Trace
Logging trace level. Only messages with the specified or higher priority will be logged.

3.122.12. DefaultPrivilegeLevel
Privilege level to be used if a per-user Management-Policy-Id is not available from a successful authentication from the AuthBy list. The privilege level is a bitmask described above.

3.122.13. PageNotFoundHook
If a page is requested but not found in the set of built-in pages PageNotFoundHook is called to try to handle the request. PageNotFoundHook is passed the requested URI and a reference to the ServerHTTP connection. If it can handle the request, it returns an array of ($httpcode, $content, @httpheaders), else undef.

```perl
PageNotFoundHook sub {return (200, "your HTML content");}
```

3.123. <StatsLog xxxxxxx>
This marks the beginning of a StatsLog clause, which defines how to log statistics from Radiator internal objects. The xxxxxxx is the name of a specific StatsLog module. For more about Diameter statistics and how to configure logging them, see Section 3.127. <DiaStatsLog xxxxxxx> on page 394. This section lists the configuration parameters all StatsLogs and DiaStatsLogs use and describes StatsLog statistics in detail.

StatsLogs may also use additional parameters that are specific for that StatsLog. StatsLog clauses are defined at the top level configuration.

Radiator collects statistics for the server as a whole, as well as for each Client, Realm, Handler, AuthBy, and Host that a packet passes through. The following statistics are collected for each object or clause:

### Table 10. Statistics collected within Radiator and usage in Format parameter

<table>
<thead>
<tr>
<th>Symbolic name</th>
<th>Description</th>
<th>Format character</th>
</tr>
</thead>
<tbody>
<tr>
<td>requests</td>
<td>Total requests</td>
<td>%22</td>
</tr>
<tr>
<td>droppedRequests</td>
<td>Total dropped requests</td>
<td>%14</td>
</tr>
<tr>
<td>duplicateRequests</td>
<td>Total duplicate requests</td>
<td>%17</td>
</tr>
<tr>
<td>Symbolic name</td>
<td>Description</td>
<td>Format character</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>proxiedRequests</td>
<td>Total proxied requests</td>
<td>%21</td>
</tr>
<tr>
<td>proxiedNoReply</td>
<td>Total proxied requests with no reply</td>
<td>%20</td>
</tr>
<tr>
<td>badAuthRequests</td>
<td>Total Bad authenticators in requests</td>
<td>%11</td>
</tr>
<tr>
<td>responseTime</td>
<td>Average response time (seconds). This is a cumulative moving average of the per-request elapsed processing time for the last 100 requests.</td>
<td>%23</td>
</tr>
<tr>
<td>accessRequests</td>
<td>Access requests</td>
<td>%6</td>
</tr>
<tr>
<td>dupAccessRequests</td>
<td>Duplicate access requests</td>
<td>%15</td>
</tr>
<tr>
<td>accessAccepts</td>
<td>Access accepts</td>
<td>%3</td>
</tr>
<tr>
<td>accessRejects</td>
<td>Access rejects</td>
<td>%5</td>
</tr>
<tr>
<td>accessChallenges</td>
<td>Access challenges</td>
<td>%4</td>
</tr>
<tr>
<td>malformedAccessRequests</td>
<td>Malformed access requests</td>
<td>%18</td>
</tr>
<tr>
<td>badAuthAccessRequests</td>
<td>Bad authenticators in authentication requests</td>
<td>%9</td>
</tr>
<tr>
<td>droppedAccessRequests</td>
<td>Dropped access requests</td>
<td>%12</td>
</tr>
<tr>
<td>accountingRequests</td>
<td>Accounting requests</td>
<td>%7</td>
</tr>
<tr>
<td>dupAccountingRequests</td>
<td>Duplicate accounting requests</td>
<td>%16</td>
</tr>
<tr>
<td>accountingResponses</td>
<td>Accounting responses</td>
<td>%8</td>
</tr>
<tr>
<td>malformedAccountingRequests</td>
<td>Malformed accounting requests</td>
<td>%19</td>
</tr>
<tr>
<td>badAuthAccountingRequests</td>
<td>Bad authenticators in accounting requests</td>
<td>%10</td>
</tr>
<tr>
<td>droppedAccountingRequests</td>
<td>Dropped accounting requests</td>
<td>%13</td>
</tr>
</tbody>
</table>

**CAUTION**

In the case of AuthBy clauses you should set a unique Identifier in each clause, otherwise you will not necessarily be able to distinguish between each AuthBy clause in StatsLog statistics.

---

**Tip**

responseTime measures the per-request processing time, the time required for Radiator to fully process a single request. It does not measure the Access-Request/ Access-Accept delay. For more information
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about how responseTime is calculated, see Table 10. Statistics collected within Radiator and usage in Format parameter on page 389.

**Tip**
responseTime will be computed based on time measurements accurate to 1 microsecond when Time::HiRes module is available. This should be the case with all modern Perl versions.

### 3.123.1. Interval

This is the time interval (in seconds) between each set of statistics. The default value is 600 seconds (10 minutes).

```plaintext
# Log once per day
Interval 86400
```

### 3.123.2. StatsType

By default statistics produce counter, for example cumulative, values. You can change this with StatsType parameter. The parameter value is the output type and can be one of:

- **cumulative**: cumulative counter shows the number of processed packets.
- **derivative**: derivative is the difference (delta) between two counter values in time interval.
- **packet_rate**: packet rate is the amount of packets transferred within time interval (packets per second).
- **all**: all produces output from all available statistic types (cumulative, derivative and packet_rate).

The default output type is cumulative.

```plaintext
# We are interested in the difference (delta)
StatsType derivative
```

### 3.123.3. RateCalculationInterval

This is used to calculate packet rates that are different from the value of Interval. RateCalculationInterval is an optional parameter that defines the time interval (in seconds) in which the packet rate is calculated. For example, if Interval is set to 600 seconds and RateCalculationInterval is set to 60, statistics is dumped in every 600 seconds but packet rate shows the average amount of packets in 60 second interval.

Calculated example: Amount of packets in Interval (600 s) is 1000 pkts and RateCalculationInterval is one minute (60 s), (1000 pkts/10 min) * (60 s/min) / (600 s/10 min) = 100 pkts/min.

RateCalculationInterval defaults to 1 (packets per second).

```plaintext
# We are interested in packets per minute
RateCalculationInterval 60
```

### 3.123.4. OutputFormat

This string defines the format of statistics entries. The value can be either **text** or **json**. The default value is **text** unless otherwise documented by a clause.

```plaintext
<StatsLog FILE>
```
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```
# Log as json instead of text
OutputFormat json

# Other configuration options
</StatsLog>
```

3.124. `<StatsLog FILE>`

This clause logs statistics from all Radiator internal objects to a flat file. There is an example configuration file in `goodies/statslog.cfg`.

In StatsLog FILE, the specified filename is opened every Interval seconds, and the statistics for each object are logged, one line per object. An optional header line is also logged. For each object logged, the log contains a timestamp (in seconds since 1970), the type of the object and a unique identifier, if available, followed by the value of each statistic in alphabetical order by their symbolic name (see Table 10. Statistics collected within Radiator and usage in Format parameter on page 389). It will use the Identifier field of available, otherwise the object Name.

Statistics for the server as a whole (ServerConfig) will be logged first, followed by each Client, each Realm, each Handler. Within each Realm and Handler, each AuthBy used by that clause will be logged (recursively for AuthBy GROUP). Within any AuthBy RADIUS, statistics for Host clauses will be logged. You can find an example of the log format in `goodies/statslog.cfg`.

3.124.1. Filename

This is the name of the file to log statistics to. Defaults to `%L/statistics`. The file name can include special formatting characters, although data from the current request or reply are never available (logging is never done in the context of a current request. For more information, see Section 3.3. Special formatters on page 19.

```
Filename /path/to/my/stats.dat
```

CAUTION

Logging to STDOUT by specifying Filename as a single dash - is no longer supported. Support for this was removed in Radiator 4.18.

3.124.2. Format

This optional parameter specifies the format for each logging line. You can use this to control exactly what statistics are logged and in what order they appear.

If Format is not defined, statistics data will be logged in the following order (also shown is the special character that is available for that data in the Format specification). All fields will be colon separated.

- Current timestamp in seconds since 1970 (%0)
- Type of object whose data is being logged (%1)
- Identifier of the object (if present) else its Name (%2)
- Each statistic in alphabetical order of its symbolic name (%3 to %23). See Table 10. Statistics collected within Radiator and usage in Format parameter on page 389.

```
# Log the timestamp, objtype, name and average response time
Format %0:%1:%2:%23
```
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3.124.3. Header

This optional parameter allows you to customise the Header line that is logged before each set of statistics. It can be useful for describing the contents of each column when importing into Excel etc.

The default is a single line beginning with a hash, followed a name for each column, colon separated.

If Header is defined as an empty string, no Header lines will be written.

```plaintext
# No headers
Header
```

3.125. <StatsLog SQL>

This clause logs statistics from all Radiator internal objects to an SQL database. There is an example configuration file in `goodies/statslog.cfg`.

For more information about what data is available for logging, see Table 10. Statistics collected within Radiator and usage in Format parameter on page 389.

By default, `<StatsLog SQL>` executes an SQL insert statement for each object to be logged, which includes a timestamp, object type, object name, and each statistic available for logging. `<StatsLog SQL>` supports all the common SQL configuration parameters. For more information about the SQL configuration parameters, see Section 3.8. SQL configuration on page 43. This clause ignores OutputFormat configuration parameter.

3.125.1. InsertQuery

This optional parameter specifies the SQL query to be used for each log. It can include special formatting characters. For more information, see Section 3.3. Special formatters on page 19. %0 to %23 are replaced by statistics data. For more information, see Section 3.124.2. Format on page 392.

The default is an SQL query something like this, which is compatible with the example RADSTATSLOG table created by the example database schemas in goodies.

```sql
insert into RADSTATSLOG (TIME_STAMP, TYPE, IDENTIFIER, <symbolic stats names>) values (9999999, 'objectname', 'objectidentifier', <statistics values>)
```

Here is an example that only logs a subset of the statistics:

```sql
InsertQuery insert into MYTABLE (TIME_STAMP, TYPE, ID, RESPONSETIME) values (%0, %1, %2, %23)
```

3.126. <StatsLog REDIS>

This clause logs statistics to Redis from all Radiator internal objects. Statistics can later fetched from Redis for management applications, log transport agents, such as logstash Redis input plugin, or other use. The statistics are currently logged in JSON format. StatsLog REDIS uses GossipRedis for communicating with a Redis server. For more information, see Section 3.134. <GossipRedis> on page 400.

There is an example configuration file in `goodies/statslog.cfg`.

For more information about what data is available for logging, see Table 10. Statistics collected within Radiator and usage in Format parameter on page 389.
### 3. Configuring Radiator

#### 3.126. StatsKey

This is a Redis key to store stats. The default is `Radiator::StatsLogREDIS`. Special formatting characters are supported.

```plaintext
# Our key has identifier and farm instance
StatsKey Radiator: %{Server: Identifier}: %O: stats
```

#### 3.127. <DiaStatsLog xxxxxxx>

This marks the beginning of a DiaStatsLog clause, which defines how to log Diameter statistics. The `xxxxxx` is the name of a specific DiaStatsLog module. This section lists the parameters all DiaStatsLogs use.

DiaStatsLogs may also use other parameters that are specific for that DiaStatsLog. DiaStatsLog clauses are defined at the top level configuration and they understand also the same parameters as `<StatsLog xxxxxxx>`. For more information, see Section 3.123. `<StatsLog xxxxxxx>` on page 389.

There is an example configuration file for the different `<DiaStatsLog>` clauses in `goodies/diastatslog.cfg`.

#### 3.127.1. PeerAliveDetectionInterval

This integer defines the time interval during which the counter update must happen, otherwise the peer is considered to be inactive. The default interval is given in seconds. The default value is 60 seconds.

`PeerAliveDetectionInterval` must be twice as long as the watchdog trigger time so that at least DWR/DWA are updated. Twinit default for watchdog trigger time is 30 seconds according to RFC 6733, thus `PeerAliveDetectionInterval` must be minimum 60 seconds. If this parameter is set to 0, it disables the peer alive checks.

#### 3.127.2. PeerRemovalThreshold

This integer defines the number of StatsLog intervals how long an inactive peer is kept in memory. The inactive peer is removed from the memory when `PeerRemovalThreshold * PeerAliveDetectionInterval` seconds is elapsed. The default value is 1. If this parameter is set to 0, inactive peer cleanup is disabled.

#### 3.128. <DiaStatsLog FILE>

This clause logs statistics from all Radiator internal Diameter objects to a flat file.

#### 3.128.1. Filename

This string defines the name of the file where the log statistics are saved. The default value is `%L/statistics`. You can use special characters but data from the current request or reply is not available as logging is never done in the context of a current request. For more information about special characters, see Section 3.3. Special formatters on page 19.

#### 3.129. <DiaStatsLog REDIS>

This clause logs statistics from all Radiator internal Diameter objects to Redis. Statistics can later be fetched from Redis for management applications, log transport agents, such as logstash Redis input plugin, or any later use. The statistics are currently logged in JSON format. `<DiaStatsLog REDIS>` uses GossipRedis for communicating with a Redis server. For more information, see Section 3.134. `<GossipRedis>` on page 400.

`<DiaStatsLog REDIS>` is currently experimental and will be documented later.
3. Configuring Radiator

3.129.1. StatsKey

This defines the Redis key to store Diameter stats. The default is `Radiator::DiaStatsLogREDIS`. You can use the special characters. For more information, see Section 3.3. Special formatters on page 19.

```bash
# Our key has identifier and farm instance
StatsKey Radiator:%{Server:Identifier}:%O:diastats
```

3.129.2. OutputFormat

This string defines the format for the statistics entries. Currently the only supported value is `JSON`, it is also set as a default.

3.130. <DiaStatsLog SQL>

This clause logs statistics from all Radiator internal Diameter objects to an SQL database. This clause ignores `OutputFormat` configuration parameter.

3.130.1. InsertQuery

This string defines the SQL query that is used for each log. This is an optional parameter. If this is not defined, only the standard set of statistics is logged. You can use special characters. For more information, see Section 3.3. Special formatters on page 19.

3.130.2. TableName

This string defines the name of the SQL table where the log data is inserted. The default value is `RADDIASTATSLOG`.

3.131. <MessageLog xxxxxxx>

This marks the beginning of a `MessageLog` clause, which defines how to log sent and received RADIUS, Diameter, and TACACS+ messages. The `xxxxxxx` is the name of a specific `MessageLog` module. This section lists the parameters all `MessageLog` use. `MessageLog` can also use other parameters that are specific for that `MessageLog`. `MessageLog` clauses must be defined at the top level configuration.

You can have more than one `MessageLog` clause. For example RADIUS, Diameter, and TACACS+ typically have separate loggers. Message logging is not enabled by default. For more information about how to enable message logging, see top level configuration parameter in Section 3.7.51. `GlobalMessageLog` on page 40.

See `goodies/logformat.cfg` for a configuration sample.

3.131.1. Identifier

This specifies an optional symbolic name that can be used to refer to the logger from somewhere else.

```bash
# Log all incoming RADIUS message with MessageLog FILE
GlobalMessageLog radius,messagelograd

<MessageLog FILE>
    Identifier messagelograd
    Format text
    Filename %L/messagelog-%0-%1
</MessageLog>
```
3. Configuring Radiator

3.131. LogSelectHook

This parameter defines an optional Perl hook that is run for each log message. If it returns true, the message is logged, otherwise logging is skipped. This is not defined by default and all messages are logged.

LogSelectHook has the following arguments:

- direction
  This argument defines the direction and is either in or out.
- protocol
  This argument defines the used protocol. The supported values are:
  - radius
  - radsec
  - diameter
  - tacacsplus
- from_ip
- from_port
- to_ip
- to_port
- request_object

The following example logs only the messages from/to 10.10.10.10:

LogSelectHook sub { return 1 if ($_[2] eq '10.10.10.10' || $_[4] eq '10.10.10.10') }

3.132. <MessageLog FILE>

This clause logs RADIUS, Diameter, or TACACS+ messages to a file. You can define as many <MessageLog FILE> clauses as you wish at the top level configuration. Each clause can specify different logging conditions and a different log file.

```
# This message logger logs to a file
<MessageLog FILE>
  Identifier myauthlogger
  Format text
  #Encoding hex
  Filename %L/messagelog-%0-%1
</MessageLog>
```

<MessageLog FILE> understands also the same parameters as all MessageLogs. For more information, see Section 3.131. <MessageLog xxxxxx> on page 395.

3.132.1. Filename

This optional parameter specifies the name of the file where messages log entries are written. You can use any of the special characters defined. For more information about special characters, see Section 3.3. Special formatters on page 19. The default value is %L/messagelog.

The special characters are replaced as follows:

- $0 is replaced by the protocol.
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For the supported protocols, see Section 3.7.5. GlobalMessageLog on page 40.

- `%1` is replaced by the log format value.
  For the supported log format values, see Section 3.132.2. Format on page 397.
- `%2` is replaced by the encoding.
  For the supported encodings, see Section 3.132.3. Encoding on page 397.

If the Filename parameter starts with a vertical bar character (`'|`), the rest of the filename is assumed to be a program to which the output is to be piped. Otherwise the output appends to the named file:

```
# Example file name: messagelog-radius-text-hex
Filename %L/messagelog-%0-%1-%2
```

3.132.2. Format

This optional parameter specifies the format for the message log entries. Possible values are: text and text2pcap. Unknown values default to text, which is also the default value.

```
# Prepare for possible conversion to pcap format
Format text2pcap
```

3.132.3. Encoding

This optional parameter specifies the encoding for the message log entries. Possible values are: none and hex. Unknown values default to none which is also the default value. Encoding is done after formatting.

```
# Might be useful if using a binary Format
Encoding hex
```

3.133. <Monitor>

This clause enables external client programs to make an authenticated TCP connection to Radiator, and use that connection to monitor, probe, modify, and collect statistics from Radiator. One such external client program is Radar, a real-time interactive GUI that permits monitoring, plotting of statistics and much more. For more information, see Radar website [http://www.open.com.au/radar/].

Monitor permits the telnet connections and implements a simple command syntax that allows various actions to be executed. For more information about the command language that Monitor implements, see Section 18. Monitor command language on page 482. Monitor permits multiple simultaneous independent connections. Radiator also permits multiple Monitor clauses, each listening on a different Port or BindAddress.

Monitor authenticates incoming connections. Only if the connection submits a valid user name and password Monitor honours the requests on that connection. You can configure Monitor with either a hardwired user name and password, or with a standard Radiator AuthBy clause. You can specify one or more AuthBy parameters or AuthBy clauses and an AuthByPolicy similar to `<AuthBy GROUP>`. For more information, see Section 3.37.1. AuthByPolicy on page 165. As a security measure, if a Monitor connection fails authentication 5 times, the connection is automatically disconnected.

CAUTION

Careless configuration of this clause can open security holes in your RADIUS host. To avoid this, we recommend you to take the following actions:

- Limit the clients that can connect with the Clients parameter.
3. Configuring Radiator

- Make sure the configuration file is only readable by root.
- Consider making radiusd run as a non-privileged user.
- Use secure user names and passwords to authenticate access to this server.
- Disable this clause when not required.

<Monitor> supports TLS. For more information about TLS parameters, see Section 3.11. TLS configuration on page 74.

### 3.133.1. Port

This optional parameter specifies the TCP port number to listen on. The argument may be either a numeric port number or an alphanumeric service name as specified in /etc/services (or its equivalent on your system). Defaults to 9048.

**Tip**

You can pass the port number as a command line argument to radiusd with a configuration like this:

```plaintext
Port %{GlobalVar:monitorport}
```

and then run radiusd with an argument to set the port number like this:

```plaintext
radiusd monitorport=9000 ....
```

### 3.133.2. Clients

This optional parameter specifies a list of IP addresses that Monitor will accept connection from. You can specify one or more comma or space separated IP addresses on each Client line. You can specify multiple Client parameters. Only exact matches are supported at present. The default is to accept connections from any and all clients.

If Clients is specified and a client attempts to connect from an IP address that is not named, Monitor will print a WARNING message then reject and close the connection.

```
# Only accept connections from some addresses
Clients 127.0.0.1, 203.63.154.29
Clients 203.63.154.27
```

### 3.133.3. BindAddress

This optional parameter specifies a single host address to listen for Monitor connections on. It is only useful if you are running Radiator on a multi-homed host (i.e. a host that has more than one network address). Defaults to 0.0.0.0 (i.e. listens on all networks connected to the host). For more information, see Section 3.5. Address binding on page 25.

Using this parameter, you can run multiple instances of Radiator on the one computer, where each Radiator listens to Monitor requests directed to a different host address. BindAddress can include special formatting characters.

```
# Only listen on one network address
BindAddress 203.63.154.1
```
3. Configuring Radiator

3.133.4. AuthBy, <AuthBy xxxxxx> and AuthByPolicy

Monitor supports either a hardwired user name and password, or one or more AuthBy parameters or <AuthBy xxxxxx> clauses in a similar way to <AuthBy GROUP>. For more information, see Section 3.37. <AuthBy GROUP> on page 165. If there are no AuthBy clauses, or if they all IGNORE the authentication, the hardwired Username and Password will be tried.

Tip
If you are configuring Monitor in order to accept connections from Radar, or any other application that uses the Monitor (chap) passwords, the AuthBy needs to be one that contains plaintext passwords in its database.

3.133.5. Username

This optional parameter specifies the user name that must authenticate any connection through this Monitor clause. Username and Password will be checked if there are no AuthBy clauses, or if they all IGNORE the authentication.

```
# Hardwired username and password
Username mikem
Password fred
```

3.133.6. Password

This optional parameter specifies the password that must authenticate any connection through this Monitor clause. Username and Password will be checked if there are no AuthBy clauses, or if they all IGNORE the authentication.

3.133.7. TraceOnly

This optional parameter prevents connections through this Monitor from getting statistics, getting or setting configuration data, or restarting the server. It inhibits the following Monitor commands:

- STATS
- DESCRIBE
- SET
- LIST
- RESTART
- GET

This flag is useful for limiting access to privileged data by certain staff.

Tip
You can have multiple Monitor clauses on different Ports, so it is possible to have one with TraceOnly and one without. This would allow you to permit some Radar users to get access only to Trace data, and some to have access to all functions.

```
# This one is restricted
<Monitor>
```
3. Configuring Radiator

<table>
<thead>
<tr>
<th>Port 9001</th>
</tr>
</thead>
<tbody>
<tr>
<td>TraceOnly</td>
</tr>
<tr>
<td>Username xxx</td>
</tr>
<tr>
<td>Password xxx</td>
</tr>
</tbody>
</table>

```xml
</Monitor>
```

# This one allows a superuser to get access to all data
```
<Monitor>
    Port 9002
    Username yyy
    Password yyy
</Monitor>
```

### 3.133.8. StatisticsOnly

This optional parameter prevents connections through this Monitor from tracing, getting or setting configuration data, or restarting the server. It inhibits the following Monitor commands:

- TRACE
- TRAUC_USERNAME
- DESCRIBE
- SET
- LIST
- RESTART
- GET

This flag is useful for limiting access to privileged data by certain staff.

### 3.133.9. LogMicroseconds

This optional parameter makes Monitor log the current microseconds at the end of the time string.

### 3.133.10. LogTraceId

This is a flag parameter. When set, `<Monitor>` logging includes a tracing identifier. When LogTraceId is set within `<Monitor>` clause, the tracing identifier is not added to other Radiator logging messages, it affects only the `<Monitor>` logging. Otherwise the functionality of LogTraceId within `<Monitor>` clause is similar to global Section 3.7.4. LogTraceId on page 28.

### 3.134. <GossipRedis>

<GossipRedis> clause is used to configure a Redis based Gossip instance. For more information about Gossip framework, see Section 11. Using Gossip framework on page 466.


For a configuration sample, see goodies/farmsize.cfg.

### 3.134.1. Host

This parameter specifies the Redis server to connect to. The default value is 127.0.0.1.

Here is an example of using Host:
# IPv6 is not supported yet
Host 172.16.20.3

## 3.134.2. Port
This optional parameter specifies the symbolic service name or port number of the Redis server. The default value is \texttt{6379}.

Here is an example of using \texttt{Port}:

\texttt{Port 6380}

## 3.134.3. Sock
This specifies Unix domain socket to connect to Redis server. There is no default.

Here is an example of using \texttt{Sock}:

\texttt{Sock /var/run/redis/redis.sock}

## 3.134.4. Sentinels
This specifies Redis high availability Sentinels to connect to. There is no default and Sentinel service is not used by default.

Here is an example of using \texttt{Sentinels}:

\texttt{Sentinels 10.20.30.3, 10.20.40.4}

## 3.134.5. SentinelService
This specifies the name of the service to connect to via sentinels when \texttt{Sentinels} is set. The default value is \texttt{mymaster}.

Here is an example of using \texttt{SentinelService}:

\texttt{SentinelService radiusmaster}

## 3.134.6. SentinelPort
This specifies the symbolic service name or port number of the \texttt{Sentinels}. The default value is \texttt{26379}.

Here is an example of using \texttt{SentinelPort}:

\texttt{SentinelPort 26380}

## 3.134.7. Password
This specifies a password to login to the Redis server. There is no default.

Here is an example of using \texttt{Password}:

\texttt{Password secret}

## 3.134.8. Prefix
This specifies the prefix for the Redis connection name, pubsub channels, and get/set keys. The default value is \texttt{radiator}.
Here is an example of using `Prefix`:

```
Prefix radius
```

### 3.134.9. `InstanceId`

This specifies the instance-specific part of the Redis connection name and pubsub channels. Special formatting characters are supported. The default value is `%h.%O` (hostname and farm instance number).

Here is an example of using `InstanceId`:

```
InstanceId devel-%h.%O
```

### 3.134.10. `DbIndex`

This specifies the Redis DB index. The default value is 0.

Here is an example of using `DbIndex`:

```
DbIndex 3
```

### 3.134.11. `Timeout`

This sets the connection and command timeout period in seconds for the connection to the Redis server, sentinel connections, sentinel reads, sentinel writes, server read, and server write. The default value is 1 second.

Here is an example of using `Timeout`:

```
Timeout 2
```

### 3.134.12. `FailureBackoffTime`

This specifies the reconnect interval when trying to login to the Redis server. The default value is 10 seconds.

Here is an example of using `FailureBackoffTime`:

```
FailureBackoffTime 30
```

### 3.135. `<GossipUDP>`

`<GossipUDP>` clause is used to configure a UDP-based Gossip instance. For more information about Radiator Gossip framework, see Gossip framework on page 466.

`<GossipUDP>` provides support for direct UDP communication between Gossip peers. `<GossipUDP>` is currently experimental.

### 4. Running `radiusd`

`radiusd` is the Radiator RADIUS server. At start-up, `radiusd` tries to open its configuration file. If the file cannot be opened, `radiusd` exits. After the configuration has been read, `radiusd` finishes its start-up. It can change its user and group, create a PID file and do other work depending on the configuration. The location of configuration file and PID file, if PID file is written at all, and many other settings can be changed with command line and configuration file options.
Signals

If `radiusd` is signalled with SIGHUP, it reinitialises by rereading the configuration file. All Clients, Realms, Handlers, and the others defined in the old configuration file are lost, and new ones are configured. The effect of SIGHUP is expected to be the same as if you killed and then restarted `radiusd`.

If `radiusd` is signalled with SIGTERM, it exits gracefully.

If `radiusd` is signalled with SIGUSR1, it increases its current Trace level by 1. SIGUSR2 decreases it by one.

Environment variables

Environment variables can be used to add Radiator location to Perl module search path. It's possible to add new paths before and after the default search paths. See also `-I` command line option for adding to module path.

- `PERL5LIB` is processed by the Perl interpreter. These paths are prepended to the module search path before `radiusd` is started.

- `RADIATOR_INC`, `RADIATOR_INC_CARRIER`, `RADIATOR_INC_DIAMETER`, `RADIATOR_INC_GBA_BSF` and `RADIATOR_INC_SIM` are appended to the module search path. They are processed immediately by `radiusd` when it starts.

`PERL5LIB` is the recommended environment variable for modifying module search path. Radiator packages that come in RPM, deb and other formats, do not set this variable. Radiator packages use environment variables starting with `RADIATOR_INC`. The value of these should be a single directory currently.

Tip

Value of `PERL5LIB` is a list of directories. The list separator depends on the platform, and it is a colon `:` on unix or a semicolon `;` on Windows.

Command line arguments

Command line arguments given to `radiusd` override global configuration parameter settings in the configuration file. For more information, see Section 3.7. Global parameters on page 27.

The arguments are:

```
radiusd [-I dirname] [-h] [-v] [-c]  
[-auth_port port,...] [-acct_port port,...]  
[-db_dir dirname] [-log_dir dirname]  
[-bind_address address,...]  
[-log_file filename] [-config_file filename] [-dictionary_file file,...]  
[-foreground] [-daemon] [-log_stdout] [-trace n]  
[-pid_file filename] [-no_pid_file]  
[-service] [-installservice] [-uninstallservice] [-servicename name]  
[-serviceperlargs perlargs]  
[globalvarname=value]
```

- `-h`

  This prints usage information and exits.

- `-I dirname`

  This prepends `dirname` to the module search path. This parameter is processed by `radiusd` before any environment variables that start with `RADIATOR_INC`. 
4. Running radiusd

- **-v**
  This prints version information and exits.

- **-c**
  This parses the configuration file, reports errors in the usual way, then exits.

- **-auth_port port,...**
  This specifies the ports to listen for Access-Requests and overrides AuthPort.

- **-acct_port port,...**
  This specifies the ports to listen for Accounting-Requests and overrides AcctPort.

- **-db_dir dirname**
  This specifies the database directory and overrides DbDir.

- **-log_dir dirname**
  This specifies the log file directory and overrides LogDir.

- **-log_file filename**
  This specifies the name of the log file and overrides LogFile.

- **-config_file filename**
  This reads the filename as the configuration file. The default value depends on the operating system:
  - Unix: /etc/radiator/radius.cfg
  - Windows: C:\Program Files\Radiator\radius.cfg

- **-dictionary_file filename,...**
  This specifies the name of one or more dictionary file and overrides DictionaryFile.

- **-foreground**
  This runs radiusd in the foreground, not as a daemon. The default behaviour is to run as a daemon.

- **-daemon**
  This forces radiusd to run as a daemon in the background, regardless of the setting of Foreground in the configuration file.

- **-log_stdout**
  This logs to STDOUT as well as to LogFile, if running in the foreground.

- **-trace n**
  This sets the trace level to n and overrides Trace.

- **-pid_file filename**
  This writes the PID to filename and overrides the global PidFile parameter setting. If this is not set, the PidFile configuration parameter value is used. For more information, see Section 3.7.15. PidFile on page 33.

- **-no_pid_file**
  This prevents creating a PID file.

- **-bind_address address,...**
5. Configuring Radiator with GUI

This specifies one or more IPv4 or IPv6 addresses to listen on and overrides \texttt{BindAddress}. For more information, see Section 3.5. Address binding on page 25.

- \texttt{-service}

This is for specialised use on Windows only. It tells Radiator to run as a Windows Service. It requires Win32::Daemon, and requires that the service have been previously installed with \texttt{-installservice}.

- \texttt{-installservice}

On Windows, this installs or reinstall Radiator to run as a Windows Service. The service is configured to run Radiator with all the same arguments as was passed with \texttt{-installservice}, and it adds the \texttt{-service} flag. After this, the Radiator service appears in the Windows Service list as 'Radiator Radius Server'. The Service automatically starts next time the host is booted. Using this requires Win32::Daemon.

On Windows 7 and others, the command prompt needs to be started with right click -> "Run as administrator". Otherwise the service does not get installed, even if the user has administrator privileges.

- \texttt{-uninstallservice}

On Windows, this removes Radiator from Running as a Windows Service. Ensure the service is stopped before uninstalling it. This requires Win32::Daemon. If a \texttt{-servicename} argument was used with \texttt{-installservice}, then the same \texttt{-servicename} argument must be used to uninstall the service.

- \texttt{-servicename}

On Windows, if Radiator is being installed or uninstalled as a service, this argument specifies the name that the service is installed under. The default value is 'Radiator'. Specifying a different service name allows multiple Radiator services to be run at the same time.

- \texttt{-serviceperlargs args}

On Windows, if Radiator is being installed or uninstalled as a service, this argument specifies extra arguments to pass to Perl when the service starts. This is useful for specifying an alternative install directory for the Radiator Perl modules:

\begin{verbatim}
perl c:/Radiator/radiusd -installservice -serviceperlargs "-I c:/Radiator"
\end{verbatim}

- \texttt{globalvarname=value}

Defines the global variable called \texttt{globalvarname} to be defined as the string "value". The value can be accessed anywhere special formatting characters are permitted with \$\{GlobalVar:globalvarname\}. This argument has exactly the same effect as the following setting in the configuration file:

\begin{verbatim}
DefineFormattedGlobalVar globalvarname value
\end{verbatim}

5. Configuring Radiator with GUI

If your Radiator configuration file has a \texttt{<ServerHTTP>} clause configured, you can connect to Radiator with any standard web browser and use it to inspect, monitor, configure, restart, reconfigure, save and check statistics of your Radiator server from anywhere in your network. For more information, see Section 3.122. \texttt{<ServerHTTP>} on page 387.

This makes configuration and maintenance of your Radiator easier for staff that are not familiar with more traditional command-line tools and configuration file editing.
Tip
A simple configuration file that enables <ServerHTTP>, allowing you to get started with using the web-based configuration GUI is in goodies/serverhttp.cfg in your distribution.

Tip
The default port number that <ServerHTTP> uses is 9048. Use the following URL:

http://localhost:9048

If TLS or SSL is enabled in your <ServerHTTP> clause, use the following URL:

https://localhost:9048

5.1. Login page
When you first connect to the HTTP server port, you will be presented with a login page. Log in with the user name and password configured into the Radiator configuration file (the default shipped in the sample configuration file is user name ‘mikem’ and password is ‘fred’).

Tip
If the HTTP server has been configured not to require a user name and password, you will be logged in immediately without seeing the Login page.

Figure 4. Login page

After a successful login, Home Page is opened. For more information, see Section 5.2. Home Page on page 406.

5.2. Home Page
The Home page displays basic information about the GUI and provides a Navigation Area, from which you can access all the functions available to you.
5. Configuring Radiator with GUI

The Navigation area contains links to each type of page you are authorised to see. The list of links depends on your Privilege Level. For more information, see Section 3.122. <ServerHTTP> on page 387.

Figure 5. Home Page

5.3. Administration

5.3.1. Server status

The Server Status page shows details about this instance of Radiator, including the command line used to start it, the name of the configuration file, how long the server has been running for and how many requests it has processed.
5.3.2. View log

The GUI log collects and displays the last LogMaxLines of log messages at or above the current Trace level. To renew the displayed list, click Refresh on your browser.

To change the number or severity of collected log messages, click on Edit and see the ServerConfig page. Click on Show Advanced Options. Click on Server ServerHTTP and see the ServerHTTP configuration page. Adjust Trace on this page and LogMax-Lines on the Advanced Options page.
5. Configuring Radiator with GUI

5.3.3. Logout

The logout link logs you out of the GUI. A new Login page will be displayed.

5.4. Configuration

5.4.1. Edit

The Edit page displays configuration details for a single configurable Radiator object. Each Edit page corresponds to a Radiator configuration clause. By clicking on appropriate links you can drill down into the hierarchy of configuration clauses and examine and change the configuration of each clause.

The first page you see when you click on the Edit link is the ServerConfig page, which is the main (top-level) configuration page. All the Radiator configuration clauses and their sub-clauses are accessed starting at the ServerConfig page and drilling down into subclauses.
Figure 8. Edit Page

ServerConfig

ServerConfig defines the behaviour of the Radiator RADIUS server as a whole, and is the starting point for configuring Radiator. For the simplest RADIUS server configuration, you should define at least one Client and at least one Realm. Inside the Realm, you should define at least one AuthBy to do the authentication.

Basic Options Show Advanced Options>

- AcctPort: 1646
- AuthPort: 1845
- Client: DEFAULT (delete)
- DbDir: 
- LogDir: 
- LogFile: %L/logfile
- LogStdout: 
- Realm: DEFAULT (delete)
- Trace: Debug

Click to see advanced options
Click to edit Client sub clause
Click to add new Client sub clause
Click to delete Realm sub clause
Click to apply changes

For a given configuration object, the GUI displays up to four different pages, one for each level of configuration detail:

- Basic Options
  Displays the most basic configuration options that must be configured in order for the object to work at all.

- Advanced Options
  Shows more advanced options that can fine tune the basic operation of the object.

- Very Advanced Options
  Shows options that are rarely used and which are only required under unusual circumstances.

- Deprecated Options
5. Configuring Radiator with GUI

Shows options that should never be used in a new installation. They are only provided for compatibility with old deprecated (discouraged) options.

5.4.2. Load config file

This page allows you to upload an entire new configuration file into Radiator.

Figure 9. Load config Page

After uploading, the new configuration will take effect. However the new configuration will not be saved until you click on Save.

Tip
If the new configuration does not include a ServerHTTP clause, you will not be able to reconnect to the server with the browser.

Tip
There are many sample configuration files included in the goodies/ directory of your Radiator distribution.

5.4.3. Save

This page allows you to save the currently running Radiator configuration to the configuration file specified on the Radiator command line. The original configuration file will be saved and renamed with a ‘.bak’ extension.
5. Configuring Radiator with GUI

Figure 10. Save Page

Radiator RADIUS Server

Radiator 4.0beta on zulu. Logged in as: mikem (privilege level 15).

Administration
- Server status
- View log
- Logout

Configuration
- Edit
- Load config file
- Save

Miscellaneous
- License
- Support
- System
- Perl
- Modules

The Save button saves the currently running configuration to the current configuration file at `goodies/serverhttp.cfg`.

The currently running configuration requires saving.

---

CAUTION

The newly saved configuration file will not include any formatting or comments that may have been present in the original configuration file.

---

5.5. Miscellaneous

5.5.1. Licence

This page displays the software license that applies to your copy of Radiator.
5. Configuring Radiator with GUI

5.5.2. Support

This page displays useful information about what levels of support are available for Radiator and how to access them.
5. Configuring Radiator with GUI

5.5.3. System

This page shows information about the machine that this instance of Radiator is running on.
5.5.4. Perl

This page shows information about the version of the Perl interpreter that Radiator is using on this machine.
5.5.5. Modules

This page lists all the Radiator Perl modules that are currently loaded into Radiator, and the version number of each one. Also shown is the main Radiator version number.
Tip
The list of modules you see will depend on the precise configuration your Radiator is running, since many Radiator modules are only loaded when required.

5.6. Advanced

5.6.1. Manual edit

This page allows direct manual editing of the configuration file without having to start a text editor on the host machine. In order to use this interface, you need to be familiar with Radiator configuration file format and syntax. For more information, see Section 3. Configuring Radiator on page 16. The original configuration file will be saved and renamed with a ‘.bak’ extension.
5. Configuring Radiator with GUI

### 5.6.2. Reset server

This page allows you to Reset Radiator. Resetting causes Radiator to reread the configuration file and restart. Any unsaved configuration changes in the currently running configuration will be lost. If there are any unsaved configuration changes you will be informed of this.

**Figure 16. Manual edit Page**

Saving a new configuration with the Save button saves the edited text to the configuration file (after making a backup of the original), but Radiator will not run with the new configuration until it is reset with the Reset server page. For more information, see Section 5.6.2. Reset server on page 418.
6. Testing tools

Radiator download package contains 3 tools for testing:

- builddbm on page 419
- buildsql on page 420
- radpwtst on page 422

6.1. builddbm

builddbm is a testing tool that creates and updates DBM format user database files from flat file format user database files. For more information, see Section 9.3. DBM user database on page 459 and Section 9.2. Flat file user database on page 458. It can also be used to print or delete the information for a single user from a DBM file.

DBM files should be used with Radiator if you require fast authentication, but also need to change your user database on the fly while Radiator is running, and you do not or cannot use <AuthBy SQL> or <AuthBy FILE> in Nocache mode.

Radiator will choose the best format of DBM file available to you, depending on which DBM modules are installed on your machine.

Tip
You can force it to choose a particular DBM file format by using the -t flag.

The arguments are:

```
```

- `-z`
  This deletes all entries from the database before processing other commands.

- `-u`
  This updates the mode and replaces user entries that already exist in the DBM file rather than showing an error.

- `-f flatfile`
  The name of the flat file format user database to be used to populate the DBM file. The default value is `dbfile`, i.e. the name of the DBM file, without the `.pag` or `.dir` suffixes.

- `-d user`
  This deletes the entry for `user` from the DBM file.

- `-l user`
  This prints out the entry for `user` in a format that could be re-imported into `builddbm`.

- `-p`
This prints the contents of the DBM file in standard Livingston flat file format. The check and reply attributes of all users in the database are printed out in no particular order. The printed output goes to stdout.

- \(-t dbmtype\)

This forces `builddbm` to use a particular format of DBM file. The value of `dbmtype` can be `AnyDBM_File`, `NDBM_File`, `DB_File`, `GDBM_File`, `SDBM_File` or `ODBM_File`. Defaults to `AnyDBM_File`, which selects the best format on the host machine.

- \(dbfile\)

The base name of the DBM files to create or use. The actual filenames depend on the DBM module that Perl has selected, but, it is usually something like `dbfile.dir` and `dbfile.pag`. This is a mandatory parameter.

**Example**

Rebuild the entire DBM database in `users.dir` and `users.pag` from the users file, clearing old entries first:

```
builddbm -z users
```

**Example**

Update the Berkeley DB format database files `all.db` with the users in the file `users`:

```
builddbm -u -f users -t DB_File all.db
```

**Example**

Print the entry associated with the user `mikem` in the DBM files `staff.dir`, `staff.pag`:

```
builtbmk -l mikem staff
```

### 6.2. buildsql

`buildsql` is a testing tool that creates or updates an SQL authentication table from the contents of a Unix password file or from a (Livingston) standard RADIUS users file. It can also be used to print or delete the information for a single user from an SQL authentication table.

Use an SQL database with Radiator if you require fast authentication, large user populations, and also need to change your user database on the fly while Radiator is running, and you do not or cannot use `<AuthBy DBM>` or `<AuthBy FILE>` in Nocache mode.

By default, `buildsql` connects to the SQL database specified by the `-dbsource`, `-dbusername`, and `-dbauth` command line flags. You must specify these flags. For more information about setting these flags for different database vendors, see Section 19. Using SQL with various database vendors on page 485.

By default, `buildsql` inserts or updates records in a table called `SUBSCRIBERS`, but you can change this with a command line flag. By default, it only affects four columns in the table: `USERNAME`, `PASSWORD`, `CHECKATTR`, `REPLYATTR`, but you can change this with command line arguments. All other columns are unaffected by `buildsql`, so you can have arbitrarily complicated tables. You can change the names of the columns that `buildsql` uses with command line arguments. The default names are compatible with the default names used by the SQL authentication module.

The arguments are:

```
buildsql [-z] [-u] [-f] [-d user] [-l user] [-v]
```
-dbsource dbi:drivername:option
  [-dbsource dbi:drivername:option] [-dbusername dbusername] [-dbauth auth]
  [-password | -dbm | -flat]
  [-tablename name]
  [-username_column columnname]
  [-password_column columnname]
  [encryptedpassword]
  [-checkattr_column columnname]
  [-replyattr_column columnname] file ....

  • -z
    This deletes all user entries from the database before processing other commands.

  • -u
    This is the update mode. It replaces user entries that already exist in the database rather than shows error
    about constraint violations.

  • -f
    This forces database update for non-defined fields.

  • -d user
    This deletes user from the SQL database

  • -l user
    This prints out the entry for user in a format that could be re-imported into buildsql.

  • -v
    This prints out every SQL statement being issued before its executed

  • -dbsource dbi:drivername:option
    This specifies the data source name of the database to connect to. Must be specified.

  • -dbsource dbi:drivername:option
    This specifies the user name to use to connect to the SQL database.

  • dbauth password
    This specifies the password for dbusername. Not required for some database types.

  • -password
    The source files are in Unix password file format. For more information, see Section 9.4. Unix password file on page 460.

  • -dbm
    The source files are in DB file format. For more information, see Section 9.3. DBM user database on page 459.

  • -t dbmtype
    Forces buildsql to use a particular format of DBM file. The value of dbmtype can be AnyDBM_File, NDBM_File, DB_File, GDBM_File, SDBM_File, or ODBM_File. The default value is AnyDBM_File, which selects the best format on the host machine.

  • -flat
The source files are in standard RADIUS flat file format. For more information, see Section 9.2. Flat file user database on page 458. This is the default. If no input file type is specified, -flat is assumed.

- **-tablename name**
  This specifies the name of the database table to use. The default value is `SUBSCRIBERS`.

- **-username_column columnname**
  This specifies the name of the column where the user name are stored. The default value is `USERNAME`.

- **-password_column columnname**
  This specifies the name of the column where the passwords are stored. The default value is `PASSWORD`.

- **-checkattr_column columnname**
  This specifies the name of the column where the Check Items are stored. The default value is `CHECKATTR`.

- **-replyattr_column columnname**
  This specifies the name of the column where the Reply Items are stored. The default value is `REPLYATTR`.

- **-encryptedpassword**
  This handles and prints all passwords as if they were encrypted. When printing passwords with -l, the password is given with Encrypted-Password.

If neither `-password` or `-dbm` is specified, the input files are assumed to be in flat file format. For more information, see Section 9.2. Flat file user database on page 458.

### Example

Rebuild the entire SQL database from the `/etc/passwd` file, clearing the old entries first. Then connect to an Oracle database SID called `osc` as user system and password manager. Use the default table and column names:

```
buildsql -z -dbsource dbi:Oracle:osc \
    -dbusername system -dbauth manager \
    -password /etc/passwd
```

### Example

Print out the attributes for user `mikem` in the same database:

```
buildsql dbsource dbi:Oracle:osc \
    -dbusername system -dbauth manager -l mikem
```

### Example

Delete user `mikem` from the same database:

```
buildsql dbsource dbi:Oracle:osc \
    -dbusername system -dbauth manager -d mikem
```

### 6.3. radpwtst

`radpwtst` is a testing tool that sends requests to a RADIUS server, such as Radiator, and waits for a reply. Use it to send Access-Request, Accounting-Request (Stop and Start), and Status-Server requests. `radpwtst` checks that your Radiator server, or any other RADIUS server, is configured and behaving correctly, and also for checking if user's password is correct.
By default, `radpwtst` sends an Access-Request, waits up to 5 seconds for a reply, sends an Accounting-Request (Start), waits for a reply, then sends an Accounting-Request (Stop), and waits for a reply. You can change this behaviour with the command line flags.

---

**Tip**

When `radpwtst` is run with `-interactive` flag, it queries the password without local echo. This allows you to specify the password without the command line `-password` option.

---

**Tip**

If a Framed-IP-Address is received in an Access Accept, then `radpwtst` uses the address in subsequent Accounting Starts and Stops, unless the `-framed_ip_address` flag has been set. This allows simple testing of address allocation modules and such.

---

**Tip**

A fundamental requirement of the RADIUS protocol is that the RADIUS Client (in this case `radpwtst`) and the RADIUS Server (in this case Radiator) must use the same shared secret. If Radiator keeps rejecting your request with a “Bad Password” message, even though you are sure the password is correct, it may be because the shared secrets are not correct. Check the "Secret" line in your Radiator config file, and perhaps use the `-secret` command line argument to `radpwtst`. If you do not specify a `-secret` argument to `radpwtst`, it uses `mysecret` by default.

---

The arguments to `radpwtst` are:

```
radpwtst  [-h] [-time] [-iterations n] [-iteration_delay f] [-timestamps]
            [-log_microseconds] [-trace [level]] [-notrace] [-onlyfailed]
            [-print_stats] [-user username] [-password password]
            [-s server] [-secret secret] [-auth_port port] [-acct_port port]
            [-motp_secret xxxxxxxxxxxxxxxxxxx] [-eaphex xxxxxxxxxxxxxx]
            [-interactive] [-code requestcode] [-accton] [-acctoff]
            [-identifier n] [-no_random] [-framed_ip_address address]
            [-state state] [-useoldascendpasswords] [-incrementuser]
            [-nas_ip_address address] [-nas_identifier string]
            [-nas_port port] [-nas_port_type type] [-service_type service]
            [-calling_station_id string] [-called_station_id string]
            [-session_id string] [-session_time n]
            [-delay_time n] [-input_octets n] [-output_octets n]
            [-timeout n] [-noreply] [-retries n] [-dictionary file, file]
            [-class string] [-message Authenticator]
            [-raw data] [-rawfile filename] [-rawfileseq filename]
            [-outport port] [-bind_address address]
            [-options optionfile] [-gui]
            [attribute=value]...
```
6. Testing tools

- **-h**
  This prints the usage log and exits.

- **-time**
  This is an alias for **-print_stats**.

- **-iterations n**
  This sends all the selected requests n times, instead of just once.

- **-iteration_delay f**
  This option makes **radpwtst** to wait for specified amount of time between iterations. For example, when setting **iteration_delay** to **0.01**, **radpwtst** waits 0.01 seconds between iterations. This option is useful in testing purposes or when packet rate needs to be limited. Note that delay can be specified as float.

- **-timestamps**
  This includes a time stamp in announce messages. This option is automatically enabled when **iterations** is set to a value larger than 1.

- **-log_microseconds**
  Using this, the timestamps are logged in microseconds instead of seconds.

- **-trace [n]**
  This prints useful trace information, including the full contents of all transmitted and received requests. The default is to print limited information from the reply. Trace level 5 produces hex packet dumps of requests and replies. The trace level is optional and the default value is 1.

- **-notrace**
  The trace information is not printed. The default is to print limited information from the reply.

- **-onlyfailed**
  This shows only the failed requests.

- **-print_stats**
  Using this, **radpwtst** prints the the statistics of all requests and elapsed time taken to send and receives all iterations when it is finished and calculates packet rate for packets sent.

  This is useful for testing purposes, since it measures how fast the RADIUS server handles requests. If Perl **Time::HiRes** module is available, the elapsed time is printed with sub-second resolution. This module is available in all recent Perl distributions.

  To get useful values, the number of iterations must be large enough, for example, **8000**.

- **-user username**
  This tags the requests with User-Name of **username**. The default value is **mikem**.

- **-password password**
  In Access-Requests, the password is **password**. The default value is **fred**.

- **-s server**
  This sends all the requests to the server, which can be either the IP address or the DNS name of the host where the destination RADIUS server runs. The default value is **localhost**.

- **-secret secret**
This uses secret as the shared secret. The default value is `mysecret`.

- `-auth_port port`
  This is the port to use for authentication requests. The default value is 1645.

- `-acct_port port`
  This is the port to use for accounting requests. The default value is 1646.

- `-noauth`
  Access-Request is not sent.

- `-noacct`
  Accounting-Request is not sent.

- `-nostart`
  Accounting-Request Start is not sent.

- `-nostop`
  Accounting-Request Stop is not sent.

- `-alive`
  This sends an Accounting-Request with Acct-Status-Type of Alive.

- `-status`
  This sends a Server-Status. The contents of the reply are printed.

---

**Note**
The Status-Server RFC requires Message-Authenticator. In most cases you need the `-message_authenticator` option also.

- `-chap`
  Authentication is done with CHAP, instead of PAP.

- `-chap_nc`
  Authenticate with CHAP, instead of PAP, with the CHAP Challenge in the authenticator, and not in a separate CHAP-Challenge attribute.

- `-mschap`
  Authentication is done with MSCHAP, instead of PAP or CHAP. Requires Digest-MD4-1.0 or better from CPAN or ActiveState. For more information about CPAN, see Section 2.1.2. CPAN on page 3.

- `-mschapv2`
  Authentication is done with MSCHAP V2, instead of MSCHAP, PAP or CHAP. This requires Digest-MD4 version 1.1 or better and Digest-SHA version 5.0 or better from CPAN or ActiveState. For more information about CPAN, see Section 2.1.2. CPAN on page 3.

- `-sip`
  SIP Digest is done authentication as per draft-sterman-aaa-sip-00.txt. This requires special attributes in the additional `dictionary.sip` in your distribution, so it should be used with `-dictionary dictionary, dictionary.sip`. 
6. Testing tools

- **-eapmd5**
  Authentication is done with EAP-MD5. This usually involves 2 requests being sent to the server. The first is the EAP Identity, the second is the EAP-MD5 response.

- **-eapotp**
  Authentication is done with EAP-One Time Password. This usually involves 2 requests being sent to the server. The first is the EAP Identity, the second is the EAP-One Time Password response.

- **-eapgtc**
  Authentication is done with EAP-Generic Token Card. This usually involves 2 requests being sent to the server. The first is the EAP Identity, the second is the EAP-Generic Token Card response.

- **-eapfastgtc**
  This is similar as -eapgtc argument: authentication is done with EAP-Generic Token Card. This usually involves 2 requests being sent to the server. The first is the EAP Identity, the second is the EAP-Generic Token Card response. However, this uses RFC 5421 EAP-FAST-GTC response format.

- **-leap**
  EAP-LEAP authentication is done. This usually involves 3 requests being sent to the server. The first is the EAP Identity, the second is the LEAP client response and the third is the LEAP Access Point Challenge.

- **-motp_secret xxxxxxxxxxxxxxxx**
  This makes Mobile OTP request using the password as PIN and motp_secret as the MOTP secret key.

- **-eaphex xxxxxxxxxxxxx**
  This adds an EAP-Message attribute to the request. Argument is the message contents in hex. The correct Message-Authenticator is automatically added.

- **-interactive**
  This displays the Reply-Message, reads a new password from STDIN, and sends a new Access-Request, automatically copying any State attribute to the new request. This flag is useful for testing methods like <AuthBy ACE> and <AuthBy OPIE>, which use Access-Challenge to prompt the user during a series of steps in an authentication conversation.

  This flag is also useful if password needs to be kept secret. When -interactive is set, password is read without local echo.

  Requires Perl module Term::Readkey on Windows. Some Unix-based systems are supported directly but Term::ReadKey is recommended for cross platform support.

- **-code request code**
  This tells radpwtst to send (in addition to any other request required) a RADIUS request with the given code name. Code names such as Ascend-Access-Next-Code, Disconnect- Request and Change-Filter-Request are all supported. Note that -code Status- Server is identical in meaning to -status.

- **-accton**
  This sends Accounting-On request.

- **-acctoff**
  This sends Accounting-Off request.

- **-identifier n**
  This is the identifier number of a single RADIUS packet.
6. Testing tools

- **-no_random**
  This forces radpwtst to use fixed values for RADIUS authenticator with different CHAP methods. This allows repeating tests with known values.

- **-framed_ip_address address**
  Access requests are sent with the given Framed-IP-Address. The default value is `0.0.0.0`. If the address is `0.0.0.0`, it is sent in the request. By default, radpwtst takes notice of any Framed-IP-Address returned in an Access-Accept, and uses it in subsequent Accounting Stops and Starts. Setting `-framed_ip_address` causes the same address to be used for all Accounting Stops and Starts.

- **-state state**
  This adds the string as State attribute.

- **-useoldascendpasswords**
  This makes radpwtst to encode passwords using the old (non-RFC compliant) method that Ascend used to use for some NASs. The default is to use RFC2865-compliant algorithm.

- **-incrementuser**
  This increments the user name on each round. If the user name on the first round is `mikem001`, it changes automatically to `mikem002` on the second round.

- **-nas_ip_address address**
  Access and Accounting requests have NAS-IP-Address of address. The default value is `203.63.154.1`.

- **-nas_identifier identifier**
  Access and Accounting requests have NAS-Identifier of identifier. The default value is `203.63.154.1`.

- **-nas_port port**
  Access and Accounting request have NAS-Port of port. The default value is `1234`.

- **-nas_port_type type**
  Access and Accounting request have NAS-Port-Type of type. The default value is `Async`.

- **-service_type service**
  Access and Accounting request have Service-Type of service. The default value is `Framed-User`.

- **-called_station_id string**
  Access and Accounting requests have Called-Station-Id of string. The default value is `123456789`. If set to an empty string, Called-Station-Id is not included in the request.

- **-calling_station_id string**
  Access and Accounting requests have Calling-Station-Id of string. The default value is `987654321`. If set to an empty string, Calling-Station-Id is not included in the request.

- **-session_id string**
  Accounting request has Acct-Session-ID of string. The default value is `00001234`.

- **-session_time n**
  Accounting request has Acct-Session-Time of n. The default value is `1000`.

- **-delay_time n**
  Accounting request has Acct-Delay-Time of n. The default value is `0`. 
• \texttt{-input	extunderscore octets \textit{n}}

   Accounting request has Acct-Input-Octets of \textit{n}. The default value is \textbf{20000}.

• \texttt{-output	extunderscore octets \textit{n}}

   Accounting request has Acct-Output-Octets of \textit{n}. The default value is \textbf{30000}.

• \texttt{-timeout \textit{n}}

   This specifies the time in seconds that \texttt{radpwtst} waits for a reply. The default value is \textbf{5} seconds. If you specify 0, it does not wait for a reply at all.

• \texttt{-noreply}

   When using this, no reply is waited before sending another request.

• \texttt{-retries \textit{n}}

   If there is no reply, send up to \textit{n} retries. The default value is 0 and no retries are sent.

• \texttt{-dictionary \textit{file},\textit{file}}

   This uses \textit{file} as the dictionary file. Multiple dictionary files can be specified as comma-separated file names. If \texttt{-dictionary} is not specified, \texttt{radpwtst} loads automatically for the first file that exists from this list ($\texttt{radpwtstdir}$ is the location where \texttt{radpwtst} resides):

   \begin{itemize}
   \item \texttt{- $\texttt{radpwtstdir}/dictionary}
   \item \texttt{- /etc/radiator/dictionary}
   \item \texttt{- /usr/local/etc/raddb/dictionary}
   \item \texttt{- /usr/local/etc/radiator/dictionary}
   \item \texttt{- /opt/radiator/radiator/dictionary}
   \item \texttt{- C:\Program Files\Radiator\dictionary}
   \end{itemize}

• \texttt{-class \textit{string}}

   This makes \texttt{radpwtst} to send \textit{string} as the Class attribute in any accounting requests. Class defaults to the Class returned by any previous access-accepts.

• \texttt{-message	extunderscore authenticator}

   This sends a correctly calculated Message-Authenticator attribute with the request.

\textbf{Note}

   Some authentication methods already add Message-Authenticator automatically. For example, EAP requires Message-Authenticator.

\textbf{Note}

   Trace 4 output shows sent Message-Authenticator before its final value is calculated.

• \texttt{-raw data}

   This sends raw data literally. An example of suitable raw data is trace 5 packet dump output. White space in the data is ignored.
6. Testing tools

• -rawfile filename
  This reads raw data from file called filename and send it literally. Raw data can be split to multiple lines.

• -rawfileseq filename
  Read a sequence of raw data from file called filename and send it literally. The requests are separated with delimiter ‘NewPacket’.

• -outport port
  This reads radpwtst to send requests from the given port. Port can be a port number or a port service name as used in /etc/services or it equivalent on your system. The default value is 0, meaning allocate a random port.

• -bind_address address
  This reads radpwtst to send requests through the network interface for the given IP address. Requests appear to originate from the specified IP address. The default value is 0.0.0.0, which means the default address of the default network interface. If the destination address (such as the -s flag) is an IPv6 address and -bind_address is specified, bind_address must also be an IPv6 address.

• -options optionfile
  This reads the command line options from the file specified with optionfile. For more information, see Section 6.3.1. radpwtst option file on page 429.

• -gui
  This presents A GUI that allows easy interactive testing. This GUI runs on Unix, it is not yet available on Windows hosts. Requests are sent when the Send button is pressed, and the GUI stays up after the requests have been sent, so you can send more. Requires Perl Tk module.

• attribute=value
  You can force any number of additional attributes to be sent in each request by naming them with their values on the command line. attribute must be the name of an attribute in your dictionary, and value must be a valid value for that attribute.

6.3.1. radpwtst option file

radpwtst options can be placed in an option file. The file format is one option per line. Leading and trailing white space is ignored. To preserve leading or trailing white space, use double quotes ("”) to surround the value. Empty lines and lines with # as first nonwhite space character are ignored. Use only one space between option name and value. See the example below.

```plaintext
# Set some defaults. Note: just one space between
# the option name and value
-trace 4
-nas_identifier " name with leading and trailing spaces "

# Attributes can have whitespace in the value only. Surround
# the value with " if there is trailing or leading space
Connect-Info=52100/31200 V91
```

radpwtst looks for options in /etc/radpwtstrc and $HOME/.radpwtstrc. It loads first the options file and then processes command line options. You can override options specified in the options file using command line options. For example, if the default trace level is 4 in the options file, you can temporarily use trace level 3 by using command line option -trace 3. This allows you to define the default parameters in the options file, but you can still temporarily use different values with command line parameters.
6.3.2. radpwtst examples

Send Access-Request and Accounting Start to server oscar.open.com.au for user mikem@your.realm and password jim. Authenticate with CHAP. Make sure the request includes Connect-Info of 52100/31200 V91:

```
radpwtst -s oscar.open.com.au -nostop -chap
   -user mikem@your.realm -password jim
   Connect-Info="52100/31200 V91"
```

Send Server-Status request to fred.open.com.au, print the reply:

```
radpwtst -status -noauth -noacct -s fred.open.com.au
   -trace -message_authenticator
```

Send 1000 Access-Requests to 1.2.3.4 for user fred, password jim, and print out how long it took:

```
radpwtst -iterations 1000 -noacct -user fred
   -password jim -time
```

Send a Disconnect-Request:

```
radpwtst -noacct -noauth -code Disconnect-Request NAS-Port=1234
```

Make the GUI appear for extended interactive testing:

```
radpwtst -gui
```

Send an Access-Request to an IPv6 address:

```
radpwtst -noacct -s 2001:db8:100:f101::1
```

Send an Access-Request to the localhost loopback address using IPv6:

```
radpwtst -noacct -s ::1
```

6.3.3. radpwtst GUI

The **radpwtst** program will present a Graphical User Interface (GUI) when it is started with the **-gui** flag. If you select this option, the GUI will stay visible until dismissed. This allows you to send a number of different requests with a single mouse click, and to quickly and easily change the attributes to be sent. These features allow easy testing of Radiator (or any other RADIUS server for that matter), particularly when configuring a new realm or user.

---

**Note**

**radpwtst** **-gui** requires the Perl Tk module to be installed on your host machine.

---

The command line flags given to **radpwtst** are used to preconfigure the values you see in the interface. You can change the values at any time to affect the next request to be sent. Press the Start button to commence sending, and the Stop button to stop sending.

On each iteration, radpwtst will send one of each of the requests selected in the middle panel. The requests will contain attributes and values configured in the first panel, and the requests will be sent to the server and ports configured in the third panel. Not all attributes are sent in every request type: only the usual ones for that request type.
In the lower panel, you can trace the progress of each request and the reply. You can control the level of detail seen for each request and reply with the Options->Trace Level menu.

**Figure 18. radpwtst Graphical User Interface**

7. Check and reply items

Check items and reply items are used to authenticate users when an Access-Request message is received. Different AuthBy modules use different methods to store the check and reply items, but regardless of the module and how the user information is stored, all such items are used in the same way.

The general form of a check and reply item is

```
attribute-name = value
```
Attribute-name must be an attribute defined in your dictionary. Value may be surrounded by double quotes ("). Value must be surrounded by double quotes if it contains a comma. If a value is surrounded by double quotes use backslash (\) to escape embedded double quotes. You can have binary characters in a quoted string by specifying the octal code, preceded by a backslash. The spaces around the equals sign are optional.

Multiple check or reply items can be combined on a single line if they are separated by commas. Thus the following are all legal:

```
User-Password = fred
User-Password="fred"
User-Password = "fred",Service-Type = Framed-User
Reply-Message="this, has commas, and quotes" in it"
Tunnel-Server-Endpoint = "\000191.165.126.240 fr:20"
```

The RADIUS attributes in check and reply items must be a defined in your dictionary.

## 7. Check and reply items

Check items is the name given to the RADIUS attributes in the Access-Request that is checked before the user is granted an Access-Accept. All the check items for a user are checked. If any check item does not match the access is denied. You can have multiple check items for the same attribute, and the check only passes if all check items pass.

Most check items permit exact match, alternation, or regular expression matches. For more information about using them, see Section 7.1.49. Any other attribute defined in your dictionary on page 448.

These check items can also be used in the request selection expression in a `<Handler>` clause. For more information, see Section 3.30. `<Handler attribute=value,attribute=value, ...>` on page 132.

Usually this is used to limit the conditions under which a user is permitted to log on to your system. The most common case is to require a User-Password or Encrypted-Password, and you may also want to limit access via certain NASs, or at certain times. You can use any RADIUS attribute as a check item, and there are also some special attributes that are handled within Radiator in order to provide extra ways of controlling user access.

Since different brands and models of NAS implement different subsets of the RADIUS specification, it is not possible here to describe all the things you can configure in your NAS with reply items. For more information, see your NAS vendor's documentation.

### 7.1. User-Password, Password

A (usually) plaintext password. Passes only if the given password matches that sent in the Access-Request. If CHAP-Password attribute appears in the request then CHAP authentication will be attempted. If MS-CHAP-Challenge and MS-CHAP-Response attributes appears in the request then MSCHAP authentication will be attempted. CHAP and MSCHAP authentication is only supported with plaintext or Rcrypt encrypted passwords. You may use either Password or User-Password as the attribute name, the effect is the same.

Radiator also supports HTTP Digest password authentication with plaintext passwords. Digest authentication is supported by some web servers (e.g. Apache) and some web proxies (e.g. squid). You can add RADIUS Digest authentication to Apache with the Apache-AuthenRadius-0.3 module, and a patch available from Open System Consultants.

User-Password can be in a number of formats, not necessarily in plaintext. Radiator looks for some special format passwords and interprets them as special encryptions. The following formats are supported, along with example versions of the password "fred".

- Standard Unix crypt. This format is also compatible with Unix password encryption as used in Netscape LDAP server. Passwords starting with a leading `{crypt}` or `{CRYPT}` are interpreted as a standard Unix crypt password, using the native version of crypt() on your platform.
7. Check and reply items

- Linux MD5 password hashing. Passwords starting with "$1$" are interpreted as hashed with Linux MD5 password hashing.

  User-Password = $1$cTpht$0bu9PLSMst1TDou.mN5bk0

- Linux SHA256 and SHA512 crypt. Passwords starting with "$5$" or "$6$" are interpreted as hashed with Linux SHA256 or SHA512 password hashing, respectively.

  User-Password = $5$cTpht$i4ihNc571C1orrwWu/IIfHrhxdD1kjb095szYO4AucD
  User-Password = $6$cTpht$Z2psYxleRWW8IrshynFzxcnplpUHa7N9AM/808se885W45WHjY2K6bXaygH146.cjqgl2hucmKtX1shWTUnitU

- Linux Blowfish crypt. Passwords starting with "$2a$", "$2x$" or "$2y$" are interpreted as hashed with Linux Blowfish password hashing. Support for these algorithms depends on the system crypt() implementation support. See the system documentation on crypt() about caveats with these hashes.

- Netscape SHA password hashing as used in Netscape LDAP server. Passwords starting with {SHA}, {SSHA}, {sha}, or {ssha} are interpreted as being hashed with Netscape SHA hashing. (Requires Digest-SHA version 5.0 or later, and also Mime::Base64 from MIME-Base64-2.11.tar.gz).

  User-Password = {SHA}MQF6ciZl5K/OWGlQ9C1EptMx2r8=
  User-Password = {SSHA}k1qAjger6r6E9fhCrig+QP2/HTrJhYWE=

- SHA-2 hashes SHA 256, 384 and 512. These are similar to {SHA} and {SSHA} above. See goodies/sha.pl and goodies/ssha.pl for a utility to generate hashes.

  User-Password = {SHA256}0M/C5TGbgs3HGjOHPoj9fuETY/iskcT60iz80iHuU=
  User-Password = {SSHA256}abN9UTbhi3evQvdk7uYNML+UMZn8/BNWdxJUApQ0NzGkLQTd
  User-Password = {SHA384/QoAkviNtBctNyjN+yAkEEl6ChjtUvFkDTKhr1lx/YqIhrDG7Tx2eJhbBPkAX0mo5
  User-Password = {SSHA384}DLZqetLs6Jpok1QcugqKji0U8lx6zq7SyGoK5JRveeqCuGhxWxf12YGLq8pqgms3jw=
  User-Password = {SHA512}NWbDPDXFm6jY6e6wqgVJSs8z6gkoER7Z4WqPD/P+8P10H4FjICJnKGCVT1h61e3TUR/ZQ/19d00x3tck3j1Am8w==
  User-Password = {SSHA512}u+34y2JyCKoVRty0ADAB1zhEtp4v1Hmshr2427qjsn7tgSoOaP8cHB
  J95GT28EN1A7yvsJ3VQMyiuPq2g3PvJ04IM=

- MD5 Hex digest. Passwords starting with {MD5} or {md5}. Note that all hex digits are required to be lower case.

  User-Password = "{MD5}570a90bfbf8c7eab5dc5d4e26832d5b1"

- MD5 with Mime, as used in some other LDAP servers.

  User-Password = "{MD5}qP00V/oViFka8YbFMW5Eweg=="

- Rcrypt reversibly encrypted passwords. This reversible encryption format depends on a secret key. Radiator includes a reusable code module (Radius::Rcrypt) with encrypt and decrypt routines that you can
call from third party programs. Rcrypt passwords require that you define the RcryptKey attribute in the AuthBy clause. The leading string can be {rcrypt} or {RCRYPT}.

User-Password = "{rcrypt}nYXkJKLrxm/e3RfU0aT7w4al"

• A predigested hex MD5 signature of the concatenation of the user name, a realm and the correct password. This is only valid for Digest and SIP authentication. In this example, the user name is "mikem", the realm is "open.com.au" and the correct password is "fred".

User-Password = "\{digest-md5-hex\}884663db69c36190cf4c05c068a1a303"

• MySQL hashed password, as produced by the MySQL password() function.

User-Password = "{mysql}0569ef75321b8fed"

• MD5 hashed password in the format used by old Netscape Mail Servers.

{NS-MTAMD5}
b6b4de37d49a09bfde663033274bc83cd1bf318fa32c5866166a7edcb1
e1c87

• A Django style password. For more information, see User authentication in Django [https://docs.djangoproject.com/en/dev/topics/auth/#passwords]

User-Password =
"sha1$a19768065f52b49153328da76e13c2b462b860a70eb70b"
User-Password = "md5$a19768e67d1ca20e9c28321b86e34076cc48ab"

• DEC Hashed Password as used by DEC VMS and maybe others. Contains the algorithm type number, a salt and the hashed password, separated by vertical bars. The valid algorithm numbers are 1 (PURDY), 2 (PURDY_V) or 3 (PURDY_S). The hashed password depends on the user name as well as the algorithm and salt, so the hashed passwords are not portable between users. In VMS, user names are by convention all uppercase, and passwords are case sensitive. In this example for user name MIKEM, the algorithm type number is 3 (PURDY_S), the salt is 1234, and the hashed password (fred) is 85ad61e72a41dec4.

User-Password = {dechpwd}3|1234|85ad61e72a41dec4

• An NT Hashed Password, as used by Microsoft, Samba and others. This format is compatible with Samba SMB passwords (either in a flat file or in LDAP). Such password hashes can be generated with the Samba mkntpwd program.

User-Password = {nthash}DCB8E94AC7D0AADC8A81D9C895ACE5F4

• A password encrypted with the Microsoft SQL pwdencrypt() function. Passwords encrypted with pwdencrypt() are case insensitive. Requires Digest::SHA module. Note that the encrypted password produced by pwdencrypt() is a 46 octet binary string. Radiator recognises the encrypted password as either 46 octets of binary or 92 octets of ASCII hex characters. You can use the MS SQL `+' string concatenation operator to prepend the `{mssql}` to the encrypted password, e.g.

select '((mssql)'+ password, ..... from ..... 
User-Password =
{mssql}01003A54FC73501798169BEC84C05CA0D2FBB70009C2556313DA7959
C1A798EC34514694A13D29ED57BE9CBE5DA

• A flagged plaintext password.
7. Check and reply items

User-Password = \{clear\}fred

- A PBKDF2 (Password-Based Key Derivation Function 2) derived password. Radiator currently supports password derivation with Pseudo Random Function (PRF) HMAC-SHA1 and the following password format (PRF:rounds:salt:hash). See goodies/pbkdf2.pl for the format details. Requires Digest::HMAC_SHA1 and MIME::Base64.

User-Password = \{PBKDF2\}HMACSHA1:9000:h9Pwh4tcu0w=:iN9vitCZ1mqBKEu21d1c0RW2tlc=

- Custom format for CheckPasswordHook. For more information, see Section 3.31.26. CheckPasswordHook on page 155.

User-Password = \{OSC-pw-hook\}.......  

- Plaintext. Any other format is interpreted as a plain text password.

User-Password = fred  
User-Password = "password with spaces"

### 7.1.2. Encrypted-Password

An encrypted password. Passes only if the password sent in the Access-Request matches the given encrypted password. Most types of encrypted password only support PAP, not CHAP, MSCHAP or MSCHAPV2 authentication. Passwords encrypted with NT Hashed passwords can support PAP, MSCHAP and MSCHAPV2 authentication.

Encrypted-Password understands a number of encrypted formats: SHA, MD5, MD5 Mime, DEC Hashed passwords, NT Hashed passwords and standard Unix crypt. All the following match the plaintext password "fred":

- Encrypted-Password = \{SHA\}k1qAjger6rE9fhCrig+QPZ/HTrJhYWE="  
- Encrypted-Password = \{crypt\}1xMKc0GIVUNbE"  
  # This next one is also crypt:  
  Encrypted-Password = \{crypt\}1xMKc0GIVUNbE  
- Encrypted-Password = \$1$cTpht$0bu9PLSmst1TDou.mN5bk0"  
- Encrypted-Password = \{MD5\}qP0OV/oV1Fka8YbFMWEweg="  
- Encrypted-Password = \{MD5\}570a90bfbf8c7eab5dc5d4e26832d5b1"  
- Encrypted-Password = \{dechpwd\}31234|85ad61e72a41dec4"  
- Encrypted-Password = \{nthash\}DCB8E94AC7D0AADC8A81D9C895ACE5F4"  
  # This next one is also nthash:  
  Encrypted-Password = DCB8E94AC7D0AADC8A81D9C895ACE5F4  
  Encrypted-Password = (mssql)01003A54FC73501798169BEC84C05CA0D2FB870009C2556313DA7959C1A798EC34514694A13D29ED7B6E9CBE5DA

If there is no indication of the encryption type in an Encrypted-Password, Radiator will assume it is a Unix crypt(3) password if it is 13 or 20 bytes long (20 bytes is the BSD/OS DES extended format for crypt(3)), a binary NT hashed password if it is 16 bytes long and a hex encoded NT hashed password if it is 32 bytes long.

- \# Unix Crypt:  
  Encrypted-Password = 1xMKc0GIVUNbE  
- \# Hex encoded NT Hashed password
When Radiator authenticates an MSCHAP or MSCHAP2 request, the default encrypted password format is taken to be an MD4 hashed password, in the standard Windows NT hashed password format (either hex encoded or binary).

### 7.1.3. Realm

Checks that the realm in the login name matches. The realm is the part following the @ in the user name. You can use either exact match, alternation, or a regular expression.

**Realm = open.com.au**

### 7.1.4. Expiration, ValidTo

Specifies the account expiry date with an optional time component. Passes only if the current local date and time (according to the clock on the host where Radiator is running) is prior to the given date and time. If no time is given, it assumes midnight at the beginning of the date given. The check items Expiration and ValidTo have identical meaning. The following formats are supported:

- **Mmm dd yy(yy) (hh:mm:ss)**
- **Mmm dd, yy(yy) (hh:mm:ss)** Note the optional comma.
- **dd Mmm yy(yy) (hh:mm:ss)**
- **yyyy-mm-dd (hh:mm:ss)**
- **dd/mm/yy(yy) (hh:mm:ss)**
- **dd.mm.yy (hh:mm:ss)**

Some valid examples are:

- Dec 30 1998
- Dec 30, 2000
- 30 Dec 2000
- Dec 30, 2000 11:30:00
- 30 Dec, 2000 09:32:00
- 2002-02-02 23:00:00
- 30/12/2002 01:00:00
- 30.12.2002

All the following Expiration check items are equivalent.

**Expiration = Jan 02 1999 23:30:00**
**Expiration = 1999-01-02 23:30:00**
**Expiration = 02/01/99 23:30:00**
# Unix epoch seconds (seconds since midnight, Jan 1 1970):
**Expiration = 915280200**
Tip
You can use Session-Timeout="until ValidTo" or Session-Timeout="until Expiration" as a reply item, which will set the session timeout to be the number of seconds until the Expiration date and time. For more information, see Section 7.2.8. Session-Timeout on page 451.

7.1.5. ValidFrom
Specifies a starting validity date. The same date formats as ValidTo are supported.

ValidFrom Jan 02 1999 23:30:00

7.1.6. Auth-Type
Auth-Type triggers special behaviour for authenticating the user. The possible values are:

- Reject. Any access request will always be rejected. This is useful for temporarily disabling logins for a given user.
- Accept. Forces acceptance, regardless of any following check items. Use with caution.
- Reject:message. Same as for Reject, except that the message (which can be any string) will be sent back to the user in a Reply-Message (provided the enclosing Realm or Handler has RejectHasReason set). This may be useful for telling your user why their login has been rejected.
- Ignore. Any access request will always be ignored (i.e. no reply will be sent back to the NAS). This is sometimes useful for triggering special behaviour in cascaded AuthBy clauses.
- Anything else. Any other word specifies an Identifier in an AuthBy clause which will used to authenticate the user. The name is matched with the name specified in the Identifier parameter in an AuthBy clause. You can name any other type of AuthBy module, be it SQL, RADIUS, UNIX etc. Specifying Auth-Type for a user causes the authentication to be cascaded to another authentication module. You can cascade authentications like this to any arbitrary depth.

The Auth-Type check item is most useful when you want to have check items and/or reply items, but also want to authenticate with native Unix or NT passwords.

Checks all users using the authentication method that has the identifier System:

DEFAULT Auth-Type = System

If you want to temporarily disable logins for a single user:

username Auth-Type = Reject

This one rejects the user and tells them why:

username Auth-Type = "Reject:you did not pay your bill"

This will first authenticate with the Identifier System, and if they are also in the group "staticip", they will continue to be authenticated with the AuthBy clause that has the Identifier "statics":

DEFAULT Auth-Type=System, Group=staticip, Auth-Type=statics
7.1.7. Group

The meaning of Group depends on the type of module that is doing the authentication. For UNIX and SYSTEM, it means whether the user is a member of the group as defined by the group file (usually /etc/group/). <AuthBy SYSTEM> supports both numeric and symbolic group names.

For <AuthBy SQL>, it runs and uses the result of the GroupMembershipQuery if defined. For more information, see Section 3.40.19. GroupMembershipQuery on page 180.

For <AuthBy LDAP2>, it requires GroupSearchFilter and related options to be defined. For more information, see Section 3.48.15. GroupSearchFilter on page 216.

For other AuthBy modules, it has no meaning, and always causes a rejection.

| Group = wheel |

7.1.8. GroupList

This works similarly to Group, but succeeds if the user is in any of the space separated group names.

| GroupList = "wheel dialupusers nocstaff" |

7.1.9. Group-Authorization

When you need Group-based authorisation for a user, this parameter defines the AuthBy that does the checking.

For usage examples, see goodies/authorize-group1.cfg and goodies/authorize-group2.cfg.

7.1.10. Block-Logon-From

Specifies a time in the format 9:00 am or 15:22. Attempts to authenticate after this time of day will fail. If Block-Logon-To is also specified for a later time of day, access is blocked between those times. The time of day that is used is the local time on the host where Radiator is running. Block-Logon-From is superseded by the Time check item and will not be supported in the future. For more information, see Section 7.1.14. Time on page 439.

| Block-Logon-From = 9:00 am, |
| Block-Logon-To = 5.00 pm |

7.1.11. Block-Logon-To

Specifies a time in the format 9:00 am or 15:22. Attempts to authenticate before this time of day will fail. If Block-Logon-From is also specified for an earlier time of day, access is blocked between those times. The time of day that is used is the local time on the host where Radiator is running. Block-Logon-From is superseded by the Time check item and will not be supported in the future. For more information, see Section 7.1.14. Time on page 439.

| Block-Logon-From = 9:00 am, |
| Block-Logon-To = 5.00 pm |

7.1.12. Prefix

This check item checks for the presence of a certain prefix in the user name. If it is not present the check item will fail. If it is present, it will be removed from the user name and accepted. This is most useful in DEFAULT items to handle different variations of the same users name, but with different reply attributes.

In this example, there might be a user mikem in the System authentication method. These user entries will allow Pmikem to log in as a PPP user, and Smikem to login as a Slip user:

| DEFAULT Prefix = P, Auth-Type = System |
7. Check and reply items

<table>
<thead>
<tr>
<th>Service-Type</th>
<th>Framed-User,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framed-Protocol</td>
<td>PPP,</td>
</tr>
<tr>
<td>Framed-IP-Address</td>
<td>255.255.255.254,</td>
</tr>
<tr>
<td>Framed-MTU</td>
<td>1500</td>
</tr>
<tr>
<td>DEFAULT</td>
<td>Prefix = S, Auth-Type = System</td>
</tr>
<tr>
<td>Service-Type</td>
<td>Framed-User,</td>
</tr>
<tr>
<td>Framed-Protocol</td>
<td>SLIP,</td>
</tr>
<tr>
<td>Framed-IP-Address</td>
<td>255.255.255.254,</td>
</tr>
<tr>
<td>Framed-Compression</td>
<td>None</td>
</tr>
</tbody>
</table>

Tip
Prefix should appear before any Auth-Type check items.

7.1.13. Suffix

This check item is very similar to Prefix above, but checks for the presence of a certain suffix in the user name. If it is not present the check item will fail. If it is present, it will be removed from the user name and accepted. This is most useful in DEFAULT items to handle different variations of the same users name, but with different reply attributes.

In this example, there might be a user mikem in the System authentication method. These user entries will allow mikem.ppp to log in as a PPP user, and mikem.slip to login as a Slip user:

<table>
<thead>
<tr>
<th>DEFAULT</th>
<th>Suffix = .ppp, Auth-Type = System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service-Type</td>
<td>Framed-User,</td>
</tr>
<tr>
<td>Framed-Protocol</td>
<td>PPP,</td>
</tr>
<tr>
<td>Framed-IP-Address</td>
<td>255.255.255.254,</td>
</tr>
<tr>
<td>Framed-MTU</td>
<td>1500</td>
</tr>
<tr>
<td>DEFAULT</td>
<td>Suffix = .slip, Auth-Type = System</td>
</tr>
<tr>
<td>Service-Type</td>
<td>Framed-User,</td>
</tr>
<tr>
<td>Framed-Protocol</td>
<td>SLIP,</td>
</tr>
<tr>
<td>Framed-IP-Address</td>
<td>255.255.255.254,</td>
</tr>
<tr>
<td>Framed-Compression</td>
<td>None</td>
</tr>
</tbody>
</table>

Tip
Suffix should appear before any Auth-Type check items.

7.1.14. Time

This check item allows you to specify which times of day and which days of the week the user is allowed to log on. The Time check is preferred to the Block-Logon-From and Block-Logon-To check items, which will not be supported in the future.

The format consists of day specifiers followed by hours intervals. Multiple day specifications are permitted with multiple values separated by commas (if you use commas, the entire check item must be enclosed with double quotes (". Authentication will be permitted if the current local time on the Radiator server is within at least one of the time intervals specified.

Day specifiers are Mo, Tu, We, Th, Fr, Sa, Su for the days of the week, Wk means Mo- Fr and Al means any day. Hours intervals are specified as HHMM-HHMM. Typical examples are:
7. Check and reply items

| Time = "MoTuWe0800-1400,Wk2200-0400" |
| Time = "Al1800-0600,Wk1000-1330" |

Tip
You can use Session-Timeout="until Time" as a reply item, which will set the session timeout to be the number of seconds until the end of the valid time period. For more information, see Section 7.2.8. Session-Timeout on page 451.

7.1.15. Simultaneous-Use

Specifies the maximum number of simultaneous sessions permitted for this user. Radiator keeps track of the number of current sessions for a user by counting the Accounting Start and Stop requests received for that user. The value of this check item is either an integer or the name of a file that contains an integer. You can use any of the special formatting characters in the file name. The file will be reread for each authentication: it is not cached, so using a file name can have a slight impact on performance.

Tip
You can set the maximum number of simultaneous sessions for all the users in a Realm or Handler by using the Handler MaxSessions parameter. In this case, the smaller of MaxSessions and the users Simultaneous-Use will apply. For more information about setting default limit within an AuthBy, see Section 3.31.17. DefaultSimultaneousUse on page 152.

Simultaneous-Use = 1

7.1.16. Connect-Rate

Specifies the maximum connection speed that this user is permitted to use. Uses the Connect-Info attribute in the request to determine the speed the user is requesting. If Connect-Info is not present in the request, looks for USR-Connect-Speed. Note: not all NASs send Connect-Info or USR-Connect-Speed in Access Requests. Check with your NAS vendor's documentation.

Connect-Rate = 28800

7.1.17. NAS-Address-Port-List

Specifies the name of a file that contains a list of permitted NAS address/port combinations. For more information about port list file format, see Section 9.7. Portlist file on page 461. The filename can contain any of the special file name characters. The contents of the file are read at most once, and the port list is cached inside Radiator. If the user is not attempting to log in on one of the permitted address/port combinations, they will be rejected.

NAS-Address-Port-List %D/portlist

Tip
You can limit users to a particular NAS, irrespective of the port by using the NASIP- Address check item, possibly with a regular expression.
Tip
You can limit users to a particular port or set of ports on all NASs by using the NAS-Port check item, possibly with a regular expression.

7.1.18. Client-Id

Specifies the name of a Client that the request must come from. You can use an exact, alternation or regular expression match. The match is against the Client name (i.e. the word following Client in a <Client xxxxxxx> clause). Note that it is legal to use Client-Id=DEFAULT to match requests that arrive through a <Client DEFAULT> clause.

```xml
<Client nas1.open.com.au>
    ....
</Client>
<Client nas2.open.com.au>
    ....
</Client>
<Client DEFAULT>
    ....
</Client>

# This user can only log in through nas2.open.com.au:
username1 Password=fred,Client-Id=nas2.open.com.au
# And this one only through NASs other than nas1 and nas2
username2 Password=jim,Client-Id=DEFAULT
```

Tip
When you use the Client-Id check item, it matches against the name or address in the <Client xxxxxxx> line, but not against any of the values listed in IdenticalClients.

7.1.19. Client-Identifier

Specifies the Identifier of a Client that the request must come from. You can use an exact, alternation or regular expression match. The match is against the Client Identifier (i.e. the value of the Identifier parameter in a <Client xxxxxxx> clause).

```xml
# Several NASs at pop1
<Client nas1.open.com.au>
    IdenticalClients 1.1.1.1,1.1.1.2,1.1.1.3
    Identifier pop1
    ...
</Client>
# Several NASs at pop2
<Client nas2.open.com.au>
    IdenticalClients 2.1.1.1,2.1.1.2,2.1.1.3
    Identifier pop2
    ...
</Client>
```
# This user can only log in at NASs in pop1
username1 Password=fred,Client-Identifier=pop1
# And this one only through NASs in pop2
username2 Password=jim,Client-Identifier=pop2

## 7.1.20. NasType

Specifies that the request must come from a Client with the specified NasType. You can use an exact, alternation or regular expression match.

```xml
<Client xxx>
   NasType Livingston
   ....
</Client>
<Client yyy>
   NasType Ascend
   ....
</Client>

# This is can only log in through xxx, since it has a NasType
# of Livingston
username Password=fred,NasType=Livingston
```

## 7.1.21. Request-Type

Specifies that the type of the request must match the name given. You can use an exact, alternation or regular expression match. Typical values of request types are:

- Access-Request
- Accounting-Request
- Status-Server

This type of check item is mostly useful in Handlers for selecting special handling for particular request types:

```xml
<Handler Request-Type=Access-Request>
   # Accounting wont be handled here, only access requests
</Handler>
```

## 7.1.22. MS-Login-Hours

Specifies a map of permitted login hours per day. The value is an array of bits, one per hour starting at 0000 Sun UTC, 24 bits per day, 7 days. It is not an ASCII array, but an array of binary bytes. The format is exactly compatible with the LoginHours user attribute in Microsoft Active Directory, and can therefore be used when accessing Active Directory via LDAP:

```xml
<AuthBy LDAP2>
   Host uniform
   AuthDN cn=Administrator,cn=Users,dc=open,dc=com,dc=au
   AuthPasswordadmin
   BaseDN ou=csx users,dc=open,dc=com,dc=au
   ServerChecksPassword
   UsernameAttr sAMAccountName
</AuthBy LDAP2>
```
7.1.23. Tagged Tunnel attributes and other tagged attributes

Radiator supports the IETF RFC 2868 standard tunnel attributes, and also permits you to specify tagged tunnel attributes. Tags are a method of grouping attributes in the same packet which refer to the same tunnel. A tag is an integer from 1 to 31 inclusive. In Radiator you can specify a tag for a tunnel attribute by prefixing it with the tag number and a colon. For example, here are 3 tunnel reply attributes, all with a tag of 1:

Tunnel-Type=1:L2F,
Tunnel-Client-Endpoint=1:xyz,
Tunnel-Password=1:1234

**Note**

If a tag and colon are not specified, the tag is assumed to be 0. A tag with value 0 in reply attributes may confuse some clients. We recommend using a non-0 value for reply attributes.

Radiator reply attributes that support tags are:

- Tunnel-Type
- Tunnel-Medium-Type
- Tunnel-Client-Endpoint
- Tunnel-Server-Endpoint
- Acct-Tunnel-Connection (also called Tunnel-ID)
- Tunnel-Password
- Tunnel-Private-Group-ID
- Tunnel-Assignment-ID
- Tunnel-Preference
- Tunnel-Client-Auth-ID
- Tunnel-Server-Auth-ID

7.1.24. EAPType

If the request is an EAP request, this check item matches the EAP type number. Available EAPType numbers include 4 (MD5-Challenge), 13 (TLS) and 26 (MSCHAP-V2). Not useful for tunnelling EAP types, such as TTLS or PEAP.

7.1.25. EAPTypeName

If the request is an EAP request, this check item matches the EAP type name. Available EAPType numbers include MD5, TLS and MSCHAP-V2. Not useful for tunnelling EAP types, such as TTLS or PEAP.

7.1.26. TunnelledByTTLS

Specifies that the current request was tunnelled by EAP-TTLS.
7. Check and reply items

7.1.27. TunneledByPEAP

Specifies that the current request was tunnelled by PEAP.

7.1.28. TunneledByFAST

Specifies that the current request was tunnelled by EAP-FAST.

7.1.29. RecvFromAddress

Specifies the IP address of the RADIUS, Radsec, or TACACS+ client the request was received from. IPv4 and IPv6 addresses are supported. You can use an exact, alternation, or regular expression match.

```
RecvFromAddress=203.63.154.29
RecvFromAddress=::1
```

**Tip**

This can be useful in Handler clauses to provide special handling of requests received from a specific client:

```
<Handler RecvFromAddress=203.63.154.29>
    ....
</Handler>
```

7.1.30. RecvFromName

Specifies the DNS name of the RADIUS, Radsec, or TACACS+ client the request was received from. IPv4 and IPv6 addresses are supported. You can use an exact, alternation, or regular expression match.

```# Exact match
RecvFromName=radserver.open.com.au
# Regular expression:
RecvFromName=/.*\.open\.com\.au/
```

**Tip**

This can be useful in Handler clauses to provide special handling of requests received from a specific client:

```
<Handler RecvFromName=radsec.open.com.au>
    ....
</Handler>
```

**CAUTION**

This does a reverse name lookup on the address and depending on your environment this may take a number of seconds to resolve.
7. Check and reply items

7.1.31. RecvName

This parameter specifies the DNS name of the RADIUS, Radsec, or TACACS+ client that receives the request. It supports both IPv4 and IPv6 addresses. You can use an exact, alternation, or regular expression match. Here are examples of using different matches:

# Exact match
RecvName=radserver.open.com.au

# Regular expression:
RecvName=/.*\open\.com\.au

Tip
In Handler clauses, it can be useful to provide special handling of requests received by a local interface with a certain name:

```xml
<Handler RecvName=radsec.open.com.au>
  ...
<Handler>
```

CAUTION
This does a reverse name lookup on the address and depending on your environment this may take a number of seconds to resolve.

7.1.32. RecvAddress

This parameter specifies the IP address of the RADIUS, Radsec, or TACACS+ client that receives the request. It supports both IPv4 and IPv6 addresses. You can use an exact, alternation, or regular expression match. Here are examples of using different matches:

RecvAddress=203.63.154.29
RecvAddress=::1

Tip
In Handler clauses, it can be useful to provide special handling of requests received by a specific local address:

```xml
<Handler RecvAddress=203.63.154.29>
  ...
<Handler>
```

7.1.33. RecvPort

This parameter specifies the port number of the RADIUS, Radsec, or TACACS+ client that receives the request. It supports both IPv4 and IPv6. You can use an exact, alternation, or regular expression match. Here are examples of using different matches:
7. Check and reply items

Tip
In Handler clauses, it can be useful to provide special handling of requests received by a specific port:

```
AuthPort 1645,1812
<Handler RecvPort=1812>
    ....
<Handler>
```

7.1.34. **Max-All-Session**

Compares the total of all session times for the user against the given number. If it is exceeded, the user will be rejected. Otherwise, the time left will be available for use with `Session-Timeout = until ValidTo` to limit the remaining time for the user. Supported with AuthBy SQL when `AcctTotalQuery` is defined.

7.1.35. **Max-Hourly-Session**

Compares the total of all session times for the user from the beginning of the current hour against the given number. If it is exceeded, the user will be rejected. Otherwise, the time left will be available for use with `Session-Timeout = until ValidTo` to limit the remaining time for the user. Supported with AuthBy SQL when `AcctTotalQuery` is defined.

7.1.36. **Max-Daily-Session**

Compares the total of all session times for the user from the beginning of the current day against the given number. If it is exceeded, the user will be rejected. Otherwise, the time left will be available for use with `Session-Timeout = until ValidTo` to limit the remaining time for the user. Supported with AuthBy SQL when `AcctTotalQuery` is defined.

7.1.37. **Max-Monthly-Session**

Compares the total of all session times for the user from the beginning of the current month against the given number. If it is exceeded, the user will be rejected. Otherwise, the time left will be available for use with `Session-Timeout = until ValidTo` to limit the remaining time for the user. Supported with AuthBy SQL when `AcctTotalQuery` is defined.

7.1.38. **Max-All-Octets**

Compares the total of all traffic octets for the user against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when `AcctTotalOctetsQuery` is defined.

7.1.39. **Max-All-Gigawords**

Compares the total of all traffic for the user in GigaWords against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when `AcctTotalGigawordsQuery` is defined.
7.1.40. **Max-Hourly-Octets**

Compares the total of all traffic octets for the user from the beginning of the current hour against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalOctetsSinceQuery is defined.

7.1.41. **Max-Hourly-Gigawords**

Compares the total of all traffic GigaWords for the user from the beginning of the current hour against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalGigawordsSinceQuery is defined.

7.1.42. **Max-Daily-Octets**

Compares the total of all traffic octets for the user from the beginning of the current day against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalOctetsSinceQuery is defined.

7.1.43. **Max-Daily-Gigawords**

Compares the total of all traffic GigaWords for the user from the beginning of the current day against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalGigawordsSinceQuery is defined.

7.1.44. **Max-Monthly-Octets**

Compares the total of all traffic octets for the user from the beginning of the current month against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalOctetsSinceQuery is defined.

7.1.45. **Max-Monthly-Gigawords**

Compares the total of all traffic GigaWords for the user from the beginning of the current month against the given number. If it is exceeded, the user will be rejected. Supported with AuthBy SQL when AcctTotalGigawordsSinceQuery is defined.

7.1.46. **Variable names prefixed with GlobalVar**

The attribute to be compared is taken from a GlobalVar. GlobalVar variables can be set from the command line, or with the DefineFormattedGlobalVar parameter. This can be useful for activating different sets of users in multiple instances of Radiator.

```bash
# In the config file:
DefineFormattedGlobalVar system mysystem

# in a users file:
username Password=fred,GlobalVar:system=mysystem
```

7.1.47. **Attributes prefixed with Reply**

You can specify a check item that checks an attribute in the currently constructed reply (instead of the incoming request) by prefixing it with “Reply:”. This can be a convenient way to set up user profiles or similar.

```bash
# This will set up one of 2 different user profiles, depending
# on the value of the pseudo-attribute Profile, which was set in
```
# and earlier AuthBy:

| DEFAULT   | Reply:Profile=premium
|           | Session-Timeout=1000000 |
| DEFAULT   | Reply:Profile=cheap     |
|           | Session-Timeout=1000    |

7.1.48. Attributes prefixed with DiaRequest

You can specify a check item that checks a Diameter attribute in an incoming Diameter request. This can be useful for choosing a Handler based on Diameter attributes, for example:

```
<Handler DiaRequest:Auth-Application-Id=NASREQ>
```

or:

```
<Handler DiaRequest:Disconnect-Cause=CREDIT_CONTROL>
```

7.1.49. Any other attribute defined in your dictionary

Checking of all other attributes passes only if the corresponding attribute exists in the request and matches the value specified for the check item.

Radiator allows check items to be specified either as an exact match or as a Perl regular expression (regexp). Radiator regards check items whose value is surrounded with slashes ('/') as a regular expression. Anything else is regarded as an exact match.

- **Exact match**

  The check item will pass only if there is an exact match. The comparison is case sensitive. Radiator will look for an exact match if the value to be matched is not surrounded by slashes.

  ```
  NAS-IP-Address = 203.63.200.5
  Calling-Station-Id = 121284
  ```

- **Alternation**

  Specify multiple permitted values, separated by vertical bars ('|'). The check item will pass if at least one of the permitted values is an exact match.

  ```
  Calling-Station-Id = 121284|122882
  ```

- **Perl Regular expression**

  If the check item is surrounded by slashes ('/'), it is regarded as a Perl regular expression, and Perl is used to test whether the value of the attribute in the request matches the regexp. The expression modifiers ‘i’ (case insensitive) and ‘x’ (ignore white space in the pattern) are also permitted.

  Perl regular expressions give you an enormous amount of power to control the conditions under which a user can log in. The first example below only matches if the user logs in from the phone numbers 95980981, 95980982, 95980983 or 95980984. The second example only matches if they log into a port number with one digit (i.e. ports 1-9).

  ```
  Calling-Station-Id = /9598098(1|2|3|4)/
  NAS-Port = /^[1-9]$/
  ```
Tip
Perl regexps are very powerful, but they also take some getting used to. You should use them carefully, and test to make sure they really do what you want. Consult some Perl manuals or a Perl guru for tips on writing regexps.

Tip
You can use the ‘i’ and ‘x’ pattern modifiers to get case-insensitive or extended expressions like this, to match a Class attribute set to “myclass” without regard to case.

```
Class = /myclass/i
```

Tip
You can set up “negative” matches (i.e. that only match if the check is not equal to some string) by using Perl negative lookahead assertions in a regexp. For example, this check item will match all Service-Types except for Framed-User:

```
Service-Type = /^(?!Framed-User)/
```

Tip
You can match a string that contains unprintable characters by using a character class negation. For example to match a user name that contains any character not in a-z, A-Z or 0-9:

```
User-Name = /[\^a-zA-Z0-9]/
```

7.2. Reply items

Reply items are RADIUS attributes that are used to configure the Terminal Server or NAS when a user is successfully authenticated.

In order to determine what RADIUS attributes you need to configure your NAS, you will need to consult your NAS vendor's documentation. Some RADIUS attributes are common to all NASs, and can be used with any NAS, while some are specific to a particular vendor or model of NAS. All reply items that you use must be defined in your dictionary.

If the user is granted access, all the reply items will be returned in the Access-Accept message to the NAS. This is usually used to configure the NAS in the correct way for that user. Since different brands and models of NAS implement different subsets of the radius specification, it is not possible here to describe all the things you can configure in your NAS with reply items. Refer to your NAS vendor's documentation. Here is a typical example to configure a NAS for a dial-up PPP session:

```
Framed-Protocol = PPP,
Framed-IP-Netmask = 255.255.255.255,
```
Framed-Routing = None,
Framed-MTU = 1500,
Framed-Compression = Van-Jacobson-TCP-IP

Some reply items are given special treatment:

### 7.2.1. Framed-Group

The reply attribute is used in conjunction with FramedGroupBaseAddress in order to allocate an IP address for the user and return it in a Framed-IP-Address attribute. For more information, see Section 3.13.37. FramedGroupBaseAddress on page 99.

Framed-Group = 1

### 7.2.2. Ascend-Send-Secret

Causes the value to be encrypted with the Client's shared secret and returned to the Client.

Ascend-Send-Secret = mysecret

### 7.2.3. Tunnel-Password and other tagged attributes

Causes the password to be encrypted with the Client's shared secret according to RFC 2868. This is used by NASs for managing VPN tunnels. For more information, see Section 7.1.23. Tagged Tunnel attributes and other tagged attributes on page 443.

Tunnel-Password = 1:yourtunnelpassword

### 7.2.4. MS-CHAP-MPPE-Keys

Causes 2 session keys to be generated from the given string and then encrypted with the Client's shared secret according to RFC 2548. This is used by Microsoft MS-CHAP tunnelling. If the value is exactly 24 octets long, it is assumed to already contain 2 session keys, and will only be encrypted. Requires the Digest::MD4 Perl module to be installed.

MS-CHAP-MPPE-Keys = mymppekey

---

**Tip**

If you are doing MS-CHAP authentication with plaintext passwords and your NAS requires MS-CHAP-MPPE-Keys in the reply, then setting the AutoMPPEKeys parameter in your AuthBy clause will force Radiator to automatically reply with MSCHAP-MPPE-Keys set from the plaintext password.

---

### 7.2.5. MS-MPPE-Send-Key

Causes the key to be encrypted with the Client's shared secret according to RFC 2548. This is used by Microsoft MS-CHAP tunnelling.

MS-MPPE-Send-Key = mysendkey

### 7.2.6. MS-MPPE-Recv-Key

Causes the key to be encrypted with the Client's shared secret according to RFC 2548. This is used by Microsoft MS-CHAP tunnelling.
7. Check and reply items

| MS-MPPE-Recv-Key = myrecvkey |

7.2.7. Fall-Through

This attribute is not actually returned to the NAS. Its presence causes Radiator to continue looking for a match with the next DEFAULT user name.

| Fall-Through = yes |

7.2.8. Session-Timeout

If your NAS supports the Session-Timeout RADIUS attribute, this attribute can be used in several ways.

As a simple number, it specifies the maximum time (in seconds) that the session is allowed to run for:

| Session-Timeout=6300 |

With the special form "until nnnn", it will specify that the maximum time the session will last is until the time of day specified. The time is the local time (according to the host where Radiator is running). If the current time is after the time specified, the cutoff time will be that time on the following day. For example to specify that the maximum time for any session is up until 6am today:

| Session-Timeout="until 0600" |

With the special form "until Time", it will set the session timeout to be the number of seconds until the end of the Time check item that permitted the user to log in. This allows you to restrict users so they are only able to connect for the specified time period. In the following example, user fred can log on between 1000 and 1700 each week day, and they will be disconnected (by Session-Timeout) at 1700.

| fred Password=jim, Time="Wk1000-1700"
Session-Timeout="until Time" |

With the special form "until Expiration" or “until ValidTo, it will set the session timeout to be the number of seconds until the Expiration or ValidTo check item that permitted the user to log in. This allows you to restrict users so they are only able to connect until the end of their account validity period. In the following example, user fred can log on up until January 1 2003 and they will be disconnected (by Session-Timeout) at midnight of December 31 2002.

| fred Password=jim, ValidTo="2003-01-01"
Session-Timeout="until ValidTo" |

7.2.9. Exec-Program

This pseudo reply does not actually add any reply items to the reply. It runs the external program given by the argument and waits for it to terminate. It is only run during reply handling, which means that it is only run if the user successfully authenticates. This is a handy way to run an external program when a user successfully logs in. The argument may contain any special characters. For more information, see Section 3.3. Special formatters on page 19.

Tip

There is no guaranteed environment for the external program to run in, so you should specify a program with its full path name.
7. Check and reply items

```
Exec-Program="/usr/local/bin/sendgreeting %u"
```

**Tip**

Radiator is blocked while the external program runs. On Unix, if you do not want Radiator to wait for the program to terminate, use an ampersand (&) at the end of the line:

```
Exec-Program="/usr/local/bin/myslowprogram %u &"
```

# 7.2.10. Ascend-Data-Filter, Ascend-Call-Filter

Radiator supports Ascend Binary Filters, which are given the type ‘abinary’ in the dictionary. The standard dictionary contains the standard abinary attributes Ascend-Data-Filter and Ascend-Call-Filter.

Ascend Binary Filters are binary encoded strings. However Radiator allows you to create filters in a symbolic, textual form. See your NAS documentation about the meaning, construction and use of Ascend Binary Filters with your NAS.

Radiator supports three basic types of filter, each with slightly different syntax.

- **IP Filter**

  The general syntax of an IP filter is:

  \[ \text{ip dir action [dstip n.n.n.n/nn] [srcip n.n.n.n/nn] [proto [dstport cmp port] [srcport cmp port] [est]]} \]

  - **dir** is IN or OUT, case insensitive
  - **action** is FORWARD or DROP. Case insensitive
  - **proto** is a protocol name, such as ip, icmp, tcp, lower case
  - **cmp** is a port comparison operator like <, =, > or !=
  - **port** is a defined port name or integer port number, such as ftp-data, telnet, smtp, lower case

  Examples:

  - Ascend-Data-Filter = "ip in forward icmp"
  - Ascend-Data-Filter = "ip in forward dstip 1.2.3.4/24 tcp"
  - Ascend-Data-Filter = "ip in forward dstip 195.174.219.30 tcp dstport=20",

- **Generic filter**

  The general syntax of a generic filter is:

  \[ \text{generic dir action offset mask value [cmp] [more]} \]

  - **dir** is IN or OUT, case insensitive
  - **action** is FORWARD or DROP, case insensitive
  - **offset** is an integer offset
  - **cmp** is == or !=
Examples:

Ascend-Data-Filter = "generic in forward 0 0 0"
Ascend-Data-Filter = "generic in drop 0 ffff 0080 != more"

• IPX Filter

The general syntax for an IPX filter is:

```
ipx dir action [srcipxnet nnnn srcipxnode mmmmm [srcipxsoc cmp value]]
[dstipxnet nnnn dstipxnode mmmmm [dstipxsoc cmp value]]
```

– dir is IN or OUT, case insensitive
– action is FORWARD or DROP, case insensitive
– cmp is a comparison operator like <, =, > or !=

Examples:

Ascend-Call-Filter = "ipx in forward srcipxnet 1 srcipxnode 0x11223344aabb srcipxsoc > abcd dstipxnet 5678 dstipxnode 0xaabbccddee00 dstipxsoc > 1234"

CAUTION

Radiator is very strict in its interpretation of filters. You cannot change the order of filter elements, but you can omit the ones shown in square brackets [...]
8. Rewriting user names

You can change the User-Name attribute in each request by using RewriteUsername configuration parameters globally and in different clauses. This allows you to apply separate rewriting rules to the User-Name. In case there are several clauses with RewriteUsername parameters, rewriting rules for a request are executed in the following order:

- Globally when received by Radiator. This occurs prior to other rewrites.
- Within a <Client>, <ServerRADSEC> or <ServerTACACSPLUS> clause depending on how the request was received.
- When handled by a <Handler> or <Realm> depending on which clause is selected.
- When handled by an <AuthBy GROUP> clause. This occurs before any of the <AuthBy> clauses in the group are called.

The parameter is a Perl substitution regular expression that is applied to the User-Name attribute in the request. If you do not know how to write Perl substitution regexps, you should consult a Perl programmer. At Trace level 4, you can see the result of each separate rewrite for debugging purposes.

You can have any number of RewriteUsername parameters. The rewrites are applied to the username in the same order that they appear in the configuration file.

Here are some example of using this feature in a variety of circumstances:

- Strip the realm name from the username. This is handy if your user database contains only the usernames without the realm extension, for example, fred instead of fred@yourdomain.com.

  ```
  # Strip realm
  RewriteUsername s/^([^@]+).*/$1/
  ```

- Convert Microsoft or other style usernames from domain\user to the user@realm form that Radiator uses. Note that regexps need to quote some characters. For example @ needs to be quoted with backslash \\:

  ```
  # Convert a MSN realm/user into user@realm
  RewriteUsername s/^(.*)\/(.*)$/2\1/
  ```

- Force all usernames to be lower case or upper case:

  ```
  # Translate all uppercase to lowercase
  RewriteUsername tr/A-Z/a-z/
  ```

- Remove any white spaces from the username:

  ```
  RewriteUsername s/\s+//g
  ```

- Convert all <user>@realm1 to <user>@realm2:

  ```
  RewriteUsername s/^([^@]+)@realm1/$1@realm2/
  ```

- Change any mikem username to fred:

  ```
  RewriteUsername s/^mikem\@/fred\@/
  ```

9. File formats
9.1. Dictionary file

The dictionary file defines easy-to-read names for the attributes and values used in RADIUS messages. It defines how RADIUS attribute numbers map to readable attribute names, and how RADIUS value numbers map to readable value names. The dictionary also defines the type of data that each attribute can hold.

The dictionary file is an ASCII text file. Each definition occupies one line. A hash mark # marks the beginning of a comment. Comment and blank lines are ignored.

9.1.1. ATTRIBUTE attrname attrnum type [flags]

This defines the name, RADIUS attribute number, and type for an attribute. Here is an example of attribute definition:

```
ATTRIBUTE Service-Type 6 integer
```

ATTRIBUTE is the keyword that says this is an attribute definition. Service-Type is the name of the attribute: the string that is used as the attribute name when printing the attribute and when setting attributes in the user database. 6 is the standard RADIUS attribute number for this attribute (see RFC 2865), and integer is the data type for this attribute. The supported data types are:

- **string**
  ASCII string of up to 253 bytes. Trailing NULs are stripped.
- **text**
  Similar to string
- **integer**
  32-bit unsigned value
- **signed-integer**
  32-bit signed value
- **integer8**
  8-bit unsigned value
- **integer16**
  16-bit unsigned value using network byte order
- **integer64**
  64-bit unsigned value using network byte order
- **date**
  Date as an integer number of seconds since 00:00:00 UTC Jan 1 1970
- **ipaddr**
  IP address in the form aaa.bbb.ccc.ddd, or a 4-byte binary string
- **ipaddrv6**
  IPv6 address in the form 2001:db8:148:100::31
- **ipaddrv4v6**
  4 or 16 octets long IPv4 or IPv6 (respectively) address in network byte order
- **binary**
  Installation and reference manual for
Radiator® 4.23. Last revised on Apr 10, 2019
Binary data

• **abinary**
  
  Ascend filter, using the special Ascend filter definition syntax. Radiator is very strict about the syntax. You must follow the filter definition syntax exactly.

• **hexadecimal**
  
  Binary data formatted as hexadecimal

• **boolean**
  
  Required only by some Nortel/Aptis CVX vendor-specific attributes. A single byte attribute. Values of 0 or 1 are permitted.

• **tagged-integer**
  
  See Section 7.1.23. Tagged Tunnel attributes and other tagged attributes on page 443.

• **tagged-string**
  
  See Section 7.1.23. Tagged Tunnel attributes and other tagged attributes on page 443.

• **ipv4prefix**
  
  IPv4 prefix in the form 192.168.1.0/24

• **ipv6prefix**
  
  IPv6 prefix in the form 2001:db8:148:100::/64

• **ifid**
  
  IPv6 interface identifier in the form aaaa:bbbb:cccc:dddd

• **tlv**
  
  Encapsulation attribute that contains one or several attributes

• **custom**
  
  See Section 9.1.10. Using VSA framework for customised attributes on page 458 for more about custom attribute VSA framework.

If you redefine an ATTRIBUTE by defining a new name for an previously defined attribute number, the new definition replaces the old one. The first is a synonym for the second when used in a reply.

attrnum may be in decimal, hex (prefixed by ’0x’) or octal (prefixed by 0).

ATTRIBUTE also supports optional flags to control whether the attribute is tagged or requires encryption like this:

```
ATTRIBUTE Tunnel-Password 69 string has_tag,encrypt=2
```

The permitted flags are:

• **has_tag**
  
  Specifies that the encoded attribute is prefixed a tag octet. The value of the tag can be specified in an attribute value with a leading tag number and a colon.

• **encrypt=n** (n = 1, 2 or 3)
  
  Specified that the attribute is to encrypted with the specified algorithm. The following algorithms are supported:
9. File formats

1. RADIUS User-Password encryption
2. The SALT algorithm as described by RFC 2548
3. Symmetric encoding and decoding as required for Ascend-Send-Secret

9.1.2. VALUE attrname valuenname value

This defines a symbolic name for an integer type attribute. When setting the value of an integer attribute in a
check or reply item, you can use the symbolic name instead of the raw integer.

```
VALUE Service-Type Login-User 1
```

VALUE is a keyword that says this is a value definition. Service-Type means that this is a definition of a value
for the Service-Type attribute (which should be of type integer). Login-User is the symbolic name for the value,
and 1 is the value that Login-User translates to. value may be in decimal or hex (prefixed by ‘0x’).

If you redefine a VALUE by defining a new name for a previously defined value number, the new definition
will silently replace the old one. The first will be a synonym for the second when used in a reply.

9.1.3. VENDORATTR vendornum attrname attrnum type [flags]

This defines a vendor-specific attribute. RADIUS defines a special attribute number 26 that can be used to hold
any vendor defined data type. This allows NAS vendors to add their own NAS-specific codes.

```
VENDORATTR 9 cisco-avpair 1 string
```

VENDORATTR is a keyword that says this is a vendor-specific attribute definition. 9 is the SMI Network
Management Private Enterprise Code of the vendor (Cisco in this example). cisco-avpair is the symbolic name
for the attribute, and string is the data type. The same data types as for ATTRIBUTE are supported. Radiator
supports both hex and decimal attribute numbers in VENDORATTR.

After an integer VENDORATTR is defined, you can have VALUE definitions in the same format as for other
ATTRIBUTES.

If you redefine a VENDORATTR by defining a new name for an previously defined vendor attribute number,
the new definition will silently replace the old one.

attrnum may be in decimal, hex (prefixed by ‘0x’) or octal (prefixed by 0).

VENDORATTR also supports the same optional flags. For more information, see Section 9.1.1. ATTRIBUTE
attrname attrnum type [flags] on page 455.

9.1.4. VENDOR vendorname vendornumber

Specifies that the decimal number vendornumber can be used to refer to the Vendor given by vendorname.

9.1.5. BEGIN-VENDOR vendorname

Specifies that all subsequent ATTRIBUTE keywords, until the next END-VENDOR are to be interpreted as
VENDORATTR definitions for the named vendor.

9.1.6. END-VENDOR

Terminates the previous BEGIN-VENDOR.

9.1.7. include filename

Includes the dictionary file specified by filename. Special characters are supported.
9. File formats

9.1.8. $INCLUDE filename

FreeRadius style include command, includes the dictionary file specified by filename. Relative filenames are relative to the directory of the current dictionary. Special characters are not supported.

9.1.9. Available dictionaries

Radiator comes with a single main dictionary, plus an optional add-on dictionaries.

- **dictionary**
  
  The is the normal and default one. It merges attribute definitions from several sources, and should be satisfactory for most configurations.

- **dictionary.ascend**
  
  This is an add-on dictionary that includes definitions for some old-fashioned Ascend non-vendor-specific attributes that would normally conflict with newer attributes. If you need these old attributes, you can specify it as a second dictionary.

- **dictionary.* and goodies/dictionary.***
  
  These dictionary files have more attributes for special cases. See the individual files for more details.

Under very unusual circumstances, you may wish to modify your dictionary. In any case, your dictionary must have entries for at least the following attributes, which are referred to by name in the `radiusd` code.

- User-Name
- User-Password
- Acct-Delay-Time
- Any other attributes that are required by your check and reply item configuration.

Wherever possible, use the default dictionary: it will work with the vast majority of cases. If you are operating with NASs from only one vendor, choose the default dictionary, or dictionary for that vendor. If you are operating in a mixed environment, use the default dictionary. If that does not work for you, try concatenating the dictionaries for the vendors you are using into one big dictionary or use `DictionaryFile` parameter to load the dictionaries as separate files.

If you need to add or modify attributes or other dictionary entries, we recommend adding them to your own site-specific dictionary, and then add that dictionary to the list of dictionaries given by the `DictionaryFile` parameter in your configuration file. See Section 3.7.16. DictionaryFile on page 33.

Whichever dictionary you choose to use, you should place it in the directory where `radiusd` expects to find it before starting `radiusd`. You should also be careful to specify the same dictionary to `radpwtst` with the `-dictionary` argument if you use it for testing.

9.1.10. Using VSA framework for customised attributes


9.2. Flat file user database

Flat file user databases are used to list all the legitimate users for the `<AuthBy FILE>` module. You can also use flat file user databases as input to the `builddbm` and `buildsql` utility to create a DBM user database. See the `users` file in the Radiator distribution for an example.
Flat file user databases are ASCII text files containing zero or more user definitions. Lines beginning with ‘#’ are ignored. Each user definition is one or more lines. The first line must start with the user name in the first column. Subsequent lines for the user must begin with white space.

User names are quoted with double quotes (") if they contain white space. The user name must be followed by white space, followed by zero or more check items. Each check item is in the form `Attribute = Value`, and it defines a RADIUS attribute that is checked in Access-Requests before the user is authenticated. Multiple check items are separated by commas. There must be no comma after the last check item in the line. Values may optionally be surrounded by double quotes, which are ignored. For more information about check items, see Section 7. Check and reply items on page 431.

The second and subsequent lines are ‘reply’ items. Each line must commence with white space. Each reply item is in the form “Attribute = Value”, and it defines a RADIUS attribute that are returned to the NAS if the authentication succeeds. Such reply items are generally used to configure the NAS for the user. Each reply item must have a trailing comma (’,’) except the last item on the last line. Values may optionally be surrounded by double quotes, which are ignored.

The following figure shows an example, if the user `mikem` is granted access, the modem is configured for Framed-Protocol of PPP, and IP netmask of 255.255.255.0, Framed-Routing of None and a Framed-MTU of 1500.

Figure 19. Typical user entry in a flat file user database

9.3. DBM user database

DBM user database file is in similar format to the DBM files supported by Merit and other RADIUS servers. Entries are hashed by user name, which is unique. Each user entry consists of two strings separated by newline characters. The first line is a list of comma separated Check items in the form “Attribute = Value”. The second line is a list of comma separated Reply items in the form ”Attribute = Value”. During authentication, the check and reply items are used in exactly the same way as for a Flat file user database. For more information, see Section 7. Check and reply items on page 431.

Radiator will choose the best format of DBM file available to you, depending on which DBM modules are installed on your machine. (Hint: You can force it to choose a particular format by using the DBType parameter, and by using the -t flag with `builddbm`).

You can convert a flat file user database directly into a DBM user database with `builddbm` utility, and you can also use `builddbm` to print the attributes for a particular user. You can convert a DBM user database into an SQL database with the `buildsql` utility.

A DBM database can have multiple DEFAULT users. During authentication, if no user name is found in the DBM database, the DEFAULT users will be tried in the order that they appeared in the input file, until a match
is found. Technical Note: when the DBM file is built from a flat file, the first DEFAULT user encountered is added to the DBM file with the name DEFAULT. The seconds and subsequent DEFAULT entries are added as DEFAULT1, DEFAULT2 etc. Therefore the uniqueness and order of DEFAULT users in the database is guaranteed.

9.4. Unix password file

A Unix password file as understood by the AuthBy UNIX module is an ASCII file consisting of one line per user. There are at least 2 colon (:) separated fields per line. The first field is the user name, and the second is the crypt(3) encrypted password. The third and subsequent fields (if they are present) are ignored.

It will be recognised that this description fits the standard Unix password file format, and Radiator will work with `/etc/password` on Unix implementations that do not use a password shadow file. It will work with `/etc/shadow` on Unix implementations that do use a password shadow file (Radiator will need to run as root to get read access to `/etc/shadow`).

9.5. Accounting log file

The accounting log file is used to store the details of every Accounting-Request received for a Realm if the AcctLogFileName parameter is defined for the Realm. It is an ASCII text file with each entry occupying one or more lines and followed by a blank line. The log file format is identical to the format used by Livingston and other RADIUS servers. The first line gives the date and time the request was received by the server. The subsequent lines give the values for every attribute in the request. Every Accounting-Request, regardless of Acct-Status-Type is stored in the log file.

*Figure 20. Typical accounting log file entry*

9.6. Password log file

The Password log file is useful for your help desk to diagnose user's login problems. It is only written if you define PasswordLogFileName for a Realm. It is an ASCII text file containing the results of password checks, one check per line. Each line contains 5 colon (':') separated fields:

time:seconds:user:submitted_password:correct_password:result
10. High availability for radiusd

The time is the full date time string, seconds is the number of seconds since January 1 1970 (Unix epoch). Result is the word “PASS” or “FAIL”. For example:

<table>
<thead>
<tr>
<th>Time</th>
<th>NAS Address</th>
<th>User</th>
<th>Port</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon Jun 29 12:24:21</td>
<td>1999:899087061</td>
<td>mikem</td>
<td>899</td>
<td>FAIL</td>
</tr>
<tr>
<td>Mon Jun 29 12:24:38</td>
<td>1999:899087078</td>
<td>redd</td>
<td>899</td>
<td>PASS</td>
</tr>
<tr>
<td>Mon Jun 29 12:38:53</td>
<td>1999:899087933</td>
<td>mikem</td>
<td>899</td>
<td>PASS</td>
</tr>
</tbody>
</table>

The file is opened, written and closed for each entry, so it can be safely rotated at any time.

9.7. Portlist file

A port list file contains a list of permitted NAS address/port combinations that are permitted for a user or group of users. It is used by the NAS-Address-Port-List check item. It is an ASCII file, with two white space separated fields. The first field is the NAS address (either as a DNS name or IP address). The second field contains the lower and upper permitted port numbers in the format “lowport-highport”. Blank lines and lines starting with hash (‘#’) are ignored. You can have any number of entries for each NAS, and any number of NASs.

**Note**

iPASS roaming users do not get their real NAS Address sent to Radiator. Radiator considers these to be address 0.0.0.0 for the purposes of NAS-Address-Port-List.

```
# Users can log into ports 1-10 and 21-30 inclusive
# on 10.1.1.1 or into ports 100 to 115 inclusive on
# 10.1.1.2, or into ports 16 to 20 inclusive on
# mynas.domain.com
10.1.1.1 1-10
10.1.1.1 21-30
10.1.1.2 100-115
mynas.domain.com 16-20
# For iPASS roaming:
0.0.0.0 0-1000
```

9.8. Group membership file

This file contains a list of groups and their members. `<AuthBy FILE>` uses these groups and the group file is defined with `GroupFilename` parameter. For more information, see Section 3.34.2. `GroupFilename` on page 163.

The format of group membership file has first the name of the group and then a comma-separated list of users that belong to that group. One user can belong to one or several groups.

Here is an example of a group membership file:

```
Admin-group username1
WiFiClient-group username1, username2, username3
Readonly-group username4, username5
```

10. High availability for radiusd

In a typical ISP, your RADIUS server is an important part of your customer service, and it is important that it is available all the time. Radiator RADIUS server is very reliable but it is possible that it is accidentally killed, or
that a system problem causes it to exit. Make provisions for Radiator to be started automatically at system start-up to make sure it is available all the time.

In a Unix environment, there are 3 ways to make Radiator to start at system start-up. The preferred method is to start and restart radiusd with restartWrapper, but you can also start and restart it with inetd(1) or init. On Windows, you can run Radiator as a system service.

10.1. Using restartWrapper

In a Unix environment, you can arrange for radiusd to be restarted automatically if it exits unexpectedly by using the restartWrapper script. restartWrapper is included in the goodies/ directory of the Radiator distribution. It is not installed automatically, so if you want to use it, you will probably want to copy it to your local binaries directory. Radiator must be run in the foreground with the Foreground parameter or the -foreground argument. For more information, see Section 3.7.1. Foreground on page 27.

restartWrapper never terminates, so you will probably want to run it in the background with an ampersand (&), especially if you are calling it from a system boot script.

You will probably want to put a call to restartWrapper in your Unix system boot script so that radiusd is started automatically at boot time by restartWrapper. This will usually involve modifying /etc/rc.local or adding a new script to /etc/rc2.d, depending on what type of Unix you are running. See your system documentation for more details about system start-up scripts.

The arguments are:

```
restartWrapper [-h] [-delay n] [-mail address]
    [-min_interval n (default: 0)]
    [-sendmail path-to-sendmail]
    [-syslog facility.level (default: user.err)]
    [-logger path-to-logger (default: /usr/bin/logger)]
    "command to run"
```

- **-h**
  
  Print usage help message.

- **-delay n**
  
  Number of seconds to wait before restarting the command. Defaults to 10 seconds.

- **-min_interval n**
  
  Minimum interval in seconds between successive restart. Defaults to 0 seconds.

- **-mail address**
  
  The email address to send a message to when the command exits. By default, no email is sent.

- **-sendmail path-to-sendmail**
  
  Specifies an alternate path to the sendmail program which will be used to send email if the -mail argument is specified. Defaults to /usr/lib/sendmail.

- **-syslog facility.level**
  
  Specifies an optional syslog facility and level to be used to log messages using syslog. If this is not specified, syslog will not be used to log messages.

- **-logger path-to-logger**
  
  Specifies the syslog logger program which will be used to log syslog messages. Defaults to /usr/bin/logger.
10. High availability for radiusd

- "command to run"

This is the complete command that is to be run, including arguments if any. You should enclose the entire command in double quotes, especially if the command contains arguments that might be mistaken for arguments to restartWrapper. You will probably want to specify the full path to the command.

Example

Run `radiusd` with a specified config file. If it stops, send email to mikem@open.com.au and wait 2 seconds before restarting it.

```
restartWrapper -mail mikem@open.com.au -delay 2 "
   /bin/radiusd -config_file /etc/radius.cfg -foreground" &
```

Tip

Make sure that Radiator is running in “foreground” mode, either with `-foreground` in the command line arguments, or with Foreground in the configuration file.

10.2. Using init

On Unix systems that support it, you can start and restart Radiator automatically with `init(1)`. Add something like this to `/etc/inittab`:

```
ra:2345:respawn:/usr/bin/radiusd -config_file \
   /etc/raddb/radius.cfg -foreground
```

Tip

Make sure that Radiator is running in “foreground” mode, either with `-foreground` in the command line arguments, or with Foreground in the configuration file.

10.3. Using inetd

If you do not wish to use `restartWrapper` or `init`, you can instead arrange for the Unix `inetd(1)` super server to start `radiusd` the first time it is required (and to restart it if it stops unexpectedly). In order to do this, you must add a new line to the `inetd` configuration file (usually `/etc/inetd.conf`). You must also ensure that the radius port number you wish to use is configured into the `/etc/services` file. You must also ensure that Radiator is configured to run in the foreground with the Foreground parameter or the `-foreground` argument. For more information, see Section 3.7.1. Foreground on page 27.

The `inetd` line you add will look something like this (the line has been wrapped due to its length in this example):

```
# Start Radiator on demand
```
10. High availability for radiusd

radius dgram udp wait root /bin/radiusd radiusd
   -config_file /etc/radius.cfg
   -foreground

After changing /etc/inetd.conf, you will need to tell inetd to reread its configuration file by sending it a HUP signal with something like

`kill -HUP pid-of-inetd`

Whenever a radius request is received and radiusd is not already running, inetd will automatically start radiusd. If radiusd stops some time later, inetd will restart it when the next request arrives. For more details on using and configuring inetd, consult your Unix vendor's documentation.

**Tip**

Make sure that Radiator is running in “foreground” mode, either with -foreground in the command line arguments, or with Foreground the configuration file.

10.4. Unix SYSV startup script

The Radiator distribution contains a Unix/Linux SYSV compatible startup script in `goodies/linux-radiator.init`.

To use this script to start and stop Radiator by hand or automatically at boot time, on Linux as root:

```
cp goodies/linux-radiator.init /etc/init.d/radiator
chmod 755 /etc/init.d/radiator
chkconfig -add radiator
```

This startup script responds to the following commands:

- **/etc/init.d/radiator start**
  
  Starts the Radiator server running in the background as a service. This is the default command which will be used to start Radiator automatically at boot time when the startup script is automatically run.

- **/etc/init.d/radiator stop**
  
  Stop the Radiator server.

- **/etc/init.d/radiator restart**
  
  Stop then restart the Radiator server.

- **/etc/init.d/radiator reload**
  
  Forces the Radiator server to reread its configuration file. It does this by sending a HUP signal to the server.

- **/etc/init.d/radiator status**
  
  Prints the current status of the Radiator server process.

- **/etc/init.d/radiator traceup**
  
  Increases the current Radiator server Trace level by one. It does this by sending a USR1 signal to the server.

- **/etc/init.d/radiator tracedown**
Decreases the current Radiator server Trace level by one. It does this by sending a USR2 signal to the server.

## 10.5. System Service on Windows

On Windows you can configure Radiator to run as a Windows Service. It is automatically started at boot time, and you can start, stop, and pause it is the Services window, also known as the MMC Services snap-in. This is the preferred way to get Radiator to run automatically every time the Windows server is started.

1. Review the Windows Perl and Radiator installation instructions on page 9. Make sure you have Win32::Daemon Perl module installed.
2. Start a Command Prompt window. Adjust the paths below for your Perl installation. Create the Radiator service with:
   
   ```
   perl c:\perl64\bin\radiusd -install
   ```
   
   This installs Radiator as a Windows Service so that it uses the default configuration file in `C:\Program Files\Radiator\radius.cfg`
3. Open the Services snap-in. You see Radiator Radius Server as one of the available services. Using the Services window you can start, stop, pause, and disable the Radiator service.
4. Start the Service.
5. Test that the Service is running correctly by sending a test request with
   
   ```
   perl c:\perl64\bin\radpwtst -user mikem -password fred
   ```
6. Edit and test the configuration in `C:\Program Files\Radiator\radius.cfg`. You need to restart the Radiator service using the Services control panel after making any changes to the configuration file in order for the change to take effect.
7. Next time the computer reboots, the Radiator Service starts automatically.

### Tip

Radiator runs successfully as a service if it runs properly using the same command line that you used during the installation testing. Try running Radiator from the root directory of the C: drive with something like `perl c:\perl64\bin\radiusd`. Since a Windows service has no “current directory” or “Current drive”, you must be very sure that your Radiator configuration file contains no relative file names. Every file name mentioned must be a fully qualified path name, including the drive name, such as:

| DbDir       | C:\Program Files\Radiator |

### Tip

A Windows Service usually runs as the System User, not as a logged-in user. To run as a Service, configure your Radiator so it does not rely on remote shares and other things that may not be accessible to the System User. Generally, this means that all Radiator configuration files, the Radiator program, and the like must be on the local disk.
11. Using Gossip framework

Radiator’s Gossip framework allows Radiator instances to share information and event notifications. The instances can be part of server farm, completely separate processes running on the same or different hosts, or any combination of thereof.

Radiator’s Gossip framework supports the following backends:

- GossipRedis clause is used to configure a Redis-based Gossip framework instance. For more information, see Section 3.134. <GossipRedis> on page 400.
- GossipUDP clause is used to configure a UDP-based Gossip framework instance. For more information, see Section 3.135. <GossipUDP> on page 402.

Currently the following Radiator modules support Gossip:

- <AuthBy RADIUS> and its subclasses can use GossipRedis for communicating next hop host unreachability and reachability information with Gossip messages. Multiple Radiator instances, in both stand-alone and FarmSize configuration, can share proxy status information. This allows, for example, just one member to run Status-Server queries when FarmSize configuration parameter is enabled.
- <AuthBy RADSEC> support is similar to <AuthBy RADIUS>.
- Radius Clients can use GossipRedis for duplicate cache. When the global configuration parameter DupCache is set to global, GossipRedis is used for RADIUS duplicate cache.
- StatsLog REDIS uses GossipRedis for storing statistics in Redis.

Gossip message format supports optional header for TTL, payload encryption, and future extensions.

More Radiator modules will be added and upgraded to use the Gossip framework in the future. You can also create customised modules for your requirements.

12. Adding custom AuthBy modules

Radiator provides an easy way of plugging in and integrating additional custom AuthBy modules. This allows you to use Radiator to authenticate from and store accounting information to other databases and storage types not currently supported by Radiator. You will need to be a competent Perl programmer in order to implement custom AuthBy modules.

Custom modules are usually written in Perl. They are automatically loaded when a matching <AuthBy ...> clause is read in the configuration file. Details on how to load, configure and implement a custom AuthBy module are described in this section.

There is a simple AuthBy module called AuthTEST.pm included in the RADIUS directory. It implements the <AuthBy TEST> clause, and would be a good starting point if you want to write your own custom AuthBy module. You should copy it to a new name and modify the copy to suit your needs.

12.1. Loading and configuring

When radiusd sees an <AuthBy XYZ> clause while parsing a Realm or Handler, it will load the file Radius/AuthXYZ.pm with a Perl require. AuthXYZ.pm is expected to be a Perl package that implements the class Radius::AuthXYZ. Realm.pm will then instantiate a new Radius::AuthXYZ by calling the constructor with Radius::AuthXYZ->new($file). The constructor is expected to create an instance of Radius::AuthXYZ that can handle all the requests for that type of authentication.

The constructor is passed a filehandle $file, which is the configuration file being currently read. The constructor is expected to configure its instance from lines read from the configuration file up until it sees a
Adding custom AuthBy modules

This is made very easy by the `Radius::Configurable` class, which your AuthBy module should inherit from.

If the `Radius::AuthXYZ` constructor fails, it is expected to return `undef`.

12.2. Handling Requests

After construction and initialisation, your instance will be called upon to handle requests that are sent to it. For each request received, the `Handler.pm` module will call

```
($result, $reason) = Radius::AuthXYZ->handle_request($p, $rp),
```

where `$p` is a reference to the `Radius::Radius` packet received from the client, and `$rp` is an empty reply packet, ready for you to fill. `Client.pm` and `Handler.pm` will filter out duplicate requests, requests from unknown clients and requests with bad authenticators, so your `handle_request` will only be called for new, good requests from known clients. The contents of the request will have been unpacked into the `Radius::Radius` instance passed in as `$p`, so you can immediately start examining attributes and doing things.

`handle_request` returns an array. The first element is a result code, and the second is an optional reason message.

The result code from `handle_request` will indicate whether `Handler.pm` should automatically send the reply to the original requester:

- If `handle_request` returns `$main::ACCEPT`, `Handler.pm` will send back `$rp` as an accept message appropriate to the type of request received (i.e. it will turn `$rp` into an Access-Accept if the original request was an Access-Request). In the case of Accounting-Request, this is the only result code that will cause a reply to be sent back.
- If `handle_request` returns `$main::REJECT`, `Handler.pm` will send back `$rp` as a reject message appropriate to the type of request received (i.e. it will turn `$rp` into an Access-Reject if the original request was an Access-Request). In this case the reason message should be supplied.
- If `handle_request` returns `$main::CHALLENGE`, `Handler.pm` will send back `$rp` as a Access-Challenge message.
- If `handle_request` returns `$main::IGNORE`, `Handler.pm` will not send any reply back to the originating client. You should only use this if the request is to be completely ignored, or if your module undertakes to send its own reply some time in the future. If the Handler or Realm has more than one AuthBy handler module specified, it will continue calling handlers in the order in which they were specified until one returns something other than `$main::IGNORE`. You can change this behaviour with `AuthByPolicy`, for more information, see Section 3.30.12. `AuthByPolicy` on page 137.

Your `handle_request` function may want to use utility functions in `Radius::Radius` (see `Radius.pm`) to examine attributes in the incoming request, and to construct replies. There are some convenience routines in `Client.pm` for packing and sending replies to the original requester, such as

```
$p->{Client}->replyTo($rp, $p);
```

If your handler cannot successfully handle the request, perhaps due to some unforeseen event, software failure, system unavailability etc., it is common to not reply at all to the original request. This will usually force the original NAS to retransmit to another server as a fallback. You can do this by returning `$main::IGNORE` from `handle_request`.

12.3. AuthGeneric

This is a generic authentication module superclass. It implements behaviour that will be required in most authentication modules, and therefore most modules should inherit from it. Most simple authentication can be handled merely by overriding the `findUser()` method, which is expected to find and return a User object.
12. Adding custom AuthBy modules

Given a user name. The `AuthGeneric::handle_request` handles all the cascading of DEFAULT users, checking of check items, assembling replies etc. All you have to do is find the user in your database and return it in `findUser()`.

`AuthGeneric` only responds to Access-Request messages. Accounting-Requests are accepted but ignored (i.e. it does nothing with them). If you want to do something with accounting messages (other than what `Realm.pm` does, such as logging to the accounting log file or wtmp file), you will probably want to override `handle_request`, pass Access-Request messages to `$self->SUPER::handle_request()`, and process Accounting-Request messages yourself.

If your handler needs to fork so it can do a “slow” authentication or accounting task, you can call `AuthGeneric::handlerFork`, which will arrange for the handler to `fork(2)`, and also arrange for the child to exit after handling is complete.

`AuthGeneric` has a number of other methods that you can override for specific functions like:

- `log($p, $s)` Logs a message that originated in that class. `$p` is a message priority (see `Log.pm`). `$s` is a message. The base class behaviour is to log to the all the logging systems configured into Radiator by calling `main::log($p, $s)`.

### 12.4. Step-by-step

Assuming you want to create a custom AuthBy module called `XYZ`, these are the basic steps:

- Figure out what parameters your new module needs from the Radiator configuration file to configure its behaviour.
- Copy `AuthTEST.pm` to `AuthXYZ.pm`.
- Replace all instances of TEST in `AuthXYZ.pm` with `XYZ`.
- Implement the `keyword` function so it parses the parameters that your new module needs.
- If your module needs any sub-objects, implement the object function to parse out any sub-objects (see example code in `Radius::Realm->object`).
- Implement the `handle_request` function. You may wish to handle Access-Requests and Accounting-Requests differently.
- Add a test realm to the configuration file with something like:

  ```xml
  <Realm xxxxxxx>
  RealmParameter1 ....
  <AuthBy XYZ>
  AuthByParameter1 ....
  ...
  </AuthBy>
  </Realm>
  ```

- Restart or SIGHUP Radiator.
- Test your new module by sending requests to the server with the `radpwtst` utility.
- Install your new module with `make install`.

If your authentication method is simple and synchronous, your class only has to override the following methods in `AuthGeneric`:

- `new` Create a new instance by calling `$class->SUPER::new($file);`
- `keyword` Recognise any class specific parameter keywords from the configuration file and remember them.
• **findUser** Construct and return a User object if the named user can be found in your database.

### 12.5. Class Hierarchy

This section is only of interest to developers who plan to build new Radiator classes. It shows the class inheritance hierarchy of all the classes provided with Radiator.

*Figure 21. Radiator Class inheritance hierarchy*

#### 13. Compatibility with other servers

The flexibility of Radiator allows you to easily emulate the behaviour of Livingston and other similar radius servers. These radius servers use special entries in the user database file to control the behaviour of the server.
Radiator, in contrast, uses the configuration file for controlling the server. Nevertheless, Radiator allows you to use the Group and Auth-Type check items that are sometimes used with Livingston.

There is an example configuration file in goodies/livingCompat.cfg in the Radiator distribution. That configuration file makes Radiator behave in the same way as a Livingston or Cistron radius server. If you use “Auth-Type = System” in a user entry in the user file, Radiator will consult the UNIX password file /etc/passwd to authenticate the user. Radiator will also behave in the same way with respect to DEFAULT users. You can have multiple DEFAULT users in a user database. During authentication, if there is no user name entry found for the user, the DEFAULT entries are checked in the order in which they appear in the file (this is the case with both AuthBy FILE and AuthBy DBM). The DEFAULT entries will continue to be checked in order until one is found where all the check items match and where the Fall-Through reply item is not set to “Yes”.

Open System Consultants can assist with converting database dumps from other commercial RADIUS servers to standard Livingston format users file, including:

- Cisco ACS database dump files
- Funk RIF database export files

Contact info@open.com.au for more details.

14. Execution sequence and hook processing

This section describes when and how hooks are processed.

Radiator supports Perl hooks in many places in the configuration file. A hook is a piece of Perl code (in fact a Perl subroutine) that is run by Radiator at specified times. This allows the administrator to add custom code to handle unique or special processing requirements at run-time.

Hooks are specified verbatim or by file name in the Radiator configuration file.

Hooks are parsed by Perl at startup time, when the Radiator configuration file is read or re-read. Any syntax or compile-time errors in the hook are reported at that time.

Hooks are run at their specified times inside a Perl eval. This means that run-time errors, or a perl die() command results in a ERROR level message logged by Radiator.

Each hook is passed a set of run-time arguments, which depend on the type of hook being called. Arguments might include, for example, a reference to the request currently being processed, allowing the custom code to inspect and depend on the contents of the request. Hook arguments are documented separately for each hook.

The code for a hook can be placed verbatim in the configuration file:

```perl
UserPasswordHook sub {return $_[1]->{'GN'}}
```

Extend it over several lines using backslash line ending:

```perl
ConnectionHook sub {$_[1]->func(-access_mode => 'read_write',
   -isolation_level => 'read_committed',
   -lock_resolution => 'wait',
   'ib_set_tx_param')}
```

You can also place the hook code in a separate external file that is named in the configuration file:

```perl
AcctHook file:"%d/hooks/sqlradacct.pl"
```

The code in the external file looks like this:

```perl
# Contents of file sqlradacct.pl:
sub
```
use DBI;
my ($p, $rp, $handled, $reason) = @_;  
........  

Tip
An external file can define several Perl functions that can be called from other functions in that file, or by another hook.

The standard hooks are:

- **StartupHook**($restarted)
- **PreClientHook**(\$request)
- **ClientHook**(\$request)
- **PreHandlerHook**(\$request)
- **PreProcessingHook**(\$request, \$reply)
- **PreAuthHook**(\$request, \$reply)
- **PostAuthHook**(\$request, \$reply, \$handledflag, \$reason) (For AuthBy)
- **PostAuthHook**(\$request, \$reply, \$handledflag, \$reason) (For Handler)
- **PostProcessingHook**(\$request, \$reply)
- **MainLoopHook**()
- **ReplyHook**(\$replyfromproxy, \$replytonas, \$originalrequest, \$senttoproxy, \$host) (<AuthBy RADIUS> only, when a reply is received)
- **CacheReplyHook**(\$authobject, \$user_name, \$request, \$reply) (Some authenticators, such as <AuthBy RADIUS>, when no reply is received, and CachePasswords is set)
- **NoReplyHook**(\$originalrequest, \$senttoproxy \$replytonas) (<AuthBy RADIUS> only, when no reply is received)
- **PostSearchHook**(\$self, \$name, \$p, \$user, \$entry, \$rp) (<AuthBy LDAP> only, after the LDAP search has completed)

Note that arguments preceded by `\` are passed by reference. You need to dereference them to get at the actual parameter. It is done this way to enable you to switch the object it points to. In any case, to reference the request in, such as **PreClientHook**, you would need to refer to it as \$_[0], and the second argument to a hook would be accessed as \$_[1], etc. For example, to get an attribute from the request in **PreClientHook**, you would use something like:

```perl
my $modtype = \$_[0]->get_attr('USR-Modulation-Type');
```

Some example hooks are found in goodies/hooks.txt in your distribution.

Hooks are executed at fixed times during request processing:

1. Server started
2. **StartupHook** called
3. Radiator waits for requests
15. Interoperation with iPASS Roaming

iPASS (TM) operate a Global Roaming system that can allow your users to log in at any cooperating ISP around the world. For more information, see iPASS website [http://www.ipass.com/]. In order to interoperate you must enter into a commercial arrangement with iPASS. iPASS will then be able to provide the software that Radiator needs to communicate with the iPASS network.

iPASS regard roaming as two distinct products:

- **NetServer**, where you originate authentication and accounting requests for users who dial in to your POP. The requests are sent to the iPASS network, where they are authenticated, possibly by someone else’s Roam Server. This happens when someone else’s customers dial in to your POP. We call this “outbound”.

---

4. Request received from NAS
5. Global RewriteUsernames applied
6. PreClientHook called
7. Client clause selected
8. Global ClientHook called
9. Client-specific ClientHook called
10. Client RewriteUsernames applied
11. Duplicate detection done
12. PreHandlerHook called
13. Handler selected
14. PreProcessingHook called
15. Handler’s RewriteUsername and RewriteFunction applied
16. Session database updated (accounting requests only)
17. Accounting log files (AcctLogFileName and WtmpFileName) written
18. PreAuthHook called
19. AuthBy clauses invoked. AuthBy-specific PostAuthHook called after each AuthBy
20. Handler-specific PostAuthHook called
21. Statistics updated
22. PostProcessingHook called (if there is a reply to be sent)
23. Reply sent to NAS (unless request was proxied)
24. Reply received from proxy server (if the request was proxied to another RADIUS server...)
25. ReplyHook called
26. PostProcessingHook called
27. Reply sent to NAS
28. If no reply was received from a proxy server by <AuthBy RADIUS>, even after multiple retransmissions and timeouts, CacheReplyHook is called (if CachePasswords is specified), then NoReplyHook is called.
29. After all requests have been satisfied and timers run at the end of the main loop, MainLoopHook is run. Typically this happens once per second.

**15. Interoperation with iPASS Roaming**

iPASS (TM) operate a Global Roaming system that can allow your users to log in at any cooperating ISP around the world. For more information, see iPASS website [http://www.ipass.com/]. In order to interoperate you must enter into a commercial arrangement with iPASS. iPASS will then be able to provide the software that Radiator needs to communicate with the iPASS network.

iPASS regard roaming as two distinct products:

- **NetServer**, where you originate authentication and accounting requests for users who dial in to your POP. The requests are sent to the iPASS network, where they are authenticated, possibly by someone else’s Roam Server. This happens when someone else’s customers dial in to your POP. We call this “outbound”.

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15. Interoperation with iPASS Roaming

- RoamServer, where authentication and accounting requests arrive from the iPASS network. This happens when your customers dial in to someone else's POP. We call this “inbound”.

Radiator uses different methods for handling inbound and outbound iPASS requests, and each must be set up separately with Radiator and with iPASS.

15.1. iPASS Outbound

Outbound requests must be proxied to an NetServer, configured to work with the iPASS system. The NetServer is provided by iPASS. The NetServer may be run either on the same host as Radiator, or on a different host. If the NetServer is run on the same host as Radiator, it must be configured to use different ports to Radiator.

As an example, here is part of a typical configuration that will handle requests for local users from a file, and proxy all other realms to an NetServer running on another host:

```
# Local realm is handled locally
<Realm my.local.realm>
  <AuthBy FILE>
    Filename xxxxxx
  </AuthBy>
</Realm>

# All other realms are proxied to NetServer on fred
<Realm DEFAULT>
  <AuthBy RADIUS>
    Host fred
    Secret mysecret
  </AuthBy>
</Realm>
```

Figure 22. Schematic diagram of how iPASS outbound requests are handled
In order to configure Radiator to handle outbound iPASS requests, you need to do the following things:

1. Enter into a commercial arrangement for iPASS to provide Net Server access to you. iPASS will provide you with an ISP partner number.

2. Download, install and configure the iPASS software. You will need to configure both the RoamServer and RADIUS server. This will involve configuring the package, requesting and receiving an encryption certificate, and submitting details of your server and realm to iPASS. Install the package in the normal place (/usr/ipass).

3. Test the installed iPASS package by using the test programs provided with it. Make sure it is really working properly before you go on to the next step.

4. Configure Radiator so that all realms that are not handled locally are forwarded to the NetServer.

5. Test Radiator with the radpwtst program to make sure that requests for non-local realms are forwarded to iPASS.

15.2. iPASS Inbound

Inbound requests are received by a special server that you also must get from iPASS called RoamServer. RoamServer receives requests from the iPASS network and then sends them to Radiator as ordinary RADIUS requests. See the following figure. RoamServer will usually run on the same host as Radiator, or possibly on a different host in your network.

Figure 23. Schematic diagram of how iPASS inbound requests are handled

In order to configure Radiator to handle inbound iPASS requests, you need to do the following things:

1. Enter into a commercial arrangement for iPASS to provide Roam Server access to you. iPASS will provide you with an ISP partner number.

2. Request the iPASS RoamServer software for your platform from iPASS.
3. Install and configure the RoamServer software according to the instructions included with it. This will involve configuring the package, requesting and receiving an encryption certificate, and submitting details of your server and realm to iPASS. Install the package in the normal place (/usr/ipass). If you have already done this for outbound requests above, you do not need to do it again.

4. Configure Radiator in the usual way for your local realms. Add a Client clause specifying the host where the RoamServer software is running, and the shared secret you configured into RoamServer:

```xml
<Client localhost>
    Secret secret
</Client>
<Realm ...>
    ...
</Realm>
```

5. Test that RoamServer sends requests to Radiator by using the test software provided with RoamServer.

16. RadSec (RFC 6614)

It is often the case that RADIUS requests need to be sent from one RADIUS server to another. This is called proxying. It is commonly used to send requests to another RADIUS server that is better able to handle the request. In Radiator proxying is usually implemented with the <AuthBy RADIUS> clause.

Conventional UDP based RADIUS proxying is inherently unreliable and insecure. It is unreliable because the UDP protocol does not guarantee delivery, and the RADIUS protocol only requires a limited number of retransmits. Therefore, in an unreliable or congested network, RADIUS packets may be irretrievably lost. Further, conventional RADIUS requests are not encrypted, and most of the attributes (other than the password) in a RADIUS request are in plaintext. This means that eavesdroppers can obtain valuable information from unprotected RADIUS requests.

As a result, RFC 6614 ‘Transport Layer Security (TLS) Encryption for RADIUS’ was created to specify a secure, reliable RADIUS transport. RFC 6614 is based on the original RadSec protocol in Radiator, and the Radiator RadSec implementation is by default compliant with RFC6614.

RFC 6614 RadSec is a communication protocol that provides secure, reliable proxying of RADIUS requests from one Radiator to another. It can be used in place of AuthBy RADIUS when proxying across insecure or unreliable networks.

When using RadSec, one Radiator is designated the RadSec client, and the other is the RadSec server. The RadSec client establishes the connection to the RadSec server, and sends RADIUS requests to the RadSec server over a reliable stream connection. The RadSec server sends any replies to each RADIUS request back to the RadSec client. A RadSec server can accept connections from any number of RadSec clients.

RadSec uses the TCP/IP (or optionally SCTP) stream protocol to transport requests from the RadSec client to the RadSec server and replies from the server to the client. By default, TLS is used to encrypt the requests, and to enforce server authentication with a server PKI certificate (i.e. the RadSec client confirms that it is connected to the RadSec server it expects by checking a server certificate). By default, the Radiator RadSec server requires that clients confirm their identity by requiring a PKI client certificate.

16.1. RadSec Certificate Validation

During the establishment of a TLS RadSec connection between a RadSec client and RadSec server, certificate validation is performed in order to confirm that they are connected to the peer they expect to be connected to. This is a brief description of how validation is performed.

If a peer presents a certificate (TLS RequireClientCert), then it is always validated using the peer certificate issuer's Root Certificate (see Section 3.11.2. TLS CAFile on page 75 or Section 3.11.3. TLS CAPath on page 75) and any certificate revocation list (CRL) for the certificate's issuer (see Section 3.11.14. TLS CRLCheck on page 77 and Section 3.11.17. TLS CRLFile on page 78). If TLS Policy OID is defined, the OIDs must be present in the certificate path. If that is successful, the contents of the peer certificate are checked:

In the RadSec server the client certificate is examined. It is accepted if:

- The certificate contains a subjectAltName extension of type IPADDR that matches the client's IP address.
- There were no subjectAltName extensions, but the certificate Subject contains a Common Name (CN) that matches the client's IP address.
- The certificate Subject matches the TLS ExpectedPeerName pattern.

and:

- If TLS SubjectAltNameURI is defined in the <ServerRADSEC> clause, the certificate must contain a subjectAltName of type URI that matches the TLS SubjectAltNameURI regular expression.
- If TLS CertificateFingerprint is defined in the <ServerRADSEC> clause, the certificate's fingerprint must match at least one of the TLS CertificateFingerprint options.

In the RadSec client, the server certificate is examined. It is accepted if:

- The certificate contains a subjectAltName extension of type IPADDR or DNS that matches the Host name used to connect to the server. If TLS SubjectAltNameDNS is set, use its value to match type DNS.
• There were no `subjectAltName` extensions, but the certificate Subject contains a Common Name (CN) that matches the Host name used to connect to the server.

• The certificate Subject matches the `TLS_ExpectedPeerName` pattern.

and:

• If `TLS_SubjectAltNameURI` is defined in the `<AuthBy RADSEC>` clause, the certificate must contain a `subjectAltName` of type URI that matches the `TLS_SubjectAltNameURI` regular expression.

• If `TLS_CertificateFingerprint` is defined in the `<AuthBy RADSEC>` clause, the certificate’s fingerprint must match at least one of the `TLS_CertificateFingerprint` options.

• `TLS_SRVName` check passes, usually applicable to `<AuthBy RADSEC>` utilised by `<AuthBy DNSROAM>`.

17. Extensible Authentication Protocol (EAP)

Extensible Authentication Protocol (EAP) is a standard for defining and extending authentication protocols. EAP is defined by RFC 3748, and RFC 2869 defines how EAP authentication messages are carried in RADIUS packets. Radiator complies with these standards, and can be extended to handle any EAP-compliant protocol. Because EAP is designed to be easily extensible, a number of EAP protocols have been defined for various special requirements. This includes mutual authentication between client and RADIUS server, and encryption of the authentication conversation. EAP over RADIUS is commonly used as the authentication protocol for 802.1X wired and wireless networks. For more information, see IETF website [https://www.ietf.org/]

Conventional RADIUS requests send the User-Name in one RADIUS attribute and the User-Password in another attribute. All EAP-over-RADIUS requests send their authentication information in the EAP-Message attribute. Usually the client sends some EAP protocol information in the EAP-Message attribute in a RADIUS Access-Request message, and the RADIUS server asks for some more information from the client by sending back another EAP-Message in a RADIUS Access-Challenge. When the server has enough information from the client, the RADIUS server replies with an Access-Accept or an Access-Reject message. Some EAP protocols, such as TLS, TTLS and PEAP, often require a number of messages (10 or more) to be exchanged between client and RADIUS server during authentication. Such a group of EAP-over-RADIUS messages while authenticating a user is called a conversation.

Note that many EAP protocols hide or encrypt the identity of the real user name of the user being authenticated, and send a generic name (typically anonymous) as the visible User-Name in the RADIUS requests.

Radiator supports several EAP protocols. This section describes their characteristics and how Radiator can be configured to support them. In order to configure Radiator to support EAP, the relevant AuthBy clauses must have the `EAPType` parameter set to the names of the EAP types that you need to support. In addition, a number of other special configuration parameters may have to be set in order to support those EAP types. An AuthBy clause can be configured to accept more than one EAP type. When that is the case, the first one in the list will be the default EAP method offered to the client. The client can accept the offered method or request another EAP method. If the requested method is one of the methods named in the `EAPType` parameter, then EAP authentication continues with that method.

There are many example configuration files covering various EAP authentication requirements in the `goodies/` directory of the Radiator distribution. See `goodies/README` for details.

17.1. EAP MD5-Challenge

In EAP MD5-Challenge, the RADIUS server sends a random challenge to the client. The client forms an MD5 hash of the user's password and the challenge and sends the result back to the server. The server then validates the MD5 hash using the known correct plaintext password from the user database. EAP MD5-Challenge does not support dynamic WEP keys.
EAP MD5-Challenge can work with most Radiator AuthBy clauses that support the retrieval of a plaintext password, such as FILE, DBFILE, SQL, LDAP etc.

17.2. EAP One-Time-Password

In EAP One-Time-Password, the client sends a plaintext one-time password to the server, which then checks the password and either accepts or rejects the request. The one-time password is sent in the clear, so it is subject to eavesdropping, and should not be used with static password. EAP One-Time-Password does not support dynamic WEP keys.

EAP One-Time-Password can work with Radiator AuthBy clauses that support one-time passwords, such as AuthBy OPIE, OTP and LDAPDIGIPASS and SQLDIGIPASS.

17.3. EAP Generic-Token

EAP Generic-Token is intended to support a range of authentication tokens from various vendors. In this context, a ‘token’ is a small device that the end user carries and which displays a login passcode that is used to authenticate the user. Examples are RSA SecurID, Encotone TeleID and Vasco tokens. Most such systems have back end servers that do the actual authentication. EAP Generic-Token does not support dynamic WEP keys.

EAP Generic-Token can be used with Radiator AuthBy clauses ACE, LDAPDIGIPASS, SQLDIGIPASS, OTP, OPIE, RSAMOBILE to support one-time passwords. It can also be used with all AuthBy clauses that support static passwords, such as FILE, SQL, LDAP, UNIX etc. In this case, it prompts the user ‘Enter your static password’.

17.4. EAP TLS

EAP TLS uses Public Key Infrastructure (PKI) digital certificates to provide mutual authentication between the EAP client and the RADIUS server. A PKI certificate is a file created by a program called a Certificate Authority. The certificate contains the name of the server or user that has been issued to. The EAP client and RADIUS server use the certificates to verify that the other party is indeed who it claims to be. In EAP TLS, a PKI certificate is required for the Radiator RADIUS server and for each and every EAP TLS client. EAP TLS does support dynamic WEP keys.

You can obtain certificates from a Public Certificate authority such as Thawte [https://www.thawte.com/]. The advantage of Public Certificates is that they will generally be recognised by any client or server without taking any special steps. A disadvantage of Public certificates is that you usually have to pay an annual fee for each one. With a Private Certificate Authority, you can generate your own server and client certificates for free, but you will generally have to install the ‘Root Certificate’ from your Certificate Authority on each client before it will recognise a private server certificate. Private Certificates are considered by many to be more secure that Public Certificates.

The basic steps of EAP TLS authentication are:

1. The EAP TLS client and RADIUS server establish a communications channel via the RADIUS protocol.
2. The RADIUS server sends its Server PKI Certificate to the client.
3. The client verifies that the server certificate is valid and is the correct certificate for the RADIUS server it is communicating with. It uses the Root Certificate of the Certificate Authority that issued the Server Certificate to validate the Server Certificate. (Root Certificates for most Public Certificate Authorities are built in to most clients. If the Server Certificate was issued by a Private Certificate Authority, the client requires a copy of the Root Certificate to be installed in order to validate the Server Certificate.)
4. If the client validates the server certificate, it then sends the user's PKI certificate to the RADIUS server.
5. The RADIUS server verifies that the client certificate is valid and is the correct certificate for the user name that is being authenticated. The RADIUS server can be configured to validate Private Client
17. Extensible Authentication Protocol (EAP)

Certificates using a locally installed copy of the Root Certificate of the Certificate Authority that issued the client certificate.

6. If the RADIUS server validates the client certificate then the authentication is successful, and the client is permitted to be connected to the network.

EAP TLS does not use or exchange any passwords, but you can use AuthBy methods in Radiator to enable or disable EAP TLS users based on their user name, time of day etc.

17.5. EAP LEAP

EAP LEAP (often called just LEAP) is a proprietary protocol from Cisco [https://www.cisco.com/]. It provides password based authentication that can be used with any Radiator authentication method that stores plaintext passwords (such as FILE, SQL, LDAP) etc., as well as direct Windows authentication using AuthBy LSA. LEAP authentication requires a special LEAP client that is only available from Cisco.

17.6. EAP TTLS

Like EAP TLS (see Section 17.4. EAP TLS on page 478), EAP TTLS uses Public Key Infrastructure (PKI) digital certificates. Unlike TLS, it only uses a Server Certificate so the client can validate the server, and then establish a secure, encrypted communications channel with the RADIUS server. When this channel is established, it is used to tunnel conventional RADIUS attributes, such as User-Name, User-Password etc. to the RADIUS server. Radiator converts each of these so-called ‘inner requests’ into a new RADIUS request which can be authenticated by any supported AuthBy method. So EAP TTLS authentication happens in 2 phases following these basic steps:

1. The EAP TTLS client and RADIUS server establish a communications channel via the RADIUS protocol.

2. The RADIUS server sends its Server PKI Certificate to the client.

3. The client verifies that the server certificate is valid and is the correct certificate for the RADIUS server it is communicating with. It uses the Root Certificate of the Certificate Authority that issued the Server Certificate to validate the Server Certificate. (Root Certificates for most Public Certificate Authorities are built in to most clients. If the Server Certificate was issued by a Private Certificate Authority, the client requires a copy of the Root Certificate to be installed in order to validate the Server Certificate.)

4. If the client validates the server certificate, it then sends the real user name and password in a RADIUS request through the encrypted TLS tunnel. Any conventional RADIUS authentication system may be used depending on the client configuration, such as PAP, CHAP, MSCHAP, MSCHAPV2 etc.

5. Radiator converts this ‘inner’ request into a new RADIUS request and dispatches it to the first matching Realm or Handler clause, where it can be handled by one or more AuthBy clauses. To assist in discriminating TTLS inner requests, each inner request is tagged with the pseudo-attribute TunnelledByTTLS set to 1.

6. The result of the inner authentication is sent back to the client through the TLS tunnel.

In order to use EAP TTLS, you must install a unique Server Certificate on your RADIUS server host, and configure Radiator to use it. For more information about Public and Private certificates and how to obtain them, see Section 17.4. EAP TLS on page 478. EAP TTLS does support dynamic WEP keys.

You can configure Radiator to handle the inner and outer requests in separate Handler or Realm clauses. You can also configure Radiator to proxy the inner RADIUS requests to another RADIUS server, which means that Radiator can server as a gateway between EAP TTLS clients and a non-EAP enabled RADIUS server.
17. Extensible Authentication Protocol (EAP)

17.7. EAP SIM

This protocol is used to authenticate using a GSM SIM card. EAP-SIM support is available as a premium add-on package for Radiator. Contact info@open.com.au for more details.

17.8. EAP AKA

This protocol is used to authenticate using a UMTS SIM card. EAP-AKA support is available as a premium add-on package for Radiator. Contact info@open.com.au for more details.

17.9. EAP AKA'

This protocol is a revision of EAP-AKA and is used to authenticate using a UMTS SIM card. EAP-AKA’ support is available as a premium add-on package for Radiator. Contact info@open.com.au for more details.

17.10. EAP PEAP

Like EAP TLS (See Section 17.4. EAP TLS on page 478), EAP PEAP (often called just PEAP) uses Public Key Infrastructure (PKI) digital certificates. Unlike TLS, it only uses a Server Certificate so the client can validate the server, and then establish a secure, encrypted communications channel with the RADIUS server. When this channel is established, it is used to tunnel encrypted EAP messages to the RADIUS server. Radiator converts each of these so-called ‘inner requests’ into a new RADIUS request which can be authenticated by any supported AuthBy method. So EAP PEAP authentication happens in 2 phases following these basic steps:

1. The EAP PEAP client and RADIUS server establish a communications channel via the RADIUS protocol.

2. The RADIUS server sends its Server PKI Certificate to the client.

3. The client verifies that the server certificate is valid and is the correct certificate for the RADIUS server it is communicating with. It uses the Root Certificate of the Certificate Authority that issued the Server Certificate to validate the Server Certificate. (Root Certificates for most Public Certificate Authorities are built in to most clients. If the Server Certificate was issued by a Private Certificate Authority, the client requires a copy of the Root Certificate to be installed in order to validate the Server Certificate.)

4. If the client validates the server certificate, it then sends one or more EAP requests through the encrypted TLS tunnel. The type of inner EAP request depends on the PEAP client configuration, but the most common types of inner EAP requests are EAP MSCHAPV2 and EAP TLS.

5. Radiator converts this ‘inner’ request into a new RADIUS request and dispatches it to the first matching Realm or Handler clause, where it can be handled by one or more AuthBy clauses. To assist in discriminating PEAP inner requests, each inner request is tagged with the pseudo-attribute TunnelledByPEAP set to 1.

6. The result of the inner authentication is sent back to the client through the TLS tunnel.

In order to use EAP PEAP, you must install a unique Server Certificate on your RADIUS server host, and configure Radiator to use it. For more information about Public and Private certificates and how to obtain them, see Section 17.4. EAP TLS on page 478. EAP PEAP does support dynamic WEP keys.

You can configure Radiator to handle the inner and outer requests in separate Handler or Realm clauses. You can also configure Radiator to convert an inner EAP-MSCHAPV2 request into a conventional RADIUS-MSCHAPV2 request, which means that Radiator can server as a gateway between EAP PEAP clients and a non-EAP enabled RADIUS server.
17. Extensible Authentication Protocol (EAP)

17.11. EAP MSCHAPV2

EAP MSCHAPV2 is an EAP version of the common MSCHAPV2 authentication mechanism. It provides mutual authentication between client and server. It is most commonly used as the inner authentication protocol with EAP PEAP on Microsoft Windows clients. EAP MSCHAPV2 does support dynamic WEP keys.

EAP MSCHAPV2 can be used with any Radiator AuthBy that has access to plaintext passwords, such as FILE, SQL, LDAP, DBM etc. It can also be used with AuthBy LSA to authenticate with a Windows Local Security Authority, Windows Domain Controller etc. It can also be used with LDAPDIGIPASS and SQLDIGIPASS.

17.12. EAP PAX

EAP PAX provides strong encryption and mutual authentication between supplicant and server based on a per-user Authentication Key (AK). It is described in RFC 4746. Based on the per-user AK, the server and supplicant derive strong cryptographic keys and authenticate each others knowledge of the AK. The derived keys can be used for dynamic WEP and WPA keys.

The AK is required to be configured into the per-user data in the Radiator user database, and also into each user’s EAP-PAX supplicant configuration. The AK is required to be 16 bytes. It can be specified in a Radiator user database as 32 hex digits:

    pskuser     User-Password=1234567890123456789012345678901

EAP PAX can be used with any Radiator user database that supports a plaintext User-Password. Requires Crypt::Rijndael and Digest::HMAC_SHA1. Both are part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

17.13. EAP PSK

EAP PSK provides strong encryption and mutual authentication between supplicant and server based on a per-user Pre-Shared-Key (PSK). It is described in RFC 4764. Based on the per-user PSK, the server and supplicant derive strong cryptographic keys and authenticate each others knowledge of the PSK. The derived keys can be used for dynamic WEP and WPA keys.

The PSK is required to be configured into the per-user data in the Radiator user database, and also into each user’s EAP-PSK supplicant configuration. The PSK is required to be 16 bytes. It can be specified in a Radiator user database as 32 hex digits:

    pskuser     User-Password=1234567890123456789012345678901

If the User-Password does not appear to be 32 hex digits, it will be regarded as a plaintext password, and will be converted into a PSK using the algorithm described in RFC 4764. The conversion to a PSK depends on the plaintext password and the server and supplicant IDs. Use of such plaintext passwords is discouraged by RFC 4764 (because the PSK then becomes vulnerable to dictionary attacks) and is not supported by all EAP PSK supplicants. We also discourage use of such plaintext passwords.

EAP PSK can be used with any Radiator user database that supports a plaintext User-Password. Requires Crypt::Rijndael and Digest::HMAC_SHA1. Both are part of CPAN. For more information, see Section 2.1.2. CPAN on page 3.

17.14. EAP PWD

EAP PWD provides strong encryption and mutual authentication between supplicant and server based on a shared password. It is described in RFC 5931. Based on the per-user password, the server and supplicant derive strong cryptographic keys and authenticate each others knowledge of the password. The derived keys can be used for dynamic WEP and WPA keys.
EAP PWD is highly secure (the password is never transmitted, even in encrypted form), and does not require PKI certificates, and also requires only 3 authentication roundtrips. Further, it is not encumbered by intellectual property issues. So it is considered efficient to roll out in eduroam and other environments.

Authentication of EAP PWD by Radiator depends in having access to the user's plain text password. EAP PWD can be used with any Radiator user database that supports a User-Password in format like below. Some EAP PWD clients may also support additional password formats. For more information, see Section 3.10.57. EAP_PWD_PrepMethod on page 72:

```
username    User-Password=fred
```

EAP PWD requires OpenSSL 0.9.8i libraries or later, Crypt::OpenSSL::EC and Crypt::OpenSSL::Bignum 0.06 or later.

Tip
Crypt::OpenSSL::EC and Crypt::OpenSSL::Bignum may not be readily available for Windows. We recommend Linux or Unix hosts for deployment of EAP PWD.

### 18. Monitor command language

The Monitor clause client programs to make an (authenticated) TCP connection to Radiator, and use that connection to monitor, probe, modify and collect statistics from Radiator. For more information, see Section 3.133. `<Monitor>` on page 397.

Monitor implements a simple command language, which is described in this section.

All Monitor connections must be authenticated with the LOGIN command before any significant command can be executed. If a connection has not been authenticated, the only commands that can be executed are LOGIN, HELP and QUIT.

Monitor supports 2 basic connection types:

- **ASCII text with line-feed terminators**, which permits use by Telnet or other interactive TCP programs. New connections always start in this mode.
- **BINARY mode**, which permits specialised external client programs (such as Radar from Open System Consultants) to exchange information more efficiently. BINARY mode is entered with the BINARY command.

Monitor supports 2 types of authentication in the LOGIN command:

- **Plaintext**. The password is supplied as plaintext. Since the password will be transmitted as plaintext on a TCP connection, it is possible for eavesdroppers to sniff the password. Therefore you should only use this on interactive Telnet connections over trusted connections.
- **CHAP**. The password is supplied as CHAP response to a CHAP challenge. This is suitable for client programs to authenticate Monitor connections. CHAP passwords start with `{chap}`.

#### 18.1. Object naming

Some Monitor commands accept Radiator object names as arguments. This allows you to identify specific internal Radiator objects to operate on or to monitor. A Radiator object is an internal Radiator structure which generally corresponds to a clause in the Radiator configuration file. There always exists a main object (ServerConfig) that represents the server as a whole, and which is the ultimate ‘parent’ of all the other objects. The Radiator objects form a tree structure with ServerConfig as the root.
You can identify specific Radiator objects with an object name. An object name consists of a number of dot (‘.’) separated words. A single dot is taken to mean the root, the main ServerConfig object. In object names, case is significant.

Consider this skeleton Radiator configuration file:

```
DbDir ....
Trace 4
...
<Client 1.2.3.4>
  ...
</Client>
<Realm xyz.com>
  <AuthBy FILE>
    ...
  </AuthBy>
</Realm>
```

Then the following object names could be used:

- A single dot refers to the server as a whole, or ServerConfig. If you got STATS from . then you would receive the statistics for the whole server.

- .Client.0
  This refers to the first (and only) Client 1.2.3.4 clause.

- .Realm.0
  This refers to the first (and only) Realm xyz.com clause.

- .Realm.0.AuthBy.0
  This refers to the AuthBy FILE clause inside the Realm clause.

### 18.2. Commands

All command names are case insensitive, but arguments to commands may be case sensitive.

#### 18.2.1. BINARY

Makes the connection run in BINARY mode. In BINARY mode, commands and their responses are separated by NULL characters. BINARY mode is only suitable for Monitor client programs. Do not use BINARY for interactive Telnet connections.

#### 18.2.2. CHALLENGE

Requests a CHAP challenge from Monitor. The reply may be used to generate a CHAP response in a subsequent LOGIN command. This allows client programs to avoid sending plaintext passwords on the Monitor TCP connection.

#### 18.2.3. DESCRIBE objectname

Describes the named object by returning a list of its attributes and their types.
18.2.4. GET objectname

Not implemented.

18.2.5. HELP

Prints a list of the supported commands.

18.2.6. ID

Prints the Radiator server identification string.

18.2.7. LIST objectname

If objectname names an object array parameter (such as a Client, Realm or Handler array), prints a list of the objects in the array and their indexes.

18.2.8. LOGIN username password

Authenticate the connection, so that privileged commands can be executed. Username and password must be authenticated by one of the Monitor's AuthBy clauses, or by the hardwired Username and Password (if present).

Password may be either a plaintext password or a CHAP response to a previously issued CHALLENGE command.

```
LOGIN mikem fred
LOGGEDIN
```

or

```
CHALLENGE
CHALLENGE 5b0e00b1a379ae225634946268cc0144
LOGIN mikem {chap}4bda435ca72249c0e9fe05d32775eb6e98
LOGGEDIN
```

18.2.9. RESTART

Causes Radiator to restart and reread its configuration file, with the same effect as a SIGHUP.

18.2.10. TRACE n

Causes Radiator to start printing log message at or below the given log level. The number n can be 0 to 5 inclusive. Each new Monitor connection starts out at level 0 (ERR level). Level 4 is DEBUG level. After setting a new Trace level, Radiator will send all log messages at or below that level on the Monitor connection.

If a TRACE_USERNAME is in force, only messages that result from requests from that specific User-Name will be printed.

18.2.11. TRACE_USERNAME user name

Causes TRACE to only print log messages that result from a RADIUS request from the given User-Name. This is handy for seeing only log messages for a given user when debugging connection problems.

The user name is compared to the User-Name in the incoming request after any RewriteUsername rules have been applied. Setting the TRACE_USERNAME to an empty string (the default) turns off this special behaviour, and all messages that are at or below the current TRACE level will be output.
In the following example, the TRACE level is set to 4, meaning all DEBUG and lower level log messages will be printed. Then the TRACE_USERNAME is set to mikem@open.com.au, which means that only DEBUG and lower log messages due to requests from mikem@open.com.au will be printed. Finally the TRACE_USERNAME is set to an empty string, which means that all DEBUG and lower level log messages will be printed again.

<table>
<thead>
<tr>
<th>TRACE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACE_USERNAME <a href="mailto:mikem@open.com.au">mikem@open.com.au</a></td>
</tr>
<tr>
<td>&lt;&lt;&lt; only messages that are at or below the current TRACE level for requests from <a href="mailto:mikem@open.com.au">mikem@open.com.au</a> are output here.&gt;&gt;&gt;</td>
</tr>
<tr>
<td>TRACE_USERNAME</td>
</tr>
<tr>
<td>&lt;&lt;&lt; no more user-specific logging now. All trace level 4 messages will be output &gt;&gt;&gt;</td>
</tr>
</tbody>
</table>

### 18.2.12. SET objectname parameter value

Sets a new value for the named parameter in the named object. The new value will persist in the Radiator until it is restarted. This is useful for experimenting with new configuration values without having to restart the server. It is probably most useful for setting the PacketTrace parameter, permitting DEBUG level tracing of all packets that pass through a given object.

For example, this command will set PacketTrace on the first Client clause. Subsequently, all packets arriving from that Client will be logged to this Monitor connection (and any other logger) at DEBUG level:

```
SET .Client.0 PacketTrace 1
```

### 18.2.13. STATS objectname

Requests all the statistics available from the named object.

### 18.2.14. QUIT

Forces disconnection from Monitor.

### 19. Using SQL with various database vendors

Radiator’s SQL modules can be used with any Relational Database that is supported by a database specific DBD module or ODBC DBD module. Some examples are: Oracle, Microsoft SQL Server, PostgreSQL, MySQL, MariaDB, SQLite, Firebird, Sybase and Informix. Many of these databases have both: you can use a database specific DBD module or DBD::ODBC to connect to them.

We have not directly tested every one of these. We have tested some of them, and this section contains some tips about using Radiator with them. We supply some simple schemas with Radiator for a few databases. See the goodies/*Create.sql files in the distribution for more information about them. You will probably want to create a more elaborate schema to handle the tasks you need, and the schemas we supply should be regarded as a starting point only. You should probably consult with a Database Analyst to maximise the performance of your SQL database.

### 19.1. General

Whenever Perl's DBI module is used to work with a database, you need to supply up to 3 pieces of information in order to specify the database to which you want to connect:

- DBSource
19. Using SQL with various database vendors

This is the data source name. It has the special format: “dbi:drivername:options”, where driver name is the name of the DBI driver to use, and options is an option string whose exact format depends on the DBI driver you are using.

- DBUsername
  This is usually the SQL user name to use to connect to the SQL database, but for some database types, it has a different meaning.

- DBAuth
  This is usually the password for DBUsername, but for some database types, it has a different meaning or is not required.

19.2. MySQL and MariaDB

In DBSource, driver name is “mysql”, and options is the database name. DBUsername is the MySQL user name, and DBAuth is the password for the MySQL user.

To create a new database, see goodies/mysqlCreate.sql for more information.

Configure your SQL clause like this:

```
DBSource    dbi:mysql:radius
DBUsername  radius
DBAuth      password
```

**Tip**
To specify server name and port, use:

```
  dbi:mysql[:database[:host=hostname[:port=port]]]
```

19.3. PostgreSQL

In DBSource, driver name is “Pg”, and options is the database name to use. DBUsername is the PostgreSQL user name, and DBAuth is the password for the PostgreSQL user.

To create a new database, see goodies/postgres-sqliteCreate.sql for more information.

Configure your SQL clause like this:

```
DBSource    dbi:Pg:dbname=radius
DBUsername  user
DBAuth      password
```

**Tip**
To specify server name and port, use:

```
  dbi:Pg:dbname=radius[:host=hostname[:port=port]]
```
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19.4. Oracle

In DBSource, driver name is “Oracle”, and options is the SID of the Oracle database instance you want to use. DBUsername is the Oracle user name, and DBAuth is the password for the Oracle user.

To create a new database, see goodies/oracleCreate.sql for more information.

Configure your SQL clause like this:

<table>
<thead>
<tr>
<th>DBSource</th>
<th>dbi:Oracle:sid</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBUsername</td>
<td>user</td>
</tr>
<tr>
<td>DBAuth</td>
<td>password</td>
</tr>
</tbody>
</table>

Tip

To specify server name and port directly without $ORACLE_HOME/network/admin/tnsnames.ora, use:

```
  dbi:Oracle:service_name=xe;host=10.20.30.40;port=1521
```

19.5. Microsoft SQL Server

Multiple methods are available to connect to Microsoft SQL Server.

If you run Radiator on Windows, use the ODBC administration tools and add a System DSN (data source name). Microsoft provides ODBC support for Linux and macOS with Microsoft ODBC Driver for SQL Server on Linux and macOS. The driver and installation instructions are available from the Microsoft web. For more about ODBC configuration on all operating systems, see Section 19.8. ODBC on page 488

To create a new database, see goodies/sqlserver-sybaseCreate.sql for more information.

Configure your SQL clause like this:

<table>
<thead>
<tr>
<th>DBSource</th>
<th>dbi:ODBC:radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBUsername</td>
<td>radius</td>
</tr>
<tr>
<td>DBAuth</td>
<td>password</td>
</tr>
</tbody>
</table>

If you cannot use Microsoft ODBC driver, consider DBD::Sybase with FreeTDS. Sybase and MS SQL Server have common history and for this reason DBD::Sybase is known to work with Microsoft SQL Server. You need to compile and link DBD::Sybase with FreeTDS libraries. For more about DBD::Sybase, see Section 19.9. Sybase on page 488

Yet another option is to use the ODBC driver that comes with FreeTDS and configure Radiator to use DBD::ODBC. For more about DBD::ODBC, see Section 19.8. ODBC on page 488

19.6. SQLite

DBD::SQLite is a lightweight integrated SQL library that keeps its database in a single flat file. It does not use a separate SQL server: all the SQL functions are embedded in the SQLite library. DBD::SQLite is available from CPAN. For more information, see Section 2.1.2. CPAN on page 3.

In DBSource, driver name is “SQLite”, and a required option is dbname, which specifies the path name of the single file where the database is to be stored. It can be an absolute file path or a relative path. DBUsername and DBAuth are not required and are ignored.

To create a new database, see goodies/postgres-sqliteCreate.sql for more information.

Configure your SQL clause like this. DBUsername and DBAuth are not required:
19.7. Firebird

In DBSource, driver name is “Firebird”, and a required option is database, which specifies the path name of
the file where the database is to be stored. DBUsername is the Firebird user name, and DBAuth is the password
for the Firebird user.

To create a new database, see goodies/ansiCreate.sql for more information.

Configure your SQL clause like this:

```
DBSource  dbi:Firebird:database=/path/to/database.fdb
DBUsername  username
DBAuth      password
```

**Tip**

DBSource can also contain other hints and directives for connecting to the Firebird server, for example:

```
DBSource dbi:Firebird:port=3050;host=10.20.30.40;db=/path/to/database.fdb;
```

19.8. ODBC

To use ODBC, you must first create the database and tables in a way that depends on the type of database to
which you are going to connect. See your vendor's documentation. You need to install and configure your
ODBC manager. The way to do this also depends on your ODBC data manager.

For example, on Linux, macOS and other Unix systems, ODBC configuration typically is done with
odbcinst.ini and odbc.ini files in /etc, /usr/local/etc, $HOME or other directory that depends on the
system. For Windows, use the ODBC administration tools and add a System DSN (data source name).

Configure your SQL clause like this:

```
DBSource  dbi:ODBC:datasourcename
DBUsername  user
DBAuth      password
```

19.9. Sybase

In DBSource, driver name is “Sybase”, and the options can be empty. DBUsername is the Sybase user name,
and DBAuth is the password for the Sybase user.

To create a new database, see goodies/sqlserver-sybaseCreate.sql for more information.

Configure your SQL clause like this:

```
DBSource  dbi:Sybase:
DBUsername  user
DBAuth      password
```

**Tip**

DBSource can also contain other hints and directives for connecting to the Sybase server, for example:
19. Using SQL with various database vendors

You may need to set SYBASE environment variable so that the Sybase libraries can find their interfaces library. Otherwise you may need to use directives. You may also need to set LD_LIBRARY_PATH, or similar, to $SYBASE/lib.

19.10. InterBase

In DBSource, driver name is "InterBase", and a required option is database, which specifies the path name of the file where the database is to be stored. DBUsername is the InterBase user name, and DBAuth is the password for the InterBase user.

To create a new database, see goodies/ansiCreate.sql for more information.

Be careful to review the InterBase specific notes in goodies/ansiCreate.sql. Some SQL clauses require a couple of little tweaks. Note that, for example, the name of the password column is PASS_WORD. PASSWORD is a reserved word in InterBase.

Configure your SQL clause like this:

<table>
<thead>
<tr>
<th>DBSource</th>
<th>dbi:InterBase:database=/path/to/your/database.gdb</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBUsername</td>
<td>username</td>
</tr>
<tr>
<td>DBAuth</td>
<td>password</td>
</tr>
<tr>
<td>AuthSelect</td>
<td>select PASS_WORD from SUBSCRIBERS where USERNAME=%0</td>
</tr>
</tbody>
</table>

19.11. Informix

In DBSource, driver name is “Informix”. DBUsername is the Informix user name, and DBAuth is the password for the Informix user.

The Perl DBD::Informix module is very mature and was developed in conjunction with Informix development staff. Building DBD::Informix requires that you have a working Informix installation and DBA access to a test database. We recommend that you carefully follow the procedures in the DBD::Informix README file, then build, test and install DBD::Informix before attempting to create and configure a Radiator database on Informix.

The create a new database, see goodies/ansiCreate.sql for more information.

You must ensure you have your INFORMIXDIR and INFORMIXSERVER environment variable set up specifying an operating Informix server. Also check that your $INFORMIXDIR/etc/sqlhosts file has correct information.

Configure your SQL clause like this:

<table>
<thead>
<tr>
<th>DBSource</th>
<th>dbi:Informix:radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBUsername</td>
<td>user</td>
</tr>
<tr>
<td>DBAuth</td>
<td>password</td>
</tr>
</tbody>
</table>

19.12. CSV

DBD::CSV is a Perl database driver that uses flat text files as the database. The default supports comma separated files, but that can be customised in many ways, to support for example Unix password format and Excel spreadsheet formats. DBD::CSV is available from CPAN. For more information, see Section 2.1.2. CPAN on page 3.

In DBSource, driver name is "CSV", and a required option is f_dir, which specifies the directory where the database files exist. DBUsername and DBAuth are not required and are ignored.
DBD::CSV databases are flat text files. The file name is the table name, for example, subscribers for the default AuthSelect. The first line of a database file contains the names of the columns in the file. To create a new database file, you need to create the text file with an editor. A simple database file for subscribers that will work the default AuthSelect in AuthBy SQL would be named subscribers and it would look like this:

```
USERNAME, PASSWORD
mikem, fred
jim, jim
......
<more lines, one per user>
......
```

For DBD::CSV on Unix, configure your SQL clause like this. DBUsername and DBAuth are not required. f_dir specifies the directory where the database files are located. csv_eol in this example specifies that the line separators are Unix newlines. You must have this for a Unix style text file. You can leave it off to get Windows standard text files.

```
DBSource    dbi:CSV:f_dir=/your/data/dir;csv_eol=\012
```

### 19.13. DB2 and other database servers

IBM provides ODBC driver for DB2 which works with Linux and macOS. Follow the installation instructions from IBM and then configure Radiator to use ODBC to access DB2. For more information, see Section 19.8. ODBC on page 488. There is also DBD::DB2 in CPAN which works directly without ODBC.

Other databases should work with Radiator provided that there is a native DBD driver or ODBC driver available for them.

### 20. Performance and tuning

Radiator has been tuned for maximum performance. You can find some examples of server performance on the Radiator web site. The performance you achieve will depend on many factors including the hardware and the authentication type. If you find you need to get better performance than you are achieving, you might try the following ideas and suggestions:

- Operate multiple radius servers, and share the load between them. You would normally make each radius server the primary radius server for some of your NASs, and the secondary for a different group of NASs. Consider doing this anyway in order to make your network more robust in the face of a network or server failure. Consider using LOADBALANCE, VOLUMEBALANCE or ROUNDROBIN to distribute the incoming request load among multiple servers).

- Use DBM, SQL, cached FILE or UNIX authentication in preference to any other method.

- If you are using SQL, make sure that your User and Accounting tables have been designed for performance. This will usually mean adding indexes to the tables. Without indexes, selects on large tables can be very slow. A properly designed index will usually speed them up enormously.

- Deploy Radiator on a different (faster) machine. Radiator is highly portable and will run on most Unix hosts, Windows 7/8.1/10 and Server 2008/2012/2016/2019.

- Use exact Realm names instead of regexps.

- If you are authenticating multiple realms, consider creating sub-servers, one for each realm, and a main server that uses AuthBy RADIUS to retransmit to the sub-servers.

- Deploy any sub-servers on other machines on the same network as the main server.

- If you are using SQL, deploy the SQL server and Radiator on different hosts.
• If you are using LDAP, deploy the LDAP server and Radiator on different hosts.

• Do not specify RewriteUsername unless you need it.

• If you do not need accounting log files (perhaps you are already getting accounting logged by SQL?) turn off AcctLogFile.

• If you do not need wtmp log files (perhaps you are already getting accounting logged by SQL? or AcctLogFile) turn off WtmpFileName.

• Use the lowest Trace level you really need. Higher levels slow radiusd down.

• Use as few check items as possible.

• Do not use Simultaneous-Use check items that specify a filename.

• Do not use check items that are regular expressions.

• Use the Fork parameter if your authentication method is “slow”.

• Do not specify MaxSessions or Simultaneous-Use. If you do, do not specify the Nas-Type in the <Client> clause (interrogating the NAS to confirm when logins are exceeded slows Radiator down).

• Do not use PasswordLogFileName unless you really need it.

• Do not specify an external Session Database with the <SessionDatabase ...> clause unless you need Simultaneous-Use limits and you running multiple instances of Radiator.

• Consider running separate servers, one for accounting and one for authentication.

• If you have large number of concurrent users and require an external session database, consider using SessionDatabase SQL instead of SessionDatabase DBM.

21. Getting help

21.1. Support contract holders

Your Radiator license package may include email support, and Radiator support may be purchased at the time you purchase Radiator. For more information, see How to buy [http://www.open.com.au/ordering.html] in OSC website. Support contracts last for a limited period (typically one year) and may include a limited amount of pre-paid email support.

Open System Consultants will respond promptly to support email during business hours, Australian Eastern Standard time. Telephone support is not provided. We will keep track of the effort required to answer your support email, and inform you when your prepaid support time has expired.

If you have a Radiator or RADIUS support contract, you may send email to radius-support@open.com.au.

Include your support contract identifier in the Subject line. If you do not have a support contract, we will not respond to your query on this address.

If you need an urgent response outside of the standard email support hours, you may want to post to the Radiator mailing list instead. Someone will be sure to be awake somewhere in the world.

21.2. No support contract

The standard Radiator license does not include support, but it does include the full source code and free access to the Radiator mailing list. This means you can work with other Radiator users in the user community. In order to participate with others in this effort, join the Radiator mailing list [https://www.open.com.au/mailman/listinfo/radiator].
21. Getting help

The staff of OSC monitors the Radiator mailing list and frequently answers questions. The mailing list archive [http://www.open.com.au/pipermail/radiator/] is also available.

Do not post HTML to the Radiator mailing list.

21.3. What to do if you need help

Before you post to the support address or mailing list asking for assistance, we suggest you go through the following check list:


4. Check that you are using the latest version of Radiator. See Radiator downloads [https://www.open.com.au/radiator/downloads.html], use the user name and password we have issued to you. Upgrade if you need to.

5. Check whether there are any patches that address your problem. See the index file in the patches directory for your release at Radiator downloads [https://www.open.com.au/radiator/downloads.html]. Apply the patch set if you think you might need it.

6. If you still have the problem, post to the mailing list by mailing to: radiator@open.com.au. If you have a support contract, send email to radius-support@open.com.au.

   Be sure to include at least the following information:
   
   - Your company name and licence details
   - Detailed description of the problem
   - Your Radiator configuration file (remove any secrets and passwords first)
   - Extract from your Radiator log file (with Trace level of 4) illustrating the problem, or at least what is happening at the time of the problem
   - Details of the computer type, operating system etc

7. Professional services for design, installation, configuration and training are available with hourly and daily rates. Send requests to info@open.com.au.

This information helps people to understand your problem and help find a solution more quickly.

21.4. Announcements

There is a separate Radiator mailing list that just carries product announcements and upgrades. If you want to know about upgrades available, but do not want all the technical volume from the normal mailing list, this may be the one for you. Radiator product announcements will be posted to both lists.

You can join the Radiator Announcements mailing list by sending email with the single word subscribe in the body (not in the subject line) to radiator-announce-request@open.com.au.

21.5. Bug reports

We are interested in your feedback, both positive and negative, and bug reports. Please send them to info@open.com.au. Licensees are entitled to free upgrades, and we do fix bugs that are reported to us, so if
you report a bug, you can expect to get an upgrade with a fix one day. If you do not report it, it might never get fixed.

21.6. RFCs

A number of relevant RFCs can be found in the doc directory of the Radiator distribution. A full set of RFCs including the ones relevant to RADIUS, RFC 2865 and RFC 2866, can be found at IETF Documents [https://tools.ietf.org/html/].