



Steel-Belted RADIUS

Administration Guide

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Content

Revision History.....	v
About This Guide	xxi
Before You Begin	xxi
Audience	xxi
What's in This Manual	xxi
Typographical Conventions.....	xxiii
Related Documentation.....	xxv
Contacting Technical Support	xxvi
Chapter 1	1
About Steel-Belted Radius	1
Steel-Belted Radius Features	1
Licensing	2
Chapter 2	3
RADIUS Basics	3
RADIUS Overview	3
RADIUS Packets	4
RADIUS Ports.....	5
RADIUS Configuration	6
RADIUS Server Configuration	6
RADIUS Client Configuration	6
Multiple RADIUS Servers.....	6
Shared Secrets.....	7
RADIUS Secret.....	8
Replication Secret	8
Node Secret.....	8
Attributes	8
Dictionaries.....	9
Vendor-Specific Attributes	9
Dictionaries and the Make/Model Field	9
Updating Attribute Information	9

User Attribute Lists	9
Checklist Attributes	9
Return List Attributes	10
Attribute Values	10
Single- and Multi-Valued Attributes	10
Orderable Multi-Valued Attributes	10
System Assigned Values	10
Echo Property	11
Default Values	11
Centralized Configuration Management	11
Proxy RADIUS	13
Authentication	13
Native User Authentication	14
Pass-Through Authentication	14
Proxy RADIUS Authentication	14
External Authentication	15
Directed Authentication (GEE only)	15
HTTP Digest Access Authentication	15
Authenticate-Only Requests	16
Password Protocols	18
Accounting	20
Comma-Delimited Log Files	20
Proxy RADIUS Accounting	20
External Accounting	21
Tunneled Accounting	21
RADIUS Client Groups	22
IP Address Assignment	22
Resource Management	24
How Address Assignment Works	24
Setting Return List Attributes	25
Handling Address Leaks	25
Address Leakage Upon Stopping and Starting the Server	25
Overlapping Address Ranges	25

Order of Address Assignment.....	25
Concurrent User Connections	26
Concurrent Tunnel Connections	26
IPv6 Support.....	27
Address Notation	28
Address Interface IDs	30
IPv6 Network Numbers.....	30
NAS-IPv6-Address.....	35
Example	36
Framed-Interface-Id	36
Example	36
Framed-IPv6-Prefix.....	36
Example	37
Login-IPv6-Host	37
Example	37
Framed-IPv6-Pool	37
Example	38
Framed-IPv6-Route	38
Example	38
Chapter 3	40
Using SBR Administrator.....	40
Launching SBR Admin GUI	40
Clearing Cache Directories while Launching New GUI	42
Running the SBR Administrator	42
Navigating in SBR Administrator.....	44
File Menu.....	44
Edit Menu.....	45
Tools Menu.....	45
Web Menu.....	46
Help Menu.....	46
Adding an Entry.....	47
Editing an Entry.....	48
Cutting/Copying/Pasting Records	48

Resizing Columns	48
Changing Column Sequence	48
Sorting Information	48
Adding License Keys	48
Accessing Online Help	49
Displaying Version Information	49
Exiting the SBR Administrator	49
Chapter 4	50
Using Web Graphic User Interface (GUI)	50
Running the WebGUI	50
Tested Browsers	51
Navigating in the WebGUI	51
WebGUI Menus	51
WebGUI Pages	54
Adding License Keys	55
Displaying Version Information	56
Exiting the WebGUI	57
Chapter 5	58
Administering RADIUS Clients via Legacy SBR	58
Administrator	58
RADIUS Clients Panel	58
Adding a RADIUS Client or Client Group	58
Verifying a Shared Secret	62
Deleting a RADIUS Client	62
Chapter 6	63
Administering RADIUS Clients via WebGUI	63
RADIUS Clients Page	63
Adding a RADIUS Client or Client Group	63
Verifying a Shared Secret	68
Deleting a RADIUS Client	68
Chapter 7	69
Administering Users via Legacy SBR Administrator	69
User Files	69

Users Panels	69
Setting Up Native Users	70
Adding a Native User	70
Adding a Checklist or Return List Attribute for a User	73
Setting Up Windows Domain Users	74
Setting Up SecurID Users	78
Setting Up TACACS+ Users	80
Setting Up UNIX Users	82
Editing User Settings	83
Concurrent Connection Limits	85
Deleting a User	86
Chapter 8	91
Administering Users via WebGUI	91
User Files	91
Users Pages	91
Setting Up Native Users	92
Adding a Native User	92
Adding a Checklist or Return List Attribute for a User	97
Setting Up Windows Domain Users	98
Setting Up SecurID Users	104
Setting Up TACACS+ Users	106
Setting Up UNIX Users	108
Editing User Settings	110
Concurrent Connection Limits	111
Deleting a User	112
Chapter 9	113
Administering Profiles via Legacy SBR Administrator	113
About Profiles	113
Setting Up Profiles	113
Chapter 10	117
Administering Profiles via WebGUI	117
About Profiles	117
Setting Up Profiles	117

Chapter 11	123
Administering Proxy RADIUS via legacy SBR	123
Administrator	123
About Proxy RADIUS	123
Adding a Proxy Target.....	123
Maintaining an Accounting Shared Secret	126
Deleting a Proxy Target	126
Steel-Belted Radius as a Target	126
Proxy RADIUS as an Authentication Method	127
Chapter 12	128
Administering Proxy RADIUS via WebGUI	128
About Proxy RADIUS	128
Adding a Proxy Target.....	128
Maintaining an Accounting Shared Secret	131
Deleting a Proxy Target	131
Steel-Belted Radius as a Target	131
Proxy RADIUS as an Authentication Method	132
Chapter 13	133
Administering RADIUS Tunnels via Legacy SBR	133
Administrator	133
About RADIUS Tunnels	133
Called Station Id.....	134
Dictionaries for Tunnel Support	134
Configuring RADIUS Tunnels.....	135
Adding a Tunnel	135
Chapter 14.....	140
Administering RADIUS Tunnels via WebGUI	140
About RADIUS Tunnels	140
Called Station Id.....	141
Dictionaries for Tunnel Support	141
Configuring RADIUS Tunnels.....	142
Adding a Tunnel	143
Chapter 15.....	149

Administering Address Pools via Legacy SBR Administrator	149
Address Pool Files.....	149
Setting Up IP Address Pools	149
Address Allocation	154
Address Renewal.....	154
Address Release	154
DHCP Option Mapping.....	155
Using Multiple Servers.....	155
Setting Up IPX Address Pools.....	156
Chapter 16	160
Administering Address Pools via WebGUI	160
Address Pool Files.....	160
Setting Up IP Address Pools	160
Address Allocation	168
Address Renewal.....	168
Address Release	168
DHCP Option Mapping.....	169
Using Multiple Servers.....	169
Setting Up IPX Address Pools.....	170
Chapter 17	174
Setting Up Administrator Accounts via Legacy SBR Administrator	174
Administrator Files	174
Administrators Panel.....	174
Adding a Local Administrator	175
Adding a Remote Administrator	175
Deleting an Administrator	176
Chapter 18	177
Setting Up Administrator Accounts via WebGUI.....	177
Administrator Files	177
Administrators Page	177
Adding a Local Administrator	178
Adding a Remote Administrator	180
Deleting an Administrator	181

Chapter 19	182
Setting Up Filters via Legacy SBR Administrator	182
Overview	182
Order of Filter Rules	183
Values in Filter Rules	184
Filters Panel	185
Adding a Filter	185
Searching the Filter List	187
Chapter 20	189
Setting Up Filters via WebGUI	189
Overview	189
Order of Filter Rules	190
Values in Filter Rules	190
Filters Page	192
Adding a Filter	192
Searching the Filter List	194
Chapter 21	197
Setting Up EAP Authentication Policies via Legacy	197
SBR Administrator	197
About the Extensible Authentication Protocol	197
Handling EAP Requests	197
EAP-Only Setting	200
First-Handle-Via-Auto-EAP Setting	200
Certificate Chains	202
Certificate Revocation Lists	203
EAP-TLS	204
Configuring Client Certificate Validation	206
Configuring Session Resumption	207
Configuring Advanced Server Settings	208
Configuring Client Certificate Validation	210
Configuring Secondary Authentication	211
Configuring Session Resumption	212
EAP-TTLS	214

Configuring Request Filters	217
Configuring Response Filters.....	217
Configuring Client Certificate Validation	218
Configuring Session Resumption	219
Configuring Inner Authentication Settings	220
Configuring Advanced Server Settings	220
EAP-PEAP	221
Configuring Request Filters	223
Configuring Response Filters.....	224
Configuring Session Resumption	225
Configuring Inner Authentication Settings	225
Configuring Advanced Server Settings	226
Configuring Server Certificates	227
Configuring a CDP Web Proxy	228
Configuring the Server.....	230
Configuring SecurID Authentication	230
Configuring the Location of the sdconf.rec File	231
Configuring TACACS+ Authentication	231
Activating EAP Methods.....	232
Configuring EAP Settings	232
Configuring Authentication Rejection Messages.....	233
Chapter 22	235
Setting Up EAP Authentication Policies via WebGUI	235
About the Extensible Authentication Protocol	235
Handling EAP Requests	235
EAP-Only Setting.....	237
First-Handle-Via-Auto-EAP Setting	238
Certificate Chains	240
Certificate Revocation Lists	240
EAP-TLS	242
Configuring Client Certificate Validation	244
Configuring Session Resumption	245
Configuring Advanced Server Settings	246

Configuring Client Certificate Validation	249
Configuring Secondary Authentication.....	251
Configuring Session Resumption	252
EAP-TTLS.....	253
Configuring Request Filters	256
Configuring Response Filters.....	257
Configuring Client Certificate Validation	257
Configuring Session Resumption	258
Configuring Inner Authentication Settings	259
Configuring Advanced Server Settings	259
EAP-PEAP	260
Configuring Request Filters	262
Configuring Response Filters.....	263
Configuring Session Resumption	264
Configuring Inner Authentication Settings	265
Configuring Advanced Server Settings	265
Configuring Server Certificates.....	266
Configuring a CDP Web Proxy	269
Configuring the Server.....	270
Configuring SecurID Authentication	270
Configuring the Location of the sdconf.rec File	271
Configuring TACACS+ Authentication	271
Activating EAP Methods.....	272
Configuring EAP Settings	272
Configuring Authentication Rejection Messages.....	274
Chapter 23.....	276
Configuring Replication via Legacy SBR Administrator.....	276
About Replication	276
Replication Requirements.....	278
Configuring Replica Servers	279
Replication Error Messages	284
Chapter 24.....	287
Configuring Replication via WebGUI	287

About Replication	287
Replication Requirements.....	289
Configuring Replica Servers	290
Replication Error Messages	296
Chapter 25.....	299
LDAP Configuration Interface.....	299
LDAP Configuration Interface File	299
About the LDAP Configuration Interface.....	299
Example	301
LDAP Virtual Schema.....	302
LDAP Rules and Limitations	306
LDAP Command Examples	309
LDIF File Examples	314
Statistics Variables	320
stattype: server.....	321
stattype: authentication.....	321
stattype: accounting	322
stattype: proxy.....	322
Chapter 26.....	325
Configuring SQL Authentication	325
About SQL Authentication.....	325
Configuring SQL Authentication.....	327
Connecting to the SQL Database	328
SQL Statement Construction.....	328
Hashed Passwords	332
Automatic Parsing.....	333
Working with Stored Procedures in Oracle.....	333
Working with Stored Procedures in MS-SQL	335
Chapter 27	337
Configuring SQL Accounting.....	337
About SQL Accounting.....	337
Configuring SQL Accounting	338
Connecting to the SQL Database	339

SQL Statement Construction.....	340
SQL Accounting Return Values	344
Accounting Stored Procedure Example.....	344
Chapter 28.....	347
Configuring LDAP Authentication.....	347
About LDAP Authentication	347
BindName Authentication	348
Bind Authentication.....	349
Attributes and LDAP Authentication	349
Configuring LDAP Authentication	349
Supporting Secure Sockets Layer/Transport Layer Security.....	350
Hashed Passwords	352
Automatic Parsing.....	353
LDAP Authentication Sequence.....	353
LDAP Authentication Examples	354
Chapter 29.....	358
Displaying Statistics via SBR Administrator	358
Displaying Authentication Statistics	358
Displaying Accounting Statistics	359
Displaying Proxied Request Statistics.....	361
Displaying RADIUS Client Statistics.....	363
Displaying RADIUS Proxy Targets Statistics.....	364
Displaying IP Address Pool Statistics	364
Chapter 30.....	366
Displaying Statistics via WebGUI	366
Displaying Authentication Statistics	366
Displaying Accounting Statistics	368
Displaying Proxied Request Statistics.....	369
Displaying RADIUS Client Statistics.....	371
Displaying RADIUS Proxy Targets Statistics.....	372
Displaying IP Address Pool Statistics	373
Chapter 31	374
Logging and Reporting via Legacy SBR Administrator	374

Logging Files	374
Displaying the Current Sessions List.....	374
Deleting Entries from the Sessions List	376
Displaying the Authentication Log Files	376
Security Groups and Permissions.....	377
Using the User File Creation Mode Mask.....	378
Implementing Default File Permissions in Steel-Belted Radius	379
Implementing Override File Permissions in Steel-Belted Radius.....	379
Configuring the Log Retention Period	384
Using the Server Log File.....	385
Using the Authentication Log File.....	386
Using the Accounting Log File	388
Standard RADIUS Accounting Attributes	390
Chapter 32.....	392
Logging and Reporting via WebGUI	392
Logging Files	392
Displaying the Current Sessions List.....	392
Deleting Entries from the Sessions List	394
Displaying the Authentication Log Files	395
Security Groups and Permissions.....	395
Using the User File Creation Mode Mask.....	396
Implementing Default File Permissions in Steel-Belted Radius	397
Implementing Override File Permissions in Steel-Belted Radius.....	398
Configuring the Log Retention Period	401
Using the Server Log File.....	402
Using the Authentication Log File.....	403
Using the Accounting Log File	405
Standard RADIUS Accounting Attributes	407
Appendix A.....	409
Glossary.....	409
Appendix B.....	415
When to Restart Steel-Belted Radius	415
Appendix C	418

Technical Notes	418
LDAP Support for Novell eDirectory	418
CCA Support for 3COM	421
Configuration	421
Setting User and Profile Attributes	422
Ascend Filter Translation	422
Configuration	422
Syntax	423
ip out forward srcip 10.1.1.0/24 6 dstport = 80 srcport < 1023	424
Ericsson Enhanced Token Caching	424
Enhanced Token Caching Configuration	424
Enhanced Token Caching Administration	425
Uniport Plug-In	425
Operation	425
Configuration	426
Windows Performance Monitor	427
Appendix D	433
Authentication Protocols	433
Appendix E	435
Importing and Exporting Data	435
Exporting to a RADIUS Information File via Legacy SBR Administrator	435
Exporting to a RADIUS Information File via WebGUI	436
Importing into the Steel-Belted Radius Database via Legacy SBR Administrator	437
Importing into the Steel-Belted Radius Database via WebGUI	439
Appendix F	442
Stopping and Starting Steel-Belted Radius	442
Stopping the Steel-Belted Radius Server	442
Windows	442
Linux	442
Starting the Steel-Belted Radius Server	443
Windows	443
Linux	443

Displaying RADIUS Status Information (Linux)	443
Appendix G	445
Stopping and Starting “Steel-Belted Radius Jetty Server”	445
Windows.....	445
Stopping Jetty Server	445
Starting Jetty Server	445
Restarting Jetty Server	445
Linux.....	445
Stopping Jetty Server	445
Starting Jetty Server	446
Restarting Jetty Server	446
Viewing the Status of Jetty Server	446
Appendix H	447
Use Custom SSL Certificate for Launching SBR-E Web UI.....	447
Index	448

About This Guide

The Steel-Belted Radius Administration Guide/Global Enterprise Edition describes how to configure and administer the Steel-Belted Radius software on a server running the Linux operating system, or the Windows XP/Windows Server 2003 operating system.

Before You Begin

This manual assumes that you have installed the Steel-Belted Radius software and the SBR Administrator. For more information, refer to the Steel-Belted Radius Installation and Upgrade Guide.

Audience

This manual is intended for network administrators responsible for implementing and maintaining authentication, authorization, and accounting services for an enterprise. This manual assumes that you are familiar with general RADIUS and networking concepts and the specific environment in which you are installing Steel-Belted Radius.

If you use Steel-Belted Radius with third-party products such as Oracle or RSA SecurID, you should be familiar with their installation, configuration, and use.

What's in This Manual

This manual contains the following chapters and appendixes:

- [Chapter 1](#), "About Steel-Belted Radius," presents an overview of Steel-Belted Radius and describes licensing requirements for Steel-Belted Radius.
- [Chapter 2](#), "RADIUS Basics," summarizes important concepts relating to the operation of Steel-Belted Radius.
- [Chapter 3](#), "Using SBR Administrator," describes how to use the SBR Administrator to configure Steel-Belted Radius.
- [Chapter 4](#), "Using Web Graphic User Interface," describes how to use the WebGUI to configure Steel-Belted Radius.
- [Chapter 5](#), "Administering RADIUS Clients via Legacy SBR Administrator," describes how to set up a network access device (NAD) as a Steel-Belted Radius client via SBR Administrator.
- [Chapter 6](#), "Administering RADIUS Clients via WebGUI," describes how to set up a network access device (NAD) as a Steel-Belted Radius client.
- [Chapter 7](#), "Administering Users via Legacy SBR Administrator," describes how to set up users in the Steel-Belted Radius database via SBR administrator.
- [Chapter 8](#), "Administering Users via WebGUI" describes how to set up users in the Steel-Belted Radius database via WebGUI.
- [Chapter 9](#), "Administering Profiles via Legacy SBR Administrator," describes how to set up user profiles to simplify user administration via SBR administrator.
- [Chapter 10](#), "Administering Profiles via WebGUI," describes how to set up user profiles to simplify

user Administration via WebGUI.

- **Chapter 11**, “Administering Proxy RADIUS via Legacy SBR Administrator,” describes how to identify proxy RADIUS targets via SBR administrator.
- **Chapter 12**, “Administering Proxy RADIUS via WebGUI,” describes how to identify proxy RADIUS targets via WebGUI.
- **Chapter 13**, “Administering RADIUS Tunnels via Legacy SBR Administrator,” describes how to set up secure RADIUS tunnels via SBR administrator.
- **Chapter 14**, “Administering RADIUS Tunnels via WebGUI,” describes how to set up secure RADIUS tunnels WebGUI.
- **Chapter 15**, “Administering Address Pools via Legacy SBR Administrator,” describes how to set up IPv4 and IPX address pools via SBR administrator.
- **Chapter 16**, “Administering Address Pools via WebGUI,” describes how to set up IPv4 and IPX address pools via WebGUI.
- **Chapter 17**, “Setting Up Administrator Accounts via Legacy SBR Administrator,” describes how to identify who can administer Steel-Belted Radius via SBR administrator.
- **Chapter 18**, “Setting Up Administrator Accounts via WebGUI,” describes how to identify who can administer Steel-Belted Radius via WebGUI.
- **Chapter 19**, “Setting Up Filters via Legacy SBR Administrator,” describes how to configure and maintain attribute filters in Steel-Belted Radius via SBR administrator.
- **Chapter 20**, “Setting Up Filters via WebGUI,” describes how to configure and maintain attribute filters in Steel-Belted Radius via WebGUI.
- **Chapter 21**, “Setting Up EAP Authentication Policies via Legacy SBR Administrator,” presents an overview of Extensible Authentication Protocol (EAP) types and describes how to configure and sequence RADIUS authentication methods via SBR administrator.
- **Chapter 22**, “Setting Up EAP Authentication Policies via Legacy SBR Administrator,” presents an overview of Extensible Authentication Protocol (EAP) types and describes how to configure and sequence RADIUS authentication methods via SBR administrator.
- **Chapter 23**, “Configuring Replication via Legacy SBR Administrator,” describes how to configure and use the centralized configuration management (CCM) feature to coordinate Steel-Belted Radius server settings in a replication environment via SBR administrator.
- **Chapter 24**, “Configuring Replication via WebGUI,” describes how to configure and use the centralized configuration management (CCM) feature to coordinate Steel-Belted Radius server settings in a replication environment via WebGUI.
- **Chapter 25**, “LDAP Configuration Interface,” describes how to use public domain LDAP utilities to populate a Steel-Belted Radius server database.
- **Chapter 26**, “Configuring SQL Authentication,” describes how to configure authentication against records stored in an external SQL database.

- [Chapter 27](#), “Configuring SQL Accounting,” describes how to configure Steel-Belted Radius to write accounting information to an external SQL database.
- [Chapter 28](#), “Configuring LDAP Authentication,” describes how to configure authentication against records stored in an external LDAP database.
- [Chapter 29](#), “Displaying Statistics via Legacy SBR Administrator,” describes how to use the monitoring facilities in Steel-Belted Radius via SBR Administrator.
- [Chapter 30](#), “Displaying Statistics via WebGUI,” describes how to use the monitoring facilities in Steel-Belted Radius via WebGUI.
- [Chapter 31](#), “Logging and Reporting via Legacy SBR Administrator,” describes how to use the logging and reporting facilities in Steel-Belted Radius via SBR administrator.
- [Chapter 32](#), “Logging and Reporting via WebGUI,” describes how to use the logging and reporting facilities in Steel-Belted Radius via WebGUI.
- [Appendix A](#), “Glossary,” provides brief explanations for RADIUS terminology used in this and other Steel-Belted Radius manuals.
- [Appendix B](#), “When to Restart Steel-Belted Radius,” provides a summary of critical operational information.
- [Appendix C](#), “Technical Notes,” presents tips for configuring Steel-Belted Radius to interoperate with equipment and facilities from other vendors.
- [Appendix D](#), “Authentication Protocols,” provides a matrix of authentication methods and their supported authentication protocols.
- [Appendix E](#), “Importing and Exporting Data,” describes how to import and export information in a Steel-Belted Radius database to and from an XML file.
- [Appendix F](#), “Stopping and Starting Steel-Belted Radius,” describes how to stop and restart the Steel-Belted Radius service (Windows) or RADIUS daemon (Linux).
- [Appendix G](#), “Stopping and Starting Steel-Belted Radius Jetty Server” describes how to stop and restart the Steel-Belted Radius Jetty Server (Windows) or (Linux).
- [Appendix H](#), “Use Custom SSL Certificate for Launching SBR-E Web UI” describes how use custom SSL certificates for launching SBR-E Web UI.

Typographical Conventions

Table 1 describes the text conventions used throughout this manual.

Table 1: Typographical Conventions

Convention	Description	Examples
Bold typeface	Indicates buttons, field names, dialog names, and other user interface elements.	Use the Scheduling and Appointment tabs to schedule a meeting .

Convention	Description	Examples
Plain sans serif typeface	Represents: <ul style="list-style-type: none"> • Code, commands, and keywords • URLs, file names, and directories 	Examples: <ul style="list-style-type: none"> • Code: certAttr.OU = 'Retail Products Group' • URL: Download the JRE application from: http://java.sun.com/j2se/
Italics	Identifies: <ul style="list-style-type: none"> • Terms defined in text • Variable elements • Book names 	Examples: <ul style="list-style-type: none"> • Defined term: An RDP client is a Windows component that enables a connection between a Windows server and a user's machine. • Variable element: Use settings in the Users > Roles > Select Role > Terminal Services page to create a terminal emulation session. • Book name: See the Steel-Belted Radius Administration Guide.

Editions/Used In

Steel-Belted Radius is available in multiple editions to meet the requirements of different types of customers. This manual uses the following abbreviations to identify editions of Steel-Belted Radius:

- GEE – Global Enterprise Edition
- EE – Enterprise Edition

Syntax

- radiusdir represents the directory into which Steel-Belted Radius has been installed. By default, this is C:\Program Files (x86)\Pulse Secure\Steel-Belted Radius\Service for Windows systems and /opt/PSsbr/radius on Linux systems.
- Brackets [] enclose optional items in format and syntax descriptions. In the following example, the first Attribute argument is required; you can include an optional second Attribute argument by entering a comma and the second argument (but not the square brackets) on the same line.

<add | replace> = Attribute [,Attribute]

In configuration files, brackets identify section headers:

the [Processing] section of proxy.ini

In screen prompts, brackets indicate the default value. For example, if you press Enter without entering anything at the following prompt, the system uses the indicated default value (/opt).

Enter install path [/opt]:

- Angle brackets < > enclose a list from which you must choose an item in format and syntax descriptions.
- A vertical bar (|) separates items in a list of choices. In the following example, you must specify add or replace (but not both):

<add | replace> = Attribute [,Attribute]

Related Documentation

The following documents supplement the information in this manual.

Steel-Belted Radius Documentation

Please review the ReleaseNotes.txt file that accompanies your Steel-Belted Radius software. This file contains the latest information about features, changes, known problems, and resolved problems. If the information in the ReleaseNotes.txt file differs from the information found in the Steel-Belted Radius manuals, use the information in the ReleaseNotes.txt file.

In addition to this manual, the Steel-Belted Radius documentation includes the following manuals:

- The Steel-Belted Radius Installation and Upgrade Guide describes how to install the Steel-Belted Radius software on a server running the Linux operating system or the Windows XP/Windows Server 2003 operating system operating system.
- The Steel-Belted Radius Reference Guide describes the configuration options for the Steel-Belted Radius software.

Requests for Comments (RFCs)

The Internet Engineering Task Force (IETF) maintains an online repository of Request for Comments (RFC)s online at <http://www.ietf.org/rfc.html>. **Table 2** lists the RFCs that apply to this guide.

Table 2: RFCs

RFC Number	Title
RFC 1155	Structure and Identification of Management Information for TCP/IP-based Internets. M. Rose, K. McCloghrie, May 1990.
RFC 1213	Management Information Base for Network Management of TCP/IP-based internets: MIB-II. K. McCloghrie, M. Rose, March 1991.
RFC 2271	An Architecture for Describing SNMP Management Frameworks. D. Harrington, R. Presuhn, B. Wijnen, January 1998.
RFC 2284	PPP Extensible Authentication Protocol (EAP). L. Blunk, J. Vollbrecht, March 1998.
RFC 2433	Microsoft PPP CHAP Extensions. G. Zorn, S. Cobb, October 1998.
RFC 2548	Microsoft Vendor-specific RADIUS Attributes. G. Zorn. March 1999.
RFC 2607	Proxy Chaining and Policy Implementation in Roaming. B. Aboba, J. Vollbrecht, June 1999.
RFC 2618	RADIUS Authentication Client MIB. B. Aboba, G. Zorn. June 1999.
RFC 2619	RADIUS Authentication Server MIB. G. Zorn, B. Aboba. June 1999.
RFC 2620	RADIUS Accounting Client MIB. B. Aboba, G. Zorn. June 1999.
RFC 2621	RADIUS Accounting Server MIB. G. Zorn, B. Aboba. June 1999.
RFC 2622	PPP EAP TLS Authentication Protocol. B. Aboba, D. Simon, October 1999.
RFC 2809	Implementation of L2TP Compulsory Tunneling via RADIUS. B. Aboba, G. Zorn. April 2000.
RFC 2865	Remote Authentication Dial In User Service (RADIUS). C. Rigney, S. Willens, A. Rubens, W. Simpson. June 2000.

RFC Number	Title
RFC 2866	RADIUS Accounting. C. Rigney. June 2000.
RFC 2867	RADIUS Accounting Modifications for Tunnel Protocol Support. G. Zorn, B. Aboba, D. Mitton. June 2000.
RFC 2868	RADIUS Attributes for Tunnel Protocol Support. G. Zorn, D. Leifer, A. Rubens, J. Shriver, M. Holdrege, I. Goyret. June 2000.
RFC 2869	RADIUS Extensions. C. Rigney, W. Willats, P. Calhoun. June 2000.
RFC 2882	Network Access Servers Requirements: Extended RADIUS Practices. D. Mitton. July 2000.
RFC 3162	RADIUS and IPv6. B. Aboba, G. Zorn, D. Mitton. August 2001.
RFC 3575	IANA Considerations for RADIUS (Remote Authentication Dial In User Service). B. Aboba, July 2003.
RFC 3579	RADIUS (Remote Authentication Dial In User Service) Support For Extensible Authentication Protocol (EAP). B. Aboba, P. Calhoun, September 2003.
RFC 3580	IEEE 802.1X Remote Authentication Dial In User Service (RADIUS) Usage Guidelines. P. Congdon, B. Aboba, A. Smith, G. Zorn, J. Roese, September 2003.

Third-Party Products

For more information about configuring your access servers and firewalls, consult the manufacturer's documentation provided with each device.

Contacting Technical Support

For technical support, contact Pulse Secure at support@pulsesecure.net,

Check our website (<http://www.pulsesecure.net>) for additional information and technical notes. When you are running Legacy SBR Administrator, you can choose **Web > Steel-Belted Radius User Page** to access a special home page for Steel-Belted Radius users. When you are running Web GUI, you can choose **Help > Home Page > Steel-Belted Radius Home Page** to access a special home page for Steel-Belted Radius users.

When you call technical support, please have the following at hand:

- Your Steel-Belted Radius product edition and release number (for example, Global Enterprise Edition version 5.4).
- Information about the server configuration and operating system, including any OS patches that have been applied.
- For licensed products under a current maintenance agreement, your license or support contract number.
- Question or description of the problem, with as much detail as possible.
- Any documentation that might help resolve the problem, such as error messages, memory dumps, compiler listings, and error logs.

Chapter 1

About Steel-Belted Radius

Thank you for selecting Steel-Belted Radius®/Global Enterprise Edition.

Steel-Belted Radius is a complete implementation of the RADIUS (Remote Authentication Dial In User Service) protocol. Steel-Belted Radius interfaces with a wide variety of network access equipment, and authenticates remote and wireless LAN (WLAN) users against numerous back-end databases, allowing you to consolidate the administration of all your remote and WLAN users.

Steel-Belted Radius/Global Enterprise Edition delivers a total RADIUS solution on the scale required by large corporations with complex global networks. It provides the power and flexibility you need to manage the delivery of enhanced services to your users, and it integrates with all aspects of your operations, from user authentication and service delivery to cost accounting based on divisions and departments.

Steel-Belted Radius Features

- Centralized management of user access control and security simplifies access administration.
- Flexible, powerful proxy RADIUS features let you easily distribute authentication and accounting requests to the appropriate RADIUS server for processing.
- External authentication features let you authenticate against multiple, redundant SQL or LDAP databases according to configurable load balancing and retry strategies, ensuring the highest level of service delivery to your users.
- Authentication against a local database permits network access by employees.
- Flexible authentication options let you use your existing OS-based authentication database, token systems from RSA Security and other vendors, and external SQL/LDAP databases for remote and WLAN user authentication.
- Support for a wide variety of 802.1X-compliant access points and other network access servers ensures compatibility in your network environment.
- Advanced proxy features let you authenticate users against RADIUS servers at other sites.
 - You have a choice of username format, and you can configure routing based on username decoration, DNIS, or specific attributes.
 - You can selectively modify attributes as proxy packets flow to and from Steel-Belted Radius.
 - You can specify groups of proxy target servers that handle proxy requests according to load-balancing or retry strategies — for the best performance and reliability.
- You can control the time periods during which each user is allowed access. An access request is granted only during a user's allowed access hours; otherwise it is refused, even if the user presents valid credentials.
- You can configure Steel-Belted Radius by means of a graphical SBR Administrator or by means of LDAP (either programmatically or at the command line prompt).

- Administrative access levels can be defined and applied to user or group accounts on the server machine. Read, write, and read/write access can be applied selectively to various categories of configuration data, including users, RADIUS clients, proxy targets, and statistics.
- Auto-restart enables Steel-Belted Radius to restart itself automatically if it experiences a shutdown.
- Linux: SNMP support lets you centrally monitor Steel-Belted Radius from your SNMP console, in the same manner as you monitor other devices and services on your network. Steel-Belted Radius offers full SNMP support including SNMP traps and alarms.
- IPv4 – IPv6 Dual stack support for RADIUS clients.

Licensing


If you want to install the Steel-Belted Radius server software for a 30-day evaluation, you do not need a license key.

If you want to install a permanent (non-evaluation) copy of Steel-Belted Radius, you must have a single-seat software license key.

If you have more than one copy of the Steel-Belted Radius software installed, you must have a site license key or you must have a separate license key for each installation.

The SBR Administrator can be installed on as many workstations as you require. The SBR Administrator does not require a license key.

For details about licensing, please refer to the Steel-Belted Radius license agreement or contact Pulse Secure.

 **Note:** The Steel-Belted Radius license permits you to configure a total of 10 directed authentication and/or directed accounting methods. If you need additional methods, contact Pulse Secure to purchase blocks of additional licenses.

Chapter 2

RADIUS Basics

This chapter presents a conceptual overview of RADIUS (Remote Authentication Dial In User Service) authentication, authorization, and accounting services.

RADIUS Overview

RADIUS is an industry-standard protocol for providing authentication, authorization, and accounting services.

- Authentication is the process of verifying a user's identity and associating additional information (attributes) to the user's login session.
- Authorization is the process of determining whether the user is allowed on the network and controlling network access values based on a defined security policy.
- Accounting is the process of generating log files that record session statistics used for billing, system diagnosis, and usage planning.

A RADIUS-based remote access environment typically involves four types of components:

- An access client is a user who initiates a network connection. An access client might be a user dialing into a service provider network, a router at a small office/home office connecting to an enterprise network to provide network access, or a wireless client connecting to an 802.1X access point.
- A network access device (NAD), also called a RADIUS client, is a device that recognizes and processes connection requests from outside the network edge. A NAD can be a wireless access point, a modem pool, a network firewall, or any other device that needs to authenticate users. When the NAD receives a user's connection request, it might perform an initial access negotiation with the user to obtain identity/password information. The NAD then passes this information to the RADIUS server as part of an authentication/authorization request.



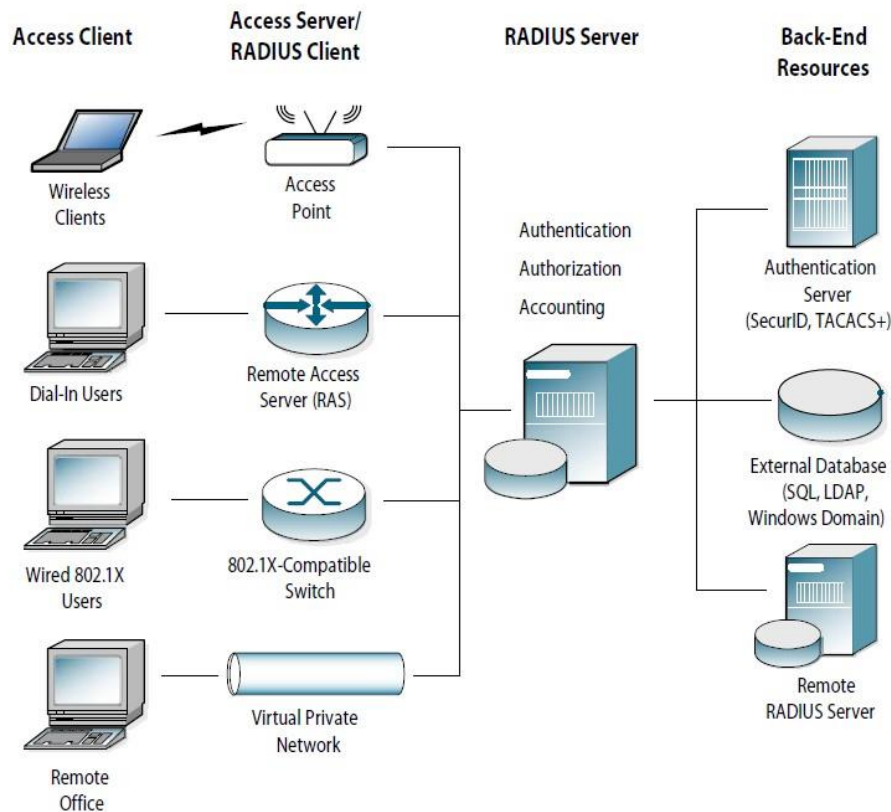
Note: The terms “network access device” (NAD), “remote access server” (RAS), and “network access server” (NAS) are interchangeable. This manual uses “NAD,” though some attribute names and parameters retain the older “NAS” in their names.

- The RADIUS server matches data from the authentication/authorization request with information in a trusted database, such as the database on the Steel-Belted Radius server or a backend database server. If a match is found and the user's credentials are correct, the RADIUS server sends an Access-Accept message to the NAD; if a match is not found or a problem is found with the user's credentials, the server returns an Access-Reject message. The NAD then establishes or terminates the user's connection. The NAD might then forward accounting information to the RADIUS server to document the transaction; the RADIUS server might store or forward this information as needed to support billing for the services provided.
- In some networks, a backend authentication server, such as RSA SecurID or TACACS+; a SQL or LDAP database; or some other RADIUS server for which this server is a proxy, stores the information against which the authentication request is compared. In some cases, the backend server passes information to the RADIUS server, which determines whether a match exists. In other cases, the matching is performed on the backend server, which then passes an accept/reject result to the

RADIUS server.

Figure 1: illustrates a simple RADIUS environment.

Figure 1: RADIUS Authentication



RADIUS Packets

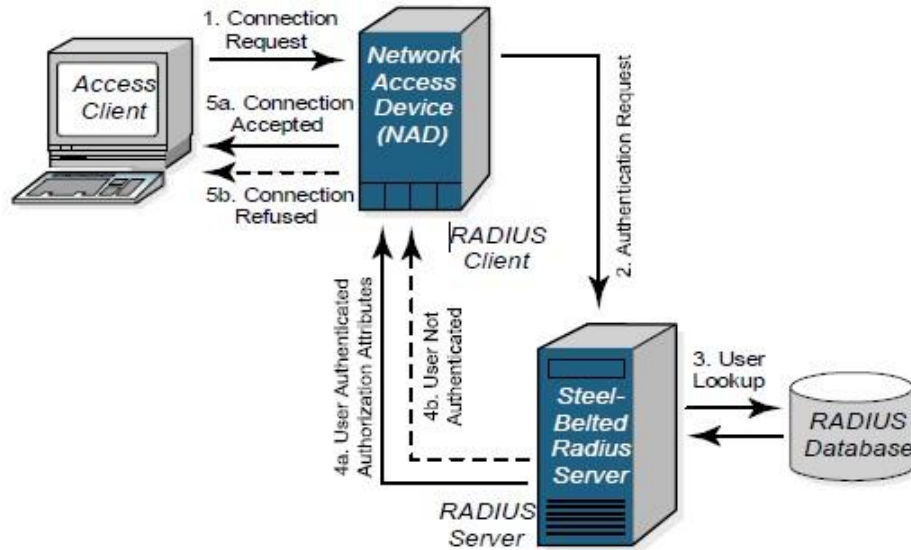
A RADIUS client and RADIUS server communicate by means of RADIUS packets. RADIUS packets carry messages between the RADIUS client and RADIUS server in a series of request/response transactions: the client sends a request and expects a response from the server. If the response does not arrive, the client can retry the request periodically.

Each RADIUS packet supports a specific purpose: authentication or accounting. A packet can contain values called attributes. The specific attributes to be found in each packet depend upon the type of packet (authentication or accounting) and the device that sent it (for example, the specific make and model of the NAD device acting as a RADIUS client).

For information on RADIUS authentication packet structures and attributes, see RFC 2865, Remote Authentication Dial In User Service (RADIUS). For information on RADIUS accounting packet structures and attributes, see RFC 2866, RADIUS Accounting.

Figure 2: illustrates a simple RADIUS authentication/authorization sequence.

Figure 2: RADIUS Authentication



1. The RADIUS access client sends an authentication request containing identification and connection information to the network access device (RADIUS client).
2. When the NAD receives a user's connection request, it typically performs an initial access negotiation with the user to establish connection information (username, password, network access device identifier, NAD port number, and so on). The NAD then forwards the user information in an authentication request to the RADIUS server.
3. The RADIUS server looks up the user information in a local or remote RADIUS authentication database. The RADIUS server verifies that the user's name and password are valid. It can also enforce fine-grained security rules by using an access checklist to verify specific attributes in the authentication request.
4. If a match is found, the RADIUS server returns an Access-Accept message (4a). The RADIUS server might also send return list information stored in the database, such as the user's authorization or connection parameters, back to the NAD.

If a match is not found, the RADIUS server returns an Access-Reject message (4b).

If third-party software such as RSA SecurID is used, the RADIUS server might prompt the user for more information before accepting or rejecting the authentication request.

5. Based on the information it receives from the RADIUS server, the NAD accepts or refuses the connection request.

After the user is authenticated and the connection established, the NAD might forward accounting data to the RADIUS server to document the transaction; the RADIUS server can store or forward this data to support billing for the services provided.

RADIUS Ports

The RADIUS standard initially used UDP ports 1645 and 1646 for RADIUS authentication and accounting packets. The RADIUS standards group later changed the port assignments to 1812 and 1813, but many organizations still use the old 1645/1646 port numbers for RADIUS.

Any two devices that exchange RADIUS packets must use compatible UDP port numbers. That is, if you are configuring a NAD to exchange authentication packets with a RADIUS server, you must find out which port the server uses to receive authentication packets from its clients (1812, for example). You must then configure the NAD to send authentication packets on the same port (1812). The same is true for RADIUS accounting.

Steel-Belted Radius can listen on multiple ports. For compatibility, the server listens to the old and new default RADIUS ports: ports 1645 and 1812 for authentication, and ports 1646 and 1813 for accounting. To add, change, or disable the ports on which Steel-Belted Radius listens, modify the radius.ini file or edit the services (Windows) or /etc/services (Linux) file. The radius.ini file and the services file are described in the Steel-Belted Radius Reference Guide.

RADIUS Configuration

You must configure a RADIUS client and RADIUS server before they can communicate. If the client and server are on the same network, one administrator might be able to configure both sides of the RADIUS communication. If the client and server are not administered by the same person, you might have to coordinate RADIUS configuration details with the administrators of other networks.

RADIUS Server Configuration

To configure Steel-Belted Radius to respond to RADIUS clients, run the SBR Administrator, open the RADIUS Clients panel, and enter the following information for each RADIUS client:

- The IPv4/IPv6 addresses of the client device.
- The RADIUS shared secret used by Steel-Belted Radius and the client device. For information on RADIUS shared secrets, see [“Shared Secrets”](#).
- The make and model of the client device, selected from a list of devices that Steel-Belted Radius supports. If a specific make and model is not listed, select **- Standard Radius -**.

Additionally, you must configure the UDP ports the server will use when sending and receiving RADIUS authentication and accounting packets. The UDP ports you configure on the RADIUS server must match the UDP ports that the RADIUS client is using for the same purposes. For more information, see [“RADIUS Ports”](#).

RADIUS Client Configuration

You must tell each RADIUS client how to contact its RADIUS server. To configure a client to work with a Steel-Belted Radius server, log in to the client device, run its administration program, bring up its RADIUS configuration interface, and enter the following information:

- The IP address of the Steel-Belted Radius server.
- The RADIUS shared secret to be used by Steel-Belted Radius and the client device. For information on RADIUS shared secrets, see [“Shared Secrets”](#).
- The UDP ports on which to send and receive RADIUS authentication and accounting packets. These must match the UDP ports that Steel-Belted Radius is using for the same purposes. For more information, see [“RADIUS Ports”](#).

Multiple RADIUS Servers

You can distribute the RADIUS workload among several servers, as follows:

- You can set up separate servers for RADIUS authentication and accounting services. When RADIUS authentication and accounting services are performed by separate servers, each client device must be configured to send its authentication packets to one RADIUS server and its accounting packets to

another.

- You can provide redundancy by pairing RADIUS servers to work in tandem. Most NAD configuration interfaces permit you to designate primary and secondary servers for authentication and accounting.

If both measures for distributing the RADIUS workload are implemented, client configuration involves identifying four servers for each client device: a primary RADIUS accounting server, a secondary RADIUS accounting server, a primary RADIUS authentication server, and a secondary RADIUS authentication server.

Shared Secrets

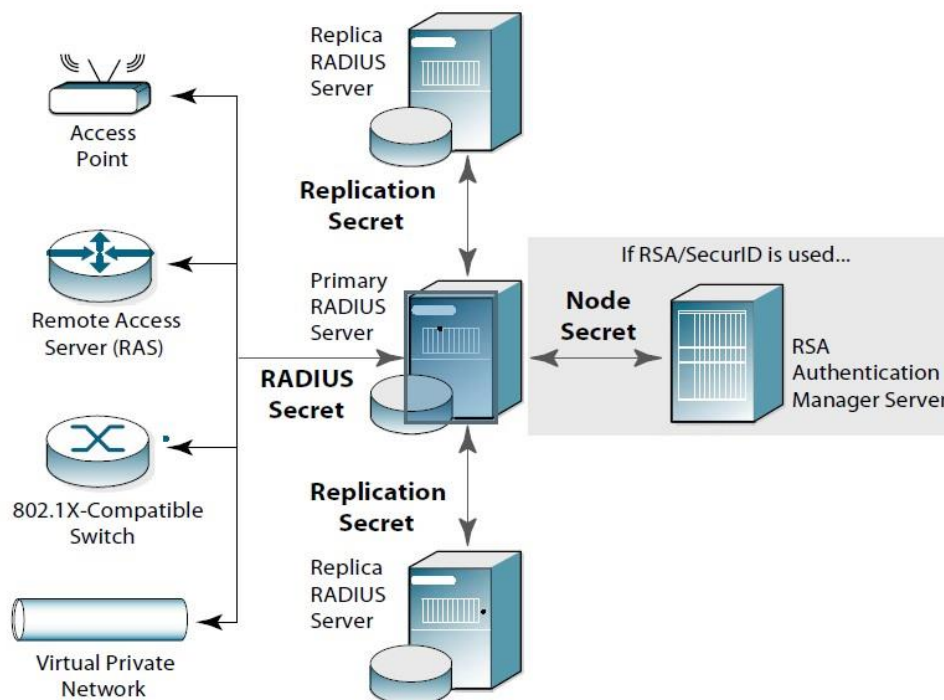
A shared secret is a case-sensitive text string used to validate communications between two RADIUS devices. You should configure shared secrets that are long enough and random enough to resist attack, and you should avoid using the same shared secret throughout your network. To maximize the security of your server's shared secret, consider using Pulse Secure's free Password Amplifier utility, which takes an ordinary shared secret or password (swordfish) and hashes it repeatedly to produce a 16-character amplified secret (g8QvQuRgRsl1AQ1E). You can paste this amplified secret into your server configuration to maximize security.

Note: For more information on Pulse Secure's free Password Amplifier utility, see <https://www.pulsesecure.net/support>.

Steel-Belted Radius uses three types of shared secrets:

- RADIUS secret – Used to authenticate communication between a RADIUS server and a RADIUS client
- Replication secret – Used to authenticate communication between a primary server and a replica server
- Node secret – If you use RSA SecurID, Steel-Belted Radius uses a node secret to authenticate communication between a RADIUS server and an RSA Authentication Manager server.

Figure 3: Shared Secrets



RADIUS Secret

A RADIUS shared secret is a case-sensitive password used to validate communications between a RADIUS server, such as Steel-Belted Radius, and a RADIUS client, such as a network access device. Steel-Belted Radius supports shared secrets of up to 127 alphanumeric characters, including spaces and the following special characters:

~!@#\$%^&*()_+|\=-'{}[]:"';<>?/.,

Identical shared secrets must be configured on both sides of the RADIUS communication link.

 Note: Not all network access devices support shared secrets of up to 127 alphanumeric/special characters. You should select shared secrets that are fully supported by RADIUS devices in your network.

Most RADIUS clients allow you to configure different secrets for authentication and accounting. On the server side, the configuration interface allows you to create a list of known RADIUS clients (network access devices). You should be able to identify the authentication shared secret and accounting shared secret that a server uses to communicate with each of the clients on this list.

During an authentication transaction, password information must be transmitted securely between the RADIUS client (network access device) and Steel-Belted Radius. Steel-Belted Radius uses the authentication shared secret to encrypt and decrypt password information.

No encryption is involved in transmitting accounting data between a RADIUS client and RADIUS server. However, the accounting shared secret is used by each device to verify that it can “trust” any RADIUS communications it receives from the other device.

Replication Secret

A replication secret is a text string used to authenticate communications between a primary server and a replica server. You do not need to configure the replication secret for a realm: the primary server generates it automatically, and each replica server in a realm receives the replication secret as part of its configuration package.

See [“About Replication”](#) for information on primary and replica servers.

Node Secret

If you use Steel-Belted Radius with RSA SecurID, the RSA Authentication Manager software views the Steel-Belted Radius service as a host agent. You must configure a node secret to authenticate communication between Steel-Belted Radius and the RSA Authentication Manager. A node secret is a pseudorandom string known only to the Steel-Belted Radius and RSA Authentication Manager. Before the Steel-Belted Radius sends an authentication request to the RSA Authentication Manager, it encrypts the data using a symmetric node secret key.

Accounting

A NAD can issue an Accounting-Request whenever it chooses, for example upon establishing a successful connection. Each time an Accounting-Request message arrives at the Steel-Belted Radius server, an accounting transaction begins. During this transaction, the server handles the message by examining the Acct-Status-Type and other attributes within the message, and taking the appropriate action.

Attributes

You work with RADIUS attributes while setting up users, profiles, and RADIUS clients in Steel-Belted Radius. The SBR Administrator lets you select RADIUS attributes by name from a predefined list. For each attribute, the SBR Administrator prompts you to enter values using familiar data types such as string, integer, telephone number,

or network address.

Dictionaries

Steel-Belted Radius uses dictionary files to store lists of RADIUS attributes. Steel-Belted Radius uses these dictionaries to parse authentication/accounting requests and generate responses.

The main Steel-Belted Radius dictionary file (radius.dct) lists attributes defined by the RADIUS standard. The radius.dct file resides in the same directory as the Steel-Belted Radius service/process (usually C:\Program Files (x86)\Pulse Secure\Steel-Belted Radius\Service on Windows computers or /opt/PSsbr/radius on Linux computers).

Vendor-Specific Attributes

In addition to the standard attributes, many network access devices use Vendor-Specific Attributes (VSAs) to complete a connection. Steel-Belted Radius supports a large number of specific network access devices by providing vendor-specific, proprietary dictionary files. These files also reside in the server directory and use the filename extension .dct.

Dictionaries and the Make/Model Field

During Steel-Belted Radius configuration, when you make a selection in the RADIUS Client Make/Model field, you are telling the server which dictionary file contains the VSAs for this client device. Thereafter, whenever the server receives a RADIUS packet from this client device, it can consult this dictionary file for any nonstandard attributes that it encounters in the packet. Standard RADIUS attributes are always defined by the radius.dct file. If you are not sure which make/model you should specify for a RADIUS Client, choose - Standard RADIUS -. The selections available in the Make/model field identify devices whose vendors have provided attribute dictionaries for use with Steel-Belted Radius.

Updating Attribute Information

If your NAD vendor announces a new product, a new attribute, or a new value for an attribute, you can add this information to your Steel-Belted Radius configuration. You can edit the dictionary file for that vendor to add new attributes or attribute values, or you can create a new vendor-specific dictionary file that contains new attributes and values. For more information on dictionary files, refer to the Steel-Belted Radius Reference Guide.

User Attribute Lists

Each user entry in the Steel-Belted Radius database provides the information necessary for the server to try to authenticate a connection request using a specific authentication method. When you view a user entry using the SBR Administrator program, this method is identified in the User type field.

You can control authentication at finer levels of detail than simple username/ password checking allow. The checklist, return list, or profile fields in the user entry in the database provide powerful tools for the authentication and authorization of users. These fields tell the server how to handle RADIUS attributes while authenticating a connection request and can be used to configure the authorization of the session.

Checklist Attributes

A checklist is a set of attributes that must accompany the authentication request before the request can be accepted. The NAD must send attributes that match the checklist associated with a user entry; otherwise, Steel-Belted Radius rejects the user even if the user's name and password are valid. By including appropriate attributes in the checklist, a variety of rules can be enforced. For example, only specific users might be permitted to use ISDN or dial-in connections to a particular NAD, or Caller ID might be used to validate a user against a list of acceptable originating telephone numbers. A checklist is created by selecting attributes from a list of all RADIUS attributes known to the Steel-Belted Radius server. This list can include a variety of vendor-specific

attributes. During authentication, Steel-Belted Radius filters the checklist based on the dictionary for the RADIUS client that sent the authentication request. The server ignores any checklist attribute that is not valid for this device.

Return List Attributes

A return list is a set of attributes that Steel-Belted Radius must return to the NAD after authentication succeeds. The return list usually provides additional parameters that the NAD needs to complete the connection, typically as part of PPP negotiations. Return list attributes can thus be considered to be “authorization configuration parameters.”

By including appropriate attributes in the return list, you can create a variety of connection policies. Specific users can be assigned particular IP addresses or IPX network numbers; IP header compression can be turned on or off; or a time limit can be assigned to the connection.

You create a return list by selecting attributes from a list of all RADIUS attributes known to Steel-Belted Radius. This list can include a variety of vendor-specific attributes.

During authentication, Steel-Belted Radius filters the return list based on the dictionary for the RADIUS client that sent the authentication request. The server omits any return list attribute that is not valid for this device.

Attribute Values

The value of each RADIUS attribute has a well-defined data type: numeric, string, IP or IPX address, time, or hexadecimal. For example, Callback-Number is of type string and contains a telephone number, while NAS-Port-Type is an item from a list, and can be Sync, Async, and so forth.



Note: Steel-Belted Radius supports signed integers (negative numbers) for attributes received in packets and processing relating to those attributes. However, SBR Administrator does not support signed integers, and treats signed and unsigned integers as unsigned integers.

Single- and Multi-Valued Attributes

Attributes can be single- or multi-valued. Single-valued attributes appear at most once in the checklist or return list; multi-valued attributes might appear several times.

If an attribute appears more than once in the checklist, this means that any one of the values is valid. For example, you can set up a checklist to include multiple telephone numbers for attribute Calling-Station-ID. A user trying to dial into your network would then have to call from one of the designated telephone numbers to be authenticated.

If an attribute appears more than once in the return list, each value of the attribute is sent as part of the response packet. For example, to enable both IP and IPX header compression for a user, the Framed-Compression attribute should appear twice in the return list: once with the value VJ-TCP-IP-header-compression and once with the value IPX-header-compression.

Orderable Multi-Valued Attributes

Certain multi-valued return list attributes are also orderable, which means the attribute can appear more than once in a RADIUS response, and the order in which the attributes appear is important. For example, the Reply-Message attribute allows text messages to be sent back to the user for display. A multi-line message is sent by including this attribute multiple times in the return list, with each line of the message in its proper sequence.

System Assigned Values

Some attributes do not allow the administrator to set a value. Steel-Belted Radius retrieves the appropriate value for this attribute when it is needed.

Echo Property

Using the echo property, you can force an attribute from the RADIUS request to be echoed in the RADIUS response. For example, you might add Callback-Number to the return list and select the echo check box. Steel-Belted Radius takes the value of the Callback-Number it receives in the RADIUS request and echoes it back to the client in the RADIUS response; if it receives no Callback-Number, it echoes nothing.

You enter Callback-Number one or more times into the checklist. This indicates that one of the callback numbers you supplied must be present in the RADIUS request, and that number should be echoed in the RADIUS response.

Default Values

Selecting default for a checklist attribute specifies that, if the RADIUS request does not include this attribute, the request should not be rejected. Instead, the value supplied as the default should be used as if it were received as part of the request. One use for default values is to require that an attribute in a RADIUS request must have one of several values, or must not be present at all. Another use is to provide a default value for an attribute in conjunction with the echo property in the return list.

Steel-Belted Radius can provide alternate values when an attribute appears in the checklist marked as default, and the same attribute appears in the return list marked as echo. The server echoes the actual value of the attribute in the RADIUS response if the attribute appears in the RADIUS request and echoes the default value (from the checklist) in the response if the attribute does not appear in the RADIUS request.

If you add multiple values of the same attribute to the checklist, only one of them can be marked as default.

For example, an administrator adds several Callback-Number values to the checklist and marks one of them as default. The administrator adds Callback-Number to the return list and specifies it as echo.

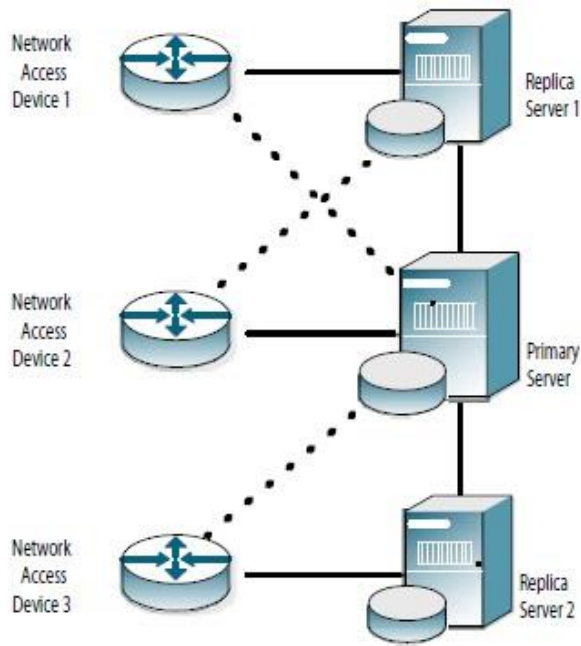
- If a Callback-Number value is present in the RADIUS request, it must match one of the checklist values or the user is rejected.
- If it does match, the user is accepted and the value supplied is echoed in the RADIUS response.
- If no Callback-Number is supplied in the request, the user is accepted and the default value is echoed in the response.

Other checklist attributes are used to provide configuration for the user, such as time-of-day and concurrent-login-limit information.

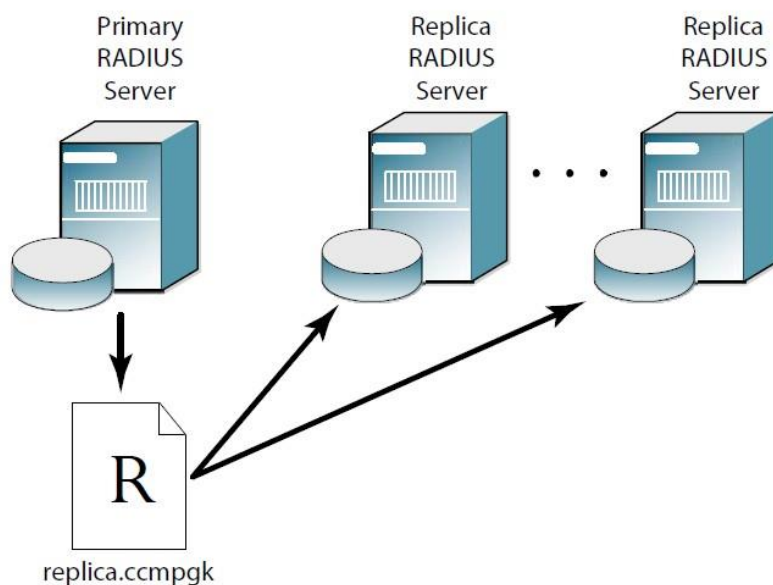
Centralized Configuration Management

Steel-Belted Radius supports the replication of RADIUS configuration data from a primary server to a maximum of 10 replica servers within a replication realm. Replica servers help balance the load of authentication requests coming in from RADIUS clients, and ensure that authentication services are not interrupted if the primary or other replica servers stops working.

For example, Figure 4 illustrates an environment where RADIUS traffic is load-balanced by configuring each network access device to authenticate users through a different RADIUS server (solid line). If a RADIUS server becomes unavailable, the NAD can fail over to its backup RADIUS server (dotted line).

Figure 4: Using Replication for Redundancy and Load Balancing

All the servers within a realm reflect the current configuration specified by the network administrator: the network administrator modifies the configuration on the primary server, and the primary server propagates the new configuration to its replica servers. For example, after a network administrator configures a new RADIUS client or profile on the primary server, the network administrator tells the primary server to publish a configuration package file (`replica.ccmpkg`) that contains the updated configuration information. After publication, the primary server notifies each replica server that a new configuration package is ready. Each replica then downloads and installs the configuration package to update its settings.

Figure 5: Configuration Package Publication

The primary server maintains a list of the replica servers that have registered with it. The primary server uses this list to track which servers to notify after it publishes an updated configuration package to resynchronize the configuration of replica servers.

If the primary server needs to be taken out of service, the network administrator promotes one of the replica

servers to be the new primary server. Thereafter, the other replica servers copy the configuration package from the promoted primary server.

Proxy RADIUS

The Steel-Belted Radius server can forward a RADIUS request to another server for processing and relay the other server's result back to its client. In such cases, Steel-Belted Radius is acting as a proxy for the target server, and Steel-Belted Radius is proxy-forwarding the request to the target server.

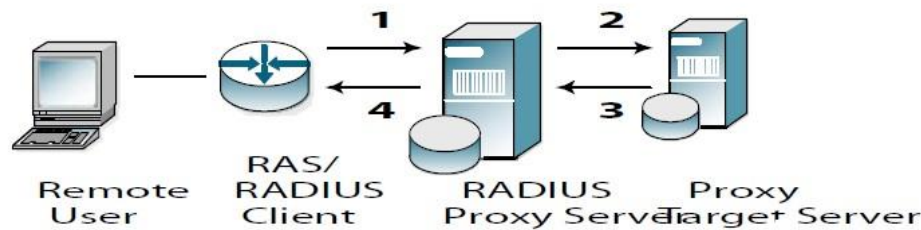
Steel-Belted Radius supports proxy RADIUS; any Steel-Belted Radius server can act as proxy or target for authentication or accounting messages.

Proxy RADIUS Authentication

RADIUS authentication messages are proxy-forwarded as follows:

1. An access client requests authentication from a RADIUS client, which sends an authentication request to a RADIUS proxy server.
2. The proxy RADIUS server forwards the message to a RADIUS target server.
3. The target RADIUS server performs the authentication services indicated by the message, then returns a response message to the proxy RADIUS server.
4. The proxy RADIUS server relays the acknowledgement response message to the RADIUS client.

Figure 6: RADIUS Proxy Forwarding



Proxy RADIUS Accounting

RADIUS accounting messages are proxy-forwarded as follows:

1. A RADIUS server receives an accounting request.
2. Depending on its configuration, the RADIUS proxy server forwards the accounting message to a target accounting server or records accounting attributes locally (or does both).
3. If the proxy server does not receive an acknowledgement of the forwarded accounting message, it re-sends periodically according to its retry policy.
4. When the target server acknowledges the request, the proxy server forwards an acknowledgement to the RADIUS client.

Authentication

RADIUS uses different types of messages during user authentication. **Table 3** summarizes the conditions under which each type of RADIUS authentication message is issued, and the purpose of any RADIUS attributes the message contains.

Table 3: RADIUS Authentication Messages and Attributes

Message Conditions	Purpose of Message Attributes
When a NAD receives a connection request from a user, the NAD requests authentication by sending an Access-Request to its RADIUS server.	Identify the user. Describe the type of connection the user is trying to establish.
When a RADIUS server is able to authenticate a user, it returns a RADIUS Access-Accept to the NAD.	Allow the NAD to complete access negotiations. Configure connection details such as providing the NAD with an IP address it can assign to the user. Enforce time limits and other “class of service” restrictions on the connection.
When a RADIUS server is unable to authenticate a connection request, it returns an Access-Reject to the NAD.	Terminate access negotiations. Identify the reason for the authorization failure.
If initial authentication conditions are met but additional input is needed from the user, the RADIUS server returns an Access-Challenge to the NAD.	Enable the NAD to prompt the user for more authentication data. Complete the current Access-Request, so the NAD can issue a new one.

Authentication Methods

Each time an Access-Request message reaches the server, an authentication transaction begins. During this transaction, the server attempts to authenticate the request by sequentially trying its configured and enabled authentication methods. The server consults its list of authentication methods to determine which methods to try and in which order to try them.

Native User Authentication

Native user authentication references user accounts stored on the Steel-Belted Radius server. When trying the native user method, Steel-Belted Radius searches its database for an entry whose User-Type is Native User, and whose username matches the User-Name in the Access-Request.

- If the entry cannot be found, or if it is found and the password is invalid, Steel-Belted Radius tries the next enabled method in the authentication methods list.
- If an entry for the user is found but the entry's checklist does not match attributes found in the Access-Request, Steel-Belted Radius returns an Access-Reject message to the NAD.
- If the entry is found and its password and checklist match perfectly, Steel-Belted Radius formats an Access-Accept message using the entry's return list, and returns it to the NAD.

Pass-Through Authentication

Pass-through authentication methods permit Steel-Belted Radius to begin the authentication by asking another entity to validate the username and password found in the Access-Request.

Steel-Belted Radius can pass authentication requests through to a Windows security database, RSA Authentication Manager (RSA SecurID), or TACACS+ server.

Proxy RADIUS Authentication

Steel-Belted Radius can convey an Access-Request to some other RADIUS server, which then (1) attempts to authenticate the connection request according to its own conventions and (2) returns a response to Steel-Belted Radius. Steel-Belted Radius then relays this response to the NAD. The set of conventions for relaying packets

between cooperating RADIUS servers is known as proxy RADIUS.

External Authentication

External authentication methods enable Steel-Belted Radius to authenticate users by referring to external SQL or LDAP databases. During external authentication, Steel-Belted Radius queries the database for authentication data, and uses the results to format a response packet. Steel-Belted Radius then relays this response to the NAD.

For information on using Steel-Belted Radius with SQL databases, see, “[Configuring SQL Authentication](#)”. For information on using Steel-Belted Radius with LDAP databases, see, “[Configuring LDAP Authentication](#)”.

Directed Authentication (GEE only)

Every authentication request works its way through the same Authentication Methods list until one of the methods succeeds or the end of the list is reached.

This behavior might not be ideal for every user (GEE). If you want requests from certain users or accounts to bypass the master Authentication Methods list and use an alternate list, you can do so by employing the directed authentication feature. This feature allows you to map the User-Name or DNIS information in an incoming authentication request to a specific list of authentication methods. The list can include any native, pass-through, proxy-as-authentication, or external database authentication method configured on the Steel-Belted Radius server.

You can also direct authentication towards a particular realm using a technique called attribute mapping. This allows you to check for the presence or absence of a particular attribute in an authentication request, or for an attribute containing a specific value. Attribute mapping can be used with both proxy realms and directed realms.

HTTP Digest Access Authentication

HTTP Digest Access authentication provides a simple challenge-response authentication mechanism that an HTTP server can use to challenge an HTTP client request.

Steel-Belted Radius supports two forms of HTTP Digest Access authentication:

- HTTP Digest Access authentication, which is described in draft-ietf-radext-digest-auth-05.txt, uses 13 new RADIUS attributes to authenticate access requests from an HTTP server. When HTTP Digest Access authentication is used:
 - a. An HTTP client sends a request without an authorization header to an HTTP server.
 - b. The HTTP server sends a challenge containing a random value (nonce) to the HTTP client.
 - c. The HTTP client creates an MD5 hash containing the username, password, nonce value, and other information, and returns this MD5 hash to the HTTP server in a request with an authentication header.
 - d. The HTTP server sends an Access-Request message containing special RADIUS attributes to Steel-Belted Radius.
 - e. Steel-Belted Radius verifies the HTTP client's credentials and returns a RADIUS Access-Accept or Access-Reject message to the HTTP server.
- The Ericsson ViG version of HTTP Digest Access authentication, which is described in **draft-sterman-aaa-sip-05.txt**, uses two Ericsson vendor-specific attributes (a Digest-Response attribute and one or more Digest-Attributes attributes) to authenticate access requests. When Ericsson ViG HTTP Digest Access authentication is enabled, Steel-Belted Radius looks for the ViG VSAs when it parses

incoming packets, and, if it finds them, converts them to AVPs compatible with HTTP Digest Access authentication.

You must edit settings in the radius.ini file to enable HTTP Digest Access authentication.

Authenticate-Only Requests

Steel-Belted Radius supports requests to authenticate a user where the server performs no other processing. The NAD specifies this type of request by setting the Service-Type field to a value of Authenticate-Only (numeric value 8). The server responds with either an Access-Reject or an Access-Accept (without any attributes).

You can disable this feature (so that attributes are always returned in the response packet) by setting the AuthenticateOnly field in the [Configuration] section of the radius.ini file to 0. For more information on radius.ini, refer to the Steel-Belted Radius Reference Guide.

Configuring the Authentication Sequence

After you configure authentication methods for Steel-Belted Radius, the Authentication Policies panel in the SBR Administrator displays them in the order in which the server tries them. Enabled methods are displayed in black text; disabled methods are displayed in gray text. During an authentication transaction, the server works down the list, skipping disabled methods.

You can enable or disable methods or re-order methods in the list by using the controls in the Authentication Methods tab of the Authentication Policies panel. For information on setting up authentication sequences, see [Setting Up EAP Authentication Policies via Legacy](#)

Configuring Authentication Methods

Each authentication method in Steel-Belted Radius performs a different type of processing on information in an incoming Access-Request packet. Table 4 summarizes what you need to do to configure each authentication method.

Table 4: Authentication Method Configuration

Method	How to Configure	See
Native User	Create native user entries in the Steel-Belted Radius database	“Setting Up Native Users”
OS Pass-Through Security	This method assumes that you already have users, groups, and passwords defined in your local security database. Create user entries in the Steel-Belted Radius database. Choose User-types as appropriate.	“Administering Users”
RSA SecurID	This method assumes that you already have PIN/token code pairs defined on an RSA SecurID server. First, configure Steel-Belted Radius to communicate with the RSA SecurID server. Then create user entries in the Steel-Belted Radius database. Choose SecurID User, <ANY>, SecurID Prefix, and SecurID Suffix User-types.	“Setting Up SecurID Users”
TACACS+	This method assumes that you have username/ password pairs defined on a TACACS+ server. First, configure Steel-Belted Radius to communicate with the TACACS+ server. Then, create user entries in the Steel-Belted Radius database. Assign TACACS+ User, <ANY>, TACACS+ Prefix, and TACACS+ Suffix	“Setting Up TACACS+ Users”

Method	How to Configure	See
Proxy RADIUS	<p>user-types.</p> <p>Add a single target. You can set up single targets that are not associated with any realm.</p> <p>or:</p> <p>Identify Proxy RADIUS realms, each of which is a pool of proxy RADIUS target servers. Each time a RADIUS request arrives addressed to this realm, Steel-Belted Radius dynamically selects the appropriate target within the realm.</p>	Administering Proxy RADIUS
EAP-TTLS	<p>This method provides a means for an authentication request to be sent directly from the client to the server through a TLS connection. The act of establishing the TLS connection authenticates the server to the client and the authentication request sent through the tunnel authenticates the client to the server.</p> <p>Create a Steel-Belted Radius ttlsauth.aut file that specifies options for the TLS connection and the manner in which Steel-Belted Radius routes the inner authentication request.</p> <p>Stop and restart Steel-Belted Radius. Subsequently, the EAP-TTLS authentication method appears in the Authentication Methods tab in the Authentication Policies panel. You can use the Authentication Policies panel to enable, disable, and re-order EAP-TTLS methods.</p>	"EAP-TLS"
External SQL Database	<p>This method assumes that you have user records stored in a SQL database. Create a Steel-Belted Radius .aut file that connects to a SQL database and issues a SELECT query based upon the username and password. Give the .aut file a unique InitializationString value. Stop and restart Steel-Belted Radius. Subsequently, the SQL authentication method appears in the Authentication Methods tab of the Authentication Policies panel, using the InitializationString value as its name. You can use the Authentication Policies panel to enable, disable, and re-order the SQL authentication method.</p>	"Configuring SQL Authentication"
External LDAP Database	<p>This method assumes that you have user records stored in an LDAP database. Create a Steel-Belted Radius .aut file that validates the username and password based upon Bind and Search requests to an LDAP database.</p> <p>Give the .aut file a unique InitializationString value. Stop and restart Steel-Belted Radius. Subsequently, the LDAP authentication method appears in the Authentication Methods tab of the Authentication Policies panel, using the InitializationString value as its name. You can use the Authentication Policies panel to enable, disable, and re-order the LDAP authentication method as desired.</p>	"Configuring LDAP Authentication"
Directed Authentication	<p>For each directed authentication method that you want to configure, add an entry to the [Directed] section of proxy.ini and create a RealmName.dir file that specifies the mapping between the routing information that you expect in the authentication packet, and a list of locally-configured authentication methods that you want to use.</p>	"Directed Authentication (GEE only)"

Two-Factor Authentication


Extensible Authentication Protocol-Tunneled Transport Layer Security (EAP-TTLS) provides for certificate-based mutual authentication between a client and a network through an encrypted tunnel. A typical implementation of EAP-TTLS uses certificates on authentication servers to create a network-to-user encryption tunnel, and then

uses EAP inside the TLS tunnel for user-to-network authentication.

An enhanced version of EAP-TTLS uses certificates on the client side to provide two-factor authentication: the end user must have both a private key for a valid certificate and the password to an active account to obtain network access.

When client certificate support in EAP-TTLS is enabled on the server, you must provide a list of trusted root certificates from which offered client certificates must derive. These certificates must be provided in DER-encoded form and must be placed in the root subdirectory of the server directory.

Optionally, you can enable certificate revocation list (CRL) checking as part of the EAP-TTLS authentication process. CRL checking verifies that an unexpired certificate has not been revoked by its issuing Certificate Authority (CA) for any reason, such as a suspected security breach. Enabling CRL checking means that, every time the client requests a connection, Steel-Belted Radius checks the CRL to confirm that the client certificate has not been revoked. This improves security but increases processing overhead.

 **Note:** If client certificate support is not enabled in EAP-TTLS, any trusted root certificates and CRL checking options are ignored.

Password Protocols

During an authentication transaction, password information is transmitted between the NAD and the RADIUS server. This password information originally comes from the user, for example during PPP negotiations between a user and a NAD. Steel-Belted Radius supports four protocols (PAP, CHAP, MS-CHAP, and MS-CHAP-V2) for receiving the password from the NAD. Steel-Belted Radius also supports the Extensible Authentication Protocol.

Table 5 lists supported protocols according to the authentication methods with which each protocol can be used.

Table 5: Authentication Methods and Password Protocols

Method	PAP	CHAP	MS-CHAP	MS-CHAP-V2
LDAP	Yes	Yes, if BindName is used and the password is in clear text form or is encrypted with enc-md5.	Yes, if BindName is used and the password is in clear text form or is encrypted with enc-md5.	Yes, if the LDAP server can return clear-text password or MD4 hash of Unicode form of password.
		No, if Bind is used	No, if Bind is used	No, if Bind is used
Local	Yes	Yes	Yes	Yes
Windows Domain Group	Yes	No	Yes, if the user is in local or trusted domain	Yes, if the user is in local or trusted domain
Windows Domain User	Yes	No	Yes, if the user is in local or trusted domain	Yes, if the user is in local or trusted domain
Proxy RADIUS	Yes	Yes	Yes	Yes
SecurID	Yes	No	No	No
SQL	Yes	Yes, if the password is available in clear text form in the database or is encrypted with	Yes, if the password is available in clear text form in the database or is encrypted with enc-md5.	Yes, can return clear-text password or MD4 hash of Unicode form of password.

		enc-md5.		
TACACS+	Yes	Yes	No	No
UNIX User	Yes	No	No	No
UNIX Group	Yes	No	No	No

Password Authentication Protocol

When the Password Authentication Protocol (PAP) is used, a remote user negotiates with the NAD “in the clear,” and no encryption is used to send the password to the NAD. After the NAD has enough information from the user to create an Access-Request, the NAD encrypts the password (using its RADIUS shared secret) before sending an Access-Request packet to Steel-Belted Radius.

Upon receiving the Access-Request, Steel-Belted Radius looks for attributes within the packet that identify the NAD that sent it. Steel-Belted Radius decrypts the password by using the shared secret configured for the RADIUS client entry associated with the sending NAD.

Ultimately, Steel-Belted Radius has the password in clear text form for authentication.

Challenge Handshake Authentication Protocol

The Challenge Handshake Authentication Protocol (CHAP) avoids sending passwords in clear text over any communication link. Under CHAP, during password negotiations the NAD generates a challenge (a random string) and sends it to the user. The user’s PPP client creates a digest (the password concatenated with the challenge), encrypts the digest using one-way encryption, and sends the digest to the NAD.

The NAD sends this digest as the password in the Access-Request.

Because the encryption is one-way, Steel-Belted Radius cannot recover the password from the digest. Instead, it performs an identical operation, using the NAD’s challenge value (provided in the Access-Request packet) and its own copy of the user’s password to generate its own digest. If the two digests match, the password is the same.

Steel-Belted Radius must be able to perform the digest operation to support CHAP. Therefore, it must have access to its own copy of the user’s password. Native User passwords are stored in the Steel-Belted Radius database. SQL or LDAP BindName authentication retrieves the password by means of a query to the database; the retrieved password can be used to create a digest if it is in clear text form. A TACACS+ server provides CHAP support and handles the digest operation itself after Steel-Belted Radius sends the username and password through. No other authentication methods support CHAP at this time.

MS-CHAP and MS-CHAP-V2

The two varieties of MS-CHAP (Microsoft Challenge Handshake Authentication Protocol) are Microsoft authentication protocols that, like CHAP, avoid sending passwords in clear text. Steel-Belted Radius supports both 40-bit and 128-bit MS-CHAP methods. Steel-Belted Radius must be able to perform a digest operation similar to CHAP to support MS-CHAP. Therefore, it must have access to its own copy of the user’s password. Native User passwords are stored in the Steel-Belted Radius database. SQL or LDAP BindName authentication retrieves the password by means of a query to the database; the retrieved password can be used to create a digest if it is in clear text form.

MS-CHAP and MS-CHAP-V2 communicate users’ requests to change their passwords to a RADIUS server. Steel-Belted Radius supports this feature, although it must also be supported by whatever application the user is using to log in.

MS-CHAP and MS-CHAP-V2 operate in the same way, but they use different attributes. An MS-CHAP client won’t accept MS-CHAP-V2 attributes, and vice-versa; be careful to use the appropriate set of attributes.

For more information about MS-CHAP and MS-CHAP-V2, see RFC 2433, Microsoft PPP CHAP Extensions; RFC 2548, Microsoft Vendor-specific RADIUS Attributes; and RFC 2759, Microsoft PPP CHAP Extensions, Version 2.

Accounting

To understand the Steel-Belted Radius accounting sequence, you will need an overview of RADIUS accounting messages. **Table 6** explains the conditions under which each type of message is issued, and the purpose of any RADIUS attributes that a message contains.

Table 6: Message Conditions and Attributes

Message Conditions	Purpose of Message Attributes
<p>The RADIUS client sends accounting data to Steel-Belted Radius using an Accounting-Request message.</p> <p>The RADIUS client is responsible for verifying that the server receives accounting requests. Most clients retry periodically until the server responds.</p>	Depending on the value of the Acct-Status-Type attribute, the message type is considered to be Start, Stop, Interim-Acct, Accounting-On, or Accounting-Off.
Upon receipt of an Accounting-Request message, the server sends an Accounting-Response.	Complete the request/response cycle.
After receiving an Access-Accept from the server, the NAD completes its access negotiation with the user. The NAD then sends a Start message to the server.	Record connection data, such as username, NAD identifier, NAD port identifier, port type, and connection start time.
At intervals of approximately every six minutes, the NAD sends an Interim-Acct message to the server.	Record a “snapshot” of statistics regarding the connection. One message contains the current value of every statistic that this NAD is capable of recording about this type of connection.
After a connection is terminated, the NAD sends a Stop message to the server.	Record statistics regarding the connection. One message contains the final value of every statistic that this NAD is capable of recording about this type of connection.
Every time a client device comes online, whether after a crash or after an orderly shutdown, it sends an Accounting-On message to the server.	Identify the device that is going online and clear all session information.
Every time a client device experiences an orderly shutdown, before completing its shutdown sequence it sends an Accounting-Off message to the server.	Identify the device that is going offline and clear all session information.

Accounting Sequence

A NAD can issue an Accounting-Request whenever it chooses, for example upon establishing a successful connection. Each time an Accounting-Request message reaches Steel-Belted Radius, an accounting transaction begins. During this transaction, the server handles the message by examining the Acct-Status-Type and other attributes within the message, and taking the appropriate action.

Comma-Delimited Log Files

When the Steel-Belted Radius accounting log is enabled, all of the RADIUS accounting attributes that the server receives are reformatted and logged to a comma-separated value (CSV) text file, which is easily imported into spreadsheets and database programs for report generation and billing.

Proxy RADIUS Accounting

Steel-Belted Radius can relay an Accounting-Request to some other RADIUS server, which records the data according to its own, locally-configured RADIUS accounting options. (You have the option of specifying that the

data also be recorded locally on the Steel-Belted Radius server.) The set of conventions for relaying packets between cooperating RADIUS servers is known as proxy RADIUS, and is defined in the RADIUS standard.

External Accounting

External accounting methods permit Steel-Belted Radius to record accounting data to external databases. Configuration files specify how Steel-Belted Radius communicates with an external database and how to insert accounting data into that database.

SQL is the only external accounting method currently supported by Steel-Belted Radius. See [“About SQL Accounting”](#).

Tunneled Accounting

During authentication, a user is typically identified by attributes such as User-Name (in the authentication request) and Class (in the authentication accept response). Standard RADIUS accounting requests typically include these attributes in messages flagging Start, Interim, and Stop events so that the user's identity can be recorded for accounting and auditing purposes.

When an organization uses a tunneled authentication protocol such as EAP/TTLS or EAP/PEAP, the identity of a user requesting authentication might be concealed from the NAD; the User-Name attribute carried by the outer authentication protocol is typically a non-unique value such as “anonymous.” As a result, the outer User-Name value included in accounting requests might not be sufficient to determine a user's identity. Class attributes provided by an authentication server cannot be included in cleartext in an outer Access-Accept message because they might contain clues about the user's identity, thereby defeating the identity-hiding feature of the tunneled protocol.

Tunneled accounting allows Steel-Belted Radius to pass user identity information to accounting processes without exposing user identities to a NAD that should not see them. When tunneled accounting is enabled, RADIUS attributes are encrypted and encapsulated in a Class attribute. If the information for a Class attribute exceeds the attribute payload size (253 octets), Steel-Belted Radius returns more than one Class attribute for a user.

The tunneled accounting transaction sequence is:

1. The Steel-Belted Radius server acting as the tunnel endpoint for EAP/TTLS or EAP/PEAP encrypts a user's inner User-Name and Class attributes when it authenticates the user.
2. The server returns the encrypted information to the NAD encapsulated in a Class attribute in the outer Access-Accept message. The NAD associates this encapsulated identity attribute with the user, and echoes the encapsulated identity attribute whenever it generates an accounting request for the user.
3. When Steel-Belted Radius receives an accounting request from a network access device, it scans the request for an encapsulated identity attribute.
4. If Steel-Belted Radius finds an encapsulated identity attribute, it de-encapsulates and decrypts the attributes to reconstitute the original inner User-Name and Class attributes.
5. Steel-Belted Radius substitutes the decrypted attributes for the ones returned from the NAD.
6. Steel-Belted Radius processes the accounting request locally or forwards the accounting request through the proxy to its intended target.

To implement tunneled accounting, you must configure the classmap.ini file to specify how attributes should be presented, and you must configure the spi.ini file to specify the keys that are used to encrypt and decrypt users' identity information. The classmap.ini file and the spi.ini file are described in the Steel-Belted Radius Reference

Guide.

For an overview of how EAP/TTLS and EAP/PEAP work, refer to “About the Extensible Authentication Protocol”.

RADIUS Client Groups

If your RADIUS clients use the same RADIUS attributes and have contiguous IP addresses, you can configure one or more RADIUS client groups and specify an address range consisting of as many as 500 IP addresses for each client group. When Steel-Belted Radius receives a RADIUS request that includes a source IP address in this range, it uses the RADIUS client group to determine the appropriate shared secret, make/model, and IP address pool.

 Please note the following when you set up address ranges for RADIUS client groups:

- Address ranges are for IPv4 networks only. Steel-Belted Radius does not support address ranges for IPv6 or IPX.
- The address range assigned to one RADIUS client group cannot overlap the address ranges assigned to other RADIUS client groups.
- The starting address of the address range assigned to a RADIUS client group cannot match the IP address of an individual RADIUS client.
- If an individual RADIUS client entry has an IP address that falls within an address range assigned to a RADIUS client group, Steel-Belted Radius uses the make/model for the individual RADIUS client. For example, if RADIUS client RAS1 is configured with IP address 192.168.21.55 and if RADIUS client group BLDG1RAS is configured with an IP address range 192.168.21.50–192.168.21.60, Steel-Belted Radius uses the client information for RAS1 if it receives a RADIUS request from 192.168.21.55, and it uses the client information for BLDG1RAS if it receives a RADIUS request from 192.168.21.56.
- A RADIUS client group cannot use a Class D, E, or F IP address (that is, an address greater than 223.255.255.0).

See “[Adding a RADIUS Client or Client Group](#)” for information on how to configure IPv4 address ranges for RADIUS clients.

IP Address Assignment

Steel-Belted Radius can assign IPv4 addresses to users in several ways:

- Static assignment—The same IP address is assigned to a user each time the user connects. For example, if the user Kevin has a Framed-IP-Address attribute set to 123.11.245.123, then the IP address 123.11.245.123 is assigned each time Kevin connects to the network.
- Assignment from a specific address pool—An address is assigned from a specific pool when the user connects. For example, if user Kevin has a Framed-IP-Address attribute set to the Sales IP address pool, the next available IP address from Sales is assigned when Kevin connects to the network.
- Assignment from the RADIUS client’s IP address pool (or set of IP address pools)—An address is assigned from one of the pools associated with the RADIUS client that makes the connection when a user connects. For example, assume that a RADIUS client called RAS1 uses IP address pool A, and a RADIUS client called RAS2 uses IP address pool B. A User entry called Kevin has a Framed-IP-Address attribute value of pool associated with RADIUS Client. When user Kevin gets a port on RAS1, an IP address from pool A is assigned. On the next call, Kevin might connect to RAS2; in this case an

address from pool B is assigned.

Alternatively, if a user has been associated with a particular NAD-specific IP address pool (and suffix), an IP address from that pool is assigned.

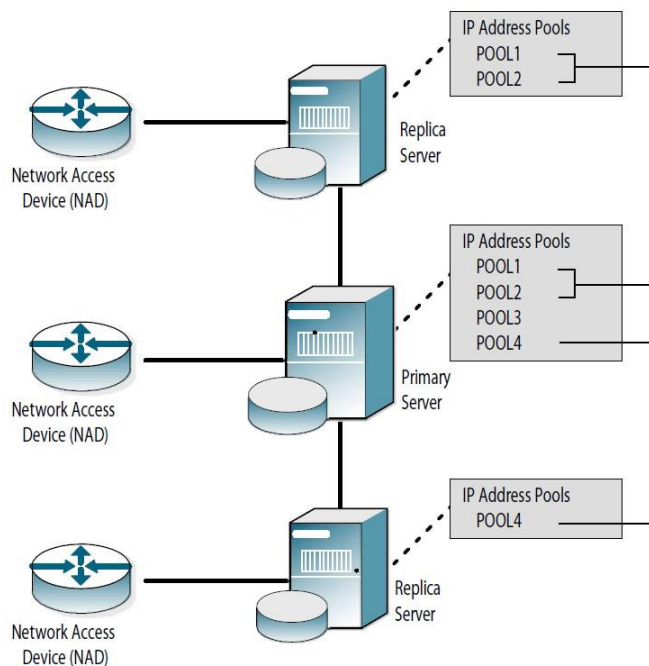
- Assignment from DHCP server—An address is assigned from a DHCP server for a user-configurable period of time (DHCP lease) when a user connects. The DHCP lease period is typically significant (for example, twenty-four hours).

Address Pools and Replication

Address pool information is not distributed with other configuration information in a replicated environment. If you are using IPv4 or IPX address pools in a replication environment, you must configure address pools separately on each replica server, and then use the same names to configure a master list of address pools on your primary server.

The master list of address pools configured on the primary server must include the names of all the pools on all of the replica servers. For example, Figure 7 illustrates a simple environment that uses four address pools. POOL1 and POOL2 are configured on one replica server and POOL4 is configured on a different replica server. As a consequence, the IP address pool list on the primary server must include POOL1, POOL2, POOL3 (the pool used by the primary server), and POOL4.

Figure 7: IP Address Pools in a Replication Environment



The network administrator must configure RADIUS clients (including the address pool associated with a RADIUS client) on the primary server. This RADIUS client/address pool association (but not the address pool information itself) is stored as part of the replication package passed from the primary server to the replica servers.

Hints

Steel-Belted Radius can treat the attribute Framed-IP-Address as a hint. This means that if this attribute appears in the Access-Request and the user return list is configured to allocate Framed-IP-Address from a pool, the IP address in the Access-Request is returned instead of the newly-allocated IP address.

This functionality is defined in the [Configuration] section of radius.ini:

[Configuration]

FramedIPAddressHint = <yes/no>

When hints are enabled, Steel-Belted Radius uses a hint to determine the value of the Framed-IP-Address attribute in the access response. This means that Framed-IP-Address in the Access-Request is returned in the Access-Accept, regardless of the Framed-IP-Address value stored in the user's account.

The default value is "no".

Table 7 details the effect of hints:

Table 7: Effect of Hints

Account Configuration	Framed-IP-Address returned without hints	Framed-IP-Address returned with hints
No Framed-IP-Address	No value	Framed-IP-Address from Access-Request
Static Address	Static address	Static address
Address from Pool	Next address from pool	Framed-IP-Address from Access-Request



Note: By using hints, you can assign the same IP address to multiple active accounts.

Resource Management

This section explains how Steel-Belted Radius manages limited resources, such as network addresses, user or tunnel connections, and UDP ports.

Network Address Assignment

The Steel-Belted Radius address pooling feature allows you to set up one or more pools out of which unique network addresses are assigned dynamically as users require them. Each pool consists of a list of one or more ranges of IP addresses (an IP pool) or IPX network numbers (an IPX pool).

By using this feature, you can avoid allocating specific fixed addresses to individual users. You can make fewer addresses go farther, and you can consolidate address assignment across all your network access devices.

How Address Assignment Works

Proper operation of address assignment from a pool depends crucially on both RADIUS authentication and RADIUS accounting transactions, as follows:

1. During the RADIUS authentication transaction, if the user's attribute settings specify address assignment from a pool, an address is allocated for that user from that pool.
2. The address is reserved for that user until a RADIUS accounting transaction indicates that the user has terminated the connection.

For this reason, the network access device must be configured for RADIUS accounting, and the same Steel-Belted Radius server must be specified for both authentication and accounting. If your NAD is not configured for accounting (or does not support accounting), you cannot use the address pooling feature because addresses would be assigned but never released.

Setting Return List Attributes

The Framed-IP-Address (or Framed-IPX-Address) return list attribute controls how the user's IP (or IPX) address is assigned. The Framed-IP-Address or Framed-IPX-Address attribute can be set for each user in the Steel-Belted Radius database.

Handling Address Leaks

Under optimal conditions, Steel-Belted Radius assigns and releases addresses automatically. In some circumstances, you can get address leakage, where an address remains reserved for a user after the user has terminated the connection.

Address leakage occurs when the address has been assigned during the authentication transaction, but the accounting transaction that would have released the address is never received by Steel-Belted Radius. This can occur for several reasons:

- The Steel-Belted Radius server might have been taken down for a period of time during which accounting transactions occurred.
- The network access device might have failed or been taken down before the user terminated the connection. (In many cases, however, Steel-Belted Radius might be able to prevent address leakage by recovering the addresses when the NAD starts up again.)
- The network access device might have sent the authentication and accounting transactions to different RADIUS servers.
- Despite a successful authentication, the user's PPP negotiation with the NAD might have terminated unsuccessfully for a variety of reasons. In such a case, some network access devices might not initiate a subsequent accounting transaction.
- Routing problems might have prevented the accounting transaction from reaching Steel-Belted Radius.

An address that has "leaked" remains out of circulation until you manually release it by displaying the Sessions list and deleting the corresponding session. See ["Deleting Entries from the Sessions List"](#).

Address Leakage Upon Stopping and Starting the Server

Steel-Belted Radius maintains all current address assignments in a persistent database on disk. If you shut down the server and then restart it, all the information about which address is assigned to which user is retained. Note that if you leave Steel-Belted Radius turned off for a substantial period of time after addresses have been assigned, address leakage might occur. After you restart the server, review the Current Sessions list (described in ["Displaying the Current Sessions List"](#)) and delete entries you know are obsolete.

Overlapping Address Ranges

If you maintain multiple IP or IPX address pools, you can duplicate some of the addresses among the pools. The address tracking mechanism of Steel-Belted Radius, when it is enabled, ensures that, if an IP address appears in more than one pool, after it is assigned out of any pool, it remains unavailable through any of the pools until it is released.

You must disable this type of address tracking if the server is assigning IP addresses from disjoint networks. In that configuration, two numerically identical IP addresses would signal a conflict, even though they actually belong to two different networks.

Order of Address Assignment

IP or IPX addresses are assigned on a first-in-first-out basis; that is, the address that was first released is the first to be reassigned. This ensures that addresses are out of use for as long as possible prior to reuse.


Concurrent Network Connections

The SBR Administrator program allows you to limit the number of active connections, on a per-user, or per-tunnel basis.

Concurrent User Connections

You can set a maximum limit on the number of concurrent connections that a user can have. Subsequently, when the user requests a new connection, Steel-Belted Radius compares the current number of connections to the maximum limit.


If a new connection would exceed the limit, Steel-Belted Radius can reject the additional connection or allow the connection, but log the event in the server log (described in [“Using the Server Log File”](#)).

 **Note:** When counting connections, Steel-Belted Radius does not distinguish between multi-link connections and new user authentication attempts.

For concurrent connection limits to work, each NAD must be configured for RADIUS accounting and the same Steel-Belted Radius server must be responsible for both authentication and accounting. These conventions give the server full access to the data it needs to track connections accurately. The maximum number of concurrent connections can be set individually for any type of user by selecting the Maximum Concurrent Connections check box and entering a number in the accompanying field in the appropriate Add User/Edit User dialog. See [“Administering Users”](#), especially [“Concurrent Connection Limits”](#).

When a concurrent connection limit is set up for a user, it affects only that user. When a concurrent connection limit is set up for a group, every member of the group receives the same connection limit. For example, if GroupA has a connection limit of two, then each member of the group can have two concurrent connections.

Authentication methods that do not require user entries must provide alternate mechanisms for supporting concurrent connection limits. For example, if you are using external database authentication there is an alias mechanism you can use in the SQL or LDAP configuration file. Concurrent connection limits can be supported under proxy authentication only if the target server supports them.

 **Note:** Concurrent user connections can be tracked across multiple Steel-Belted Radius servers by adding the Concurrency Server package.


Concurrent Tunnel Connections

Steel-Belted Radius uses its Current Sessions list to determine the number of active connections for each tunnel. The Sessions list summarizes all of the RADIUS accounting data currently available to the server. Tunnel connections appear in the Sessions list using a special display convention that distinguishes them from user connections.

You can set a maximum limit on the number of concurrent connections that can be open using a specific tunnel. Subsequently, when a user requests a new connection through that tunnel, Steel-Belted Radius compares the current number of connections to the maximum limit. If a new connection would exceed the limit, Steel-Belted Radius rejects the additional connection.

For concurrent connection limits to work, it is essential that each NAD that can open a tunnel be configured for RADIUS accounting and that the same Steel-Belted Radius server be specified for both authentication and accounting. This permits the server's Sessions list to be kept up to date and available to every NAD that needs to

authenticate tunnel connections.

 **Note:** Concurrent tunnel connections cannot be tracked across multiple Steel-Belted Radius servers without additional software extensions. Contact Pulse Secure for more information.

Phantom Records

When Steel-Belted Radius allocates resources such as IP addresses, IPX addresses, user connections, and tunnel connections, to its clients, it generates a phantom accounting record for its internal use. Phantom records are not written to the RADIUS accounting database, but they are displayed in the Current Sessions list (described in [Displaying the Current Sessions List](#)). Phantom records resemble accounting start records, except that the session ID for phantom records is displayed as N/A.

After Steel-Belted Radius receives the corresponding accounting start request packet from the client, it discards the phantom record and replaces N/A with the actual Session-ID number returned by the client device in the Current Sessions list.

In some cases, Steel-Belted Radius can allocate a resource and create a phantom record, but then never receive a corresponding start packet from the client. To avoid committing the resource indefinitely, Steel-Belted Radius waits for a limited period for the start packet to confirm the transaction. By default, Steel-Belted Radius waits 180 seconds, though you can configure a different wait period by editing the radius.ini file (described in the [Steel-Belted Radius Reference Guide](#)).

IPv6 Support

IPv6 is the next step in the evolution of the Internet Protocol, currently implemented as Internet Protocol Version 4 (IPv4). IPv6, which has been under development for more than 10 years, provides improvements over IPv4 in addressing, configuration, and security. Although IPv6 is still an evolving standard, many operating system vendors offer production-quality IPv6 implementations for customers interested in using IPv6 networks.

IPv6 and Steel-Belted Radius

With few exceptions, Steel-Belted Radius supports IPv6 addressing wherever IPv4 addressing is supported. You can perform configuration, authentication, and accounting of RADIUS IPv6 attributes per RFC 3162, RADIUS and IPv6. The SBR Administrator (configuration application) and the LDAP configuration interface (LCI) support the configuration of RADIUS IPv6 attributes.

 **Note:** Because many third-party libraries and software development kits (SDKs) do not support IPv6, the Steel-Belted Radius server must support local IPv4 socket connections.

IPv6 Features

Significant changes from IPv4 to IPv6 include the following:

- Expanded routing and addressing capabilities—IPv6 increases the IP address size from 32 bits to 128 bits. As a consequence, IPv6 supports more levels of addressing hierarchy, provides a much greater number of available addresses, and simplifies auto-configuration of addresses. As a consequence, address conservation techniques such as network address translation, are not necessary.
- Improved multicast routing—Multicast routing, which existed in IPv4, has been redefined and improved in IPv6. Multicast addresses now include a Scope field that limits the scope of multicasts,

improving scalability. A new Anycast address type allows you to send a message to the nearest single member of a multicast group.

- Header format simplification—The IPv6 packet header format has been designed to be efficient. The IPv6 header has a fixed length of 40 bytes, divided into eight fields.
- Improved support for extensions and options—IPv6 uses extension headers, which are inserted between the IPv6 header and the transport header and packet payload, to handle special packet processing requirements. Extension headers provide a flexible means to support authentication, encryption, fragmentation, source routing, network management, and other functions. An IPv6 packet can carry any number of extension headers.
- Improved datagram sizing and fragmentation—The maximum transmission unit (MTU) describes the maximum size of a datagram that can be transmitted over a network without fragmentation. IPv6 increases the minimum MTU from 576 bytes to 1280 bytes, which makes IPv6 packets more efficient and reduces the need for packet fragmentation. Path MTU discovery enables source routers to determine the appropriate packet size for a route.
- Quality-of-Service (QoS) functions—Packets belonging to a traffic flow that requires special handling, such as real-time video service, can be labeled by the sender. Because traffic in a particular flow can be identified in the IPv6 header, support for QoS can be implemented even when the payload of a packet is encrypted.
- Improved privacy and security—IPv6 supports extensions for authentication and data integrity to improve security and privacy of network traffic.

IPv6 Addressing

IPv6 addresses are 128 bits in length, which creates a much larger address space than 32-bit IPv4 addresses. IPv6 addresses identify individual interfaces and sets of interfaces. IPv6 addressing architecture is defined in RFC 2373, IP Version 6 Addressing Architecture.

Address Notation

In full form, IPv6 addresses are written as eight 16-bit hexadecimal blocks separated by colons:

```
FE80:0000:0000:0000:1232:E4BF:FE1A:8324
```

IPv6 addresses can be interpreted as having two variable-length fields: an IPv6 prefix and an IPv6 interface identifier.

- The IPv6 prefix varies from 0 to 128 bits in length and forms the routable network number portion of the IPv6 address. The trailing CIDR notation that may appear after human-readable IPv6 addresses (for example, /64) indicates the bit length of the IPv6 prefix.
- The IPv6 interface identifier consists of the non-prefix portion of the IPv6 address, if any, and identifies the host interface portion of the address, which identifies an IPv6 interface on the local network. The IPv6 interface identifier is typically generated automatically by the host as a function of a unique hardware identifier, such as an Ethernet MAC address. IPv6 hosts can automatically configure interface addresses by combining the IPv6 prefixes obtained from router advertisements with the IPv6 interface IDs that are determined locally.

For example:

```
IPv6 Prefix: FEC0:0000:0000:0000:0000:0000:0000:0000/64
```

IPv6 Interface ID:0260:08FF:FEFF:FFFF

IPv6 Address:FEC0:0000:0000:0000:0260:08FF:FEFF:FFFF

To simplify address notation, IPv6 accepts abbreviations in address notation. For example, leading zeros in a 16-bit block may be omitted:

FE80:0:0:0:0232:E4BF:FE1A:8324

A double colon (::) can replace a series of consecutive zeros within an address:

FE80::232:E4BF:FE1A:8324

Only one double colon can be used to compress an IPv6 address. If more than one double colon was included in an address, networking devices would not know how many zeros to insert for each double colon when expanding a compressed address to its full 128-bit representation.

In networks that support IPv4 and IPv6 nodes, IPv4 addresses can be embedded in the last four bytes of the address. An IPv4 address of 192.168.1.12 can be represented in IPv6 format as ::192.168.1.12, where :: represents a string of zeroes to pad the address to 128 bits.

Address Prefixes Like IPv4 addresses, IPv6 addresses are composed of a routable network number, known as the IPv6 prefix, and a host identifier, known as the IPv6 interface ID. IPv6 does not support address classes; IPv6 uses Classless Inter-Domain Routing with variable length network numbers, or prefixes, meaning that an IPv6 prefix is specified by supplying a bit length in conjunction with the address.

IPv6 prefixes are written as an IPv6 address, followed by a slash and the bit length of the prefix portion of the address. The prefix can be 0–128 bits in length, but the prefix is always written in terms of a 128-bit address. When writing prefixes, the trailing bits of the address comprising the interface ID are sometimes dropped so that the prefix can be abbreviated. The following prefixes are equivalent, assuming that the interface ID portion of the address may be ignored:

Canonical form: 2001:1c44:820d:eea0:0260:08ff:feff:ffff/64

Abbreviated form: 2001:1c44:820d:eea0::/64

In many cases, the interface ID portion of the address contains relevant information. A hierarchy of prefixes may reflect the assignment and reassignment of blocks of addresses to progressively smaller organizations. For example, in a typical hierarchy, the largest service providers are assigned the largest blocks of addresses and hence the shortest prefixes, called Top Level Aggregator Identifiers (TLA IDs). The large service providers reassign blocks of addresses to smaller service providers by adding a few more bits after the TLA ID; these added bits are known as Next Level Aggregator IDs. The smaller service providers again reassign smaller blocks of addresses to end-user organizations by again adding a few more bits after the NLA ID. These added bits are known as Site Level Aggregator IDs. The hierarchy continues in this way until the prefix is exhausted, leaving only the trailing bits that correspond to the non-routable IPv6 interface ID.

Steel-Belted Radius accepts all equivalent forms of IPv6 prefixes and recognizes them as being equivalent. The following prefixes are related by hierarchy, but only the canonical and abbreviated forms are equivalent:

Canonical form: 2001:1c44:820d:eea0:0260:08ff:feff:ffff/64

Abbreviated form: 2001:1c44:820d:eea0::/64

Site level prefix: 2001:1c44:820d::/48

Next level prefix: 2001:1c44:8200::/40

Top level prefix: 2001:1c00::/24

IPv6 prefixes should always be written out in full and unabbreviated form when wild cards are used, as the abbreviations become ambiguous in the presence of wild cards. The following prefixes are equivalent:

Canonical form: 2001:1c44:820d:eea0:0260:08ff:feff:ffff/64

With wild cards: 2001:1c*:??0d:eea0*:*:*/64

Address Interface IDs

Because the overall size of the IPv6 address is fixed, a longer address prefix means a shorter interface ID. For example, a 48-bit prefix implies an 80-bit interface ID:

Canonical prefix: 2001:1c44:820d:eea0:0260:08ff:0000:0000/48

Abbreviated prefix: 2001:1c44:820d::/48

48-bit interface ID: eea0:0260:08ff:0000:0000

Though the interface ID portion of an IPv6 address can be 0–128 bits in length, the RADIUS standard assumes 64-bit interface IDs. Steel-Belted Radius uses a convention that all interface IDs are written as a series of four unabbreviated hexadecimal fields regardless of how they are entered:

64-bit interface ID: 0260:08ff:0000:0000

IPv6 interface IDs should always be written out in full and unabbreviated form when wild cards are used, as the abbreviations become ambiguous in the presence of wild cards. The following interface IDs are equivalent:

64-bit interface ID: 0260:08ff:0000:0000

With wild cards: 02?:?:08ff*:*



Note: The use of wild cards in IPv6 interface IDs is a Steel-Belted Radius feature. Wildcards in IPv6 interface IDs are not known to be documented or prohibited by any IPv6 standards at this time.

IPv6 Network Numbers

In very specific cases, such as checklist processing, Steel-Belted Radius recognizes both IPv4 and IPv6 addresses as representing entire ranges of addresses. Steel-Belted Radius extends the concept of IPv4 network numbers to IPv6 as a means of representing a range of network addresses. Note that using this concept of network numbers means you cannot specify a valid network address that also happens to be a network number.

Prior to the adoption of Classless Inter-Domain Routing (CIDR), the IPv4 address space is divided into five address classes, as shown in **Table 8**.

Table 8: IPv4 Address Classes

Class	Address Range	Description
A	0.0.0.0 – 127.255.255.255	1-bit class, 7-bit network, 24-bit host
B	128.0.0.0 – 191.255.255.255	2-bit class, 14-bit network, 16-bit host
C	192.0.0.0 – 223.255.255.255	3-bit class, 21-bit network, 8-bit host

Class	Address Range	Description
D	224.0.0.0 – 239.255.255.255	4-bit class, 28-bit multicast group
E	240.0.0.0 – 247.255.255.255	5-bit class, 27-bit reserved

Within an IPv4 address class, each network is identified by a network number that consists of the leading class bits and the network bits that follow. Network numbers are typically written as IP addresses with trailing zero bits; for example, the network number corresponding to the class C address 199.100.10.24 would typically be written as 199.100.10.0.

Each network represents a potential physical interconnection of a maximum number of hosts determined by the number of host bits. Thus, the physical network identified by the network number 199.100.10.0 might connect up to 256 hosts identified by the addresses 199.100.10.0 through 199.100.10.255 inclusive. (In practice, host addresses such as 199.100.10.0 are avoided to prevent confusion between host addresses and network numbers.) Thus, it is reasonable to interpret a network number as the entire range of addresses sharing the same network portion of the address:

Network number: 199.100.10.0 Start

of address range: 199.100.10.0

End of address range: 199.100.10.255

As a wild carded address: 199.100.10.*

To see how the concept of network numbers can be extended to IPv6 addresses, consider that IPv6 addresses can contain embedded IPv4 addresses. The IPv6 address ::ffff:199.100.10.0 can therefore be interpreted as the range ::ffff:199.100.10.0 through ::ffff:199.100.10.255 inclusive.

The IPv6 address space is not divided into classes, because IPv6 was designed with CIDR in mind. Constructing an arbitrary definition of IPv6 network numbers that both resembles IPv4 and scales well across all possible IPv6 addresses is difficult. However, since large portions of the IPv6 address space have not yet been defined and since the RADIUS specification concerns itself only with 64-bit interface IDs, we can consider arbitrarily assigning special meaning to all IPv6 addresses ending in 64 bits of zero. This represents a fraction (1/264) of the IPv6 address space, where the addresses have arbitrarily been assigned special meaning overriding their true meaning. The cases where this arbitrary definition would cause trouble are expected to be extremely rare, and it should be possible to avoid them.

Steel-Belted Radius artificially defines the concept of IPv6 network numbers as IPv6 addresses ending in 64 bits of zero, where the network number is interpreted as the entire range of IPv6 addresses sharing the same 64-bit prefix as the network number:

Network number: 2001:1c44:820d:eea0:0000:0000:0000:0000 Start

of address range: 2001:1c44:820d:eea0:0000:0000:0000:0000

End of address range: 2001:1c44:820d:eea0:ffff:ffff:ffff:ffff

As a wild carded address: 2001:1c44:820d:eea0:*.*.*.*

IPv6 Support in Steel-Belted Radius

In general, IPv6 support in Steel-Belted Radius parallels IPv4 support, both in terms of IPv6 network transport

and in terms of RADIUS IPv6 attributes. When IPv6 networking is not supported by an operating system (either because the operating system cannot support IPv6 or because the IPv6 stack for the operating system has not been configured), Steel-Belted Radius recognizes IPv6 addresses and attributes, but does not use IPv6 transport mechanisms.

Socket interfaces in Steel-Belted Radius are both IPv4- and IPv6-capable. By default, IPv4 support is enabled and IPv6 support is disabled in Steel-Belted Radius. You must explicitly enable IPv6 support (by modifying settings in the [IPv6] section of the radius.ini file) before you can use IPv6 networking. Steel-Belted Radius recognizes IPv6 attributes whether or not IPv6 networking is enabled.

With few exceptions, IPv6 addresses may be configured wherever you can configure IPv4 addresses in configuration files and in the SBR Administrator.

Similarly, IPv6 RADIUS attributes can be configured wherever IPv4 RADIUS attributes can be configured. All IPv6 attributes are defined in the radius.dct file to allow inclusion in all standards-conforming dictionaries. IPv6 attributes are correctly interpreted and fully validated by the LDAP Configuration Interface (LCI) and by the SBR Administrator.

Table 9 presents a summary of IPv6 support in Steel-Belted Radius. Features marked “experimental” have not been tested and should not be deployed in a production network.

Table 9: IPv6 Feature Matrix

Feature	Supported?	Comments
Server networking	Yes	IPv6 networking must be explicitly enabled. IPv6 attributes can be processed even if IPv6 networking is not enabled. IPv6 network traffic is limited to the RADIUS authentication/ accounting ports (typically 1645, 1646, 1812, and 1813). Proxying to another RADIUS server is not supported. IPv6 link local and site local addressing is deprecated.
Server DNSv6	Yes	DNSv6 must be explicitly enabled. Both IPv6 and IPv4 network connections are supported with remote DNSv6 servers. Only IPv4 network connections are supported with remote DNS servers.
Server logs	Yes	The diagnostic logging and tracing of IPv6 network connections and IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
LCI networking	Experimental	If IPv6 networking is enabled, IPv6 addresses can be configured in the [LDAPAddresses] section of the radius.ini file.
LCI inputs	Experimental	In most cases, IPv6 values can be supplied wherever IPv4 inputs can be specified.
Attributes	Yes	Basic IPv6 attributes defined in RFC 3162 and listed in radius.dct are supported as native types or as regular text strings, as appropriate. Only RFC 3162 attributes have been tested.
Checklists	Checklists	IPv6 attributes can appear in checklists, and IPv6 address values can contain network numbers similar to IPv4 address values. IPv6 prefix values and IPv6 interface values cannot be masked or wildcarded. Only RFC 3162 attributes have been tested.
Return lists	Yes	IPv6 attributes can appear within return lists, and IPv6 values can be assigned. Only RFC 3162 attributes have been tested.
Attribute value pools	Yes	IPv6 attributes can appear in attribute value pools, and IPv6 values can be assigned to implement round-robin return list processing. Only RFC 3162 attributes have been tested.

Feature	Supported?	Comments
Attribute filtering	Yes	IPv6 attributes can appear in filter rules, and IPv6 values can be assigned. Only RFC 3162 attributes have been tested.
Service type mapping	Yes	IPv6 attributes can appear in a service type mapping, and IPv6 values can be wildcarded similar to IPv4 values. Reliable string comparison of regular expressions requires all values to be expressed in canonical form. Only RFC 3162 attributes have been tested.
Attribute mapping	Yes	IPv6 attributes can appear in an attribute mapping, and IPv6 values can be wildcarded similar to IPv4 values. Reliable string comparison of regular expressions requires all values to be expressed in canonical form. Only RFC 3162 attributes have been tested.
Class attribute	Experimental	The RADIUS Class attribute cannot contain any IPv6 attributes. You can configure IPv6 addresses in the [Hosts] section of the spi.ini file to process class attributes originating from IPv6 network connections.
DHCP	No	The use of IPv6 networking to communicate with any DHCP server is not supported. The allocation of IPv6 addresses obtained from any DHCP server is not supported.
IP address pools	No	The allocation of IPv6 addresses from an SBR-managed IP address pool is not supported. However, RFC 3162 provides an attribute, Framed-IPv6-Pool, that allows the RAS to implement an IPv6 address pool.
Networking for authentication	Yes	IPv6 addresses can be configured in the [Addresses] section of the radius.ini file. IPv6 network traffic is limited to the RADIUS authentication/accounting ports (typically 1645, 1646, 1812, and 1813). Proxying to another RADIUS server is not supported. IPv6 link local and site local addressing is deprecated.
Authentication logs	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Local User authentication	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Authenticate-Only requests	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Pass-through authentication	Partial	IPv6 attributes are fully supported. However, because many third-party libraries do not support IPv6, IPv6 networking is not necessarily supported with external services such as RSA SecurID and TACACS+. Only RFC3162 attributes have been tested. Third-party software may not support IPv6 networking or attributes.
External authentication (for example, LDAP or SQL)	Partial	IPv6 attributes are fully supported. However, because many third-party libraries do not support IPv6, IPv6 networking is not necessarily supported with external services such as LDAP and SQL. Only RFC 3162 attributes have been tested. Third-party software may not support IPv6 networking or attributes.
EAP-TTLS authentication	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Directed authentication	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Networking for accounting	Experimental	IPv6 addresses can be configured in the [Addresses] section of the radius.ini file.

Feature	Supported?	Comments
Accounting logs	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
External accounting (for example, SQL)	Partial	IPv6 attributes are fully supported. However, because many third-party libraries do not support IPv6, IPv6 networking is not necessarily supported with external services such as SQL. Only RFC 3162 attributes have been tested. Third-party software may not support IPv6 networking or attributes.
Directed accounting	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Spooled accounting	Yes	IPv6 attributes are fully supported. Only RFC 3162 attributes have been tested.
Networking for proxy	Experimental	IPv6 addresses can be configured in the [Interfaces] section of the proxy.ini file. Both classic and extended proxy support IPv6.
Proxy authentication	Experimental	IPv6 attributes are fully supported. Both classic and extended proxy support IPv6.
Proxy accounting	Experimental	IPv6 attributes are fully supported. Both classic and extended proxy support IPv6.
3GPP2	Experimental	RFC standards are not sufficiently evolved to enable full support of IPv6. Although IPv6 attributes can be processed, they are not meaningful in the context of 3GPP2.
Master SNMP agent	No	(Linux only) The use of IPv6 networking to communicate with an IPv6 capable SNMP management station and/or SNMP subagent is not supported.
SNMP subagent	No	(Linux only) IPv6 networking, IPv6 trap variables, and IPv6 MIB objects are not supported. IPv6 addresses are reported as IPv4 MIB objects possessing the value 255.255.255.255.
Windows events	No	(Windows only) Neither IPv6 networking nor IPv6 event variables are supported at this time.
Networking for plug-Ins	Experimental	Steel-Belted Radius does not control the networking of back end servers with its plug-ins. IPv6 networking is generally a hidden detail of third-party back end server configuration.
Plug-In APIs	Experimental	IPv6 features and parameters are exposed in the new plug-in APIs. The older plug-in APIs are deprecated but still functional. You should upgrade to the new plug-in APIs to gain access to IPv6 features. IPv6 APIs can be invoked even if IPv6 networking is not enabled.
Plug-In attributes	Experimental	Basic IPv6 attributes defined in RFC-3162 and listed in radius.dct are supported as native types or as regular text strings, as appropriate.
ODBC plug-Ins	Experimental	(Windows/Linux only) IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
JDBC plug-Ins	Experimental	(Windows/Linux only) IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
LDAP plug-In	Experimental	IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
RSA SecurID plug-Ins	Experimental	IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
PEAP Plug-In	Experimental	IPv6 attributes are fully supported, but the required third-party software either does not currently support IPv6 or we have not tested it.

Feature	Supported?	Comments
TLS plug-In	Experimental	IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
TTLS plug-In	Experimental	IPv6 attributes are fully supported, but the required third-party software may not support IPv6.
PAS plug-Ins	Experimental	(SPE only) IPv6 attributes are fully supported.
Concurrency plug-Ins	Experimental	(SPE only) IPv6 attributes are fully supported.
Uniprot Plug-In	Experimental	IPv6 attributes are fully supported.
3COM CCA Tunnels (deprecated)	Experimental	The use of IPv6 networking is not supported. IPv6 attributes can be processed even if IPv6 networking is not enabled.

RADIUS IPv6 Attributes

All RADIUS attributes defined in RFC 3162, RADIUS and IPv6, are supported in Steel-Belted Radius as native types or as regular text strings. All forms of attribute processing, such as checklist processing, return list processing, attribute echoing/deleting/merging, are supported. However, IPv6 prefix values and IPv6 interface values cannot be masked or wildcarded in checklist processing.

Third-party plug-ins that have not been upgraded to support IPv6 should be able to process IPv6 attributes as opaque hexadecimal strings.

Table 10 lists the attribute number, and the number of times an attribute can appear in an Access-Request, Access-Accept, Access-Reject, Access-Challenge, and Accounting-Request packets for each type of IPv6 RADIUS attribute.

Table 10: IPv6-Specific RADIUS Attributes

Attribute	Attr Num	Acc-Req	Acc-Accept	Acc-Rej	Acc-Chall	Acct-Req
NAS-IPv6-Address	95	0-1	0	0	0	0-1
Framed-Interface-Id	96	0-1	0-1	0	0	0-1
Framed-IPv6-Prefix	97	0+	0+	0	0	0+
Login-IPv6-Host	98	0+	0+	0	0	0+
Framed-IPv6-Route	99	0	0+	0	0	0+
Framed-IPv6-Pool	100	0	0-1	0	0	0-1

NAS-IPv6-Address

The NAS-IPv6-Address attribute is similar in function to the NAS-IP-Address attribute. Either attribute is sufficient to identify the IP address of the requesting RAS to the RADIUS server. If both attributes appear in the same RADIUS Access-Request packet, Steel-Belted Radius processes the NAS-IPv6-Address attribute for the purpose of identifying the RAS.

The NAS-IPv6-Address attribute may be specified by the RAS in access and accounting request packets. Zero or one NAS-IPv6-Address attributes may be specified. If present, the fixed length NAS-IPv6-Address attribute contains the complete 128-bit IPv6 address of the requesting RAS. Steel-Belted Radius allows zero or one 128-bit IPv6 address to be specified for each RAS.

The server authentication logic validates these addresses on extraction from the database and compares them with NAS-IPv6-Address attributes when they are received in access and accounting request packets. The server accounting logic writes these addresses to the accounting logs in a human readable format.

Example

Human readable:fe80::260:8ff:feff:ffff

RADIUS attribute:5f 12 fe 80 00 00 00 00 00 02 60 08 ff fe ff ff

Framed-Interface-Id

The Framed-Interface-Id attribute specifies the IPv6 interface ID to be assigned to a user. When combined with a Framed-IPv6-Prefix attribute, a single Framed-Interface-Id attribute forms one or more complete IPv6 addresses to be assigned to the user.

In general, the user is assigned the number of addresses equal to the number of Framed-IPv6-Prefix attributes, where the addresses have the same Framed-Interface-Id value and different Framed-IPv6-Prefix values.

It is possible to assign complete IPv6 addresses using only Framed-IPv6-Prefix attributes (i.e. without specifying any Framed-Interface-Id attribute). For example, in the case of PPP, it can be quite difficult to automatically generate a unique IPv6 interface ID for a given network segment, so it is recommended that the RADIUS server honor the hint if this attribute is suggested by the RAS. This is typically accomplished with echo attributes.

The Framed-Interface-Id attribute may be specified by the RAS in Access- and Accounting-Request packets, and by the RADIUS server in Access-Accept packets. Zero or one Frame-Interface-Id attributes may be specified. If present, the fixed length Framed-Interface-Id attribute contains the 64-bit interface ID to be assigned to the user.

Steel-Belted Radius allows zero or one 64-bit interface ID to be specified for each local user. The server authentication logic validates this interface ID on extraction from the database and includes the Framed-Interface-Id attribute in Access-Accept packets if none is received in the Access-Request packets.

Example

Human readable:260:8ff:feff:ffff

RADIUS attribute:60 0a 02 60 08 ff fe ff ff

Framed-IPv6-Prefix

The Framed-IPv6-Prefix attribute specifies the IPv6 networks to be assigned to a user. When combined with a Framed-Interface-ID attribute, a single Framed-IPv6-Prefix attribute forms one or more complete IPv6 addresses to be assigned to the user.

In general, the user is assigned the number of addresses equal to the number of Framed-IPv6-Prefix attributes, where the addresses have the same Framed-Interface-Id value, but different Framed-IPv6-Prefix values.

It is possible to assign complete IPv6 addresses using only Framed-IPv6 Prefix attributes (that is, without specifying any Framed-Interface-Id attribute). For example, the Framed-IPv6-Prefix attributes may be suggested by the RAS and overridden by the RADIUS server. In any case, the RAS is expected to be able to plumb the routes implied by the Framed-IPv6-Prefix attributes and these need not be repeated in separate Framed-IPv6-Route attributes.

The Framed-IPv6-Prefix attribute may be specified by the RAS in Access- and Accounting-Request packets, and by the RADIUS server in Access-Accept packets. Zero or more Framed-IPv6-Prefix attributes may be specified. If present, the variable-length Framed-IPv6-Prefix attribute contains an IPv6 prefix from 0 to 128 bits in length. Extra bits beyond the actual prefix length must be set to 0.

Steel-Belted Radius allows zero or more variable-length IPv6 prefixes to be specified for each local user or attribute profile. The server authentication logic validates these prefixes on extraction from the database and includes the proper number of Framed-IPv6-Prefix attributes in Access-Accept packets if none are received in the access request packets. The server accounting logic writes these prefixes to the accounting logs in a human readable format.

Example

Human readable:fe80::260:8ff:feff:ffff/10

RADIUS attribute:61 14 00 0a fe 80 00 00 00 00 00 00 00 00 00 00 00 00 00

(8-bit type) (8-bit length)

(8-bit zero) (8-bit prefix length) (128-bit IPv6 prefix)

Login-IPv6-Host

The Login-IPv6-Host attributes specify the IPv6 addresses of the systems with which the user is connected when the Login-Service attribute is also included. The Login-IPv6-Host attribute may be suggested by the RAS and overridden by the RADIUS server.

The Login-IPv6-Host attribute may be specified by the RAS in access and accounting request packets, and by the RADIUS server in Access-Accept packets. Zero or more Login-IPv6-Host attributes may be specified. If present, the fixed length Login-IPv6-Host attribute contains the complete 128-bit IPv6 address of the login host, or a special value:

- 128-bits set to 0 indicates that the RAS should select the login host for the user.
- 128-bits set to 1 indicates that the RAS should allow the user to select the login host.
- Other values indicate the actual 128-bit IPv6 address of the login host.

Steel-Belted Radius allows zero or more 128-bit IPv6 addresses (including special values) to be specified for each local user or attribute profile. The server authentication logic validates these addresses (including special values) on extraction from the database and includes the proper number of Login-IPv6-Host attributes in Access-Accept packets if none are received in the access request packets. The server accounting logic writes these addresses to the accounting logs in a human readable format.

Example

Human readable:fe80::260:8ff:feff:ffff

RADIUS attribute:62 12 fe 80 00 00 00 00 00 00 02 60 08 ff fe ff ff ff

Framed-IPv6-Pool

The Framed-IPv6-Pool attribute specifies the name of a RAS managed pool (as opposed to a RADIUS server managed pool) from which the RAS should assign an IPv6 prefix to the user. The Framed-IPv6-Pool attribute may not be suggested by the RAS and is always determined by the RADIUS server.

The Framed-IPv6-Pool attribute may be specified by the RAS in Accounting-Request packets, and by the RADIUS server in Access-Accept packets. Zero or one Framed-IPv6-Pool attributes may be specified. If present, the variable-length Framed-IPv6-Pool attribute contains the name of a RAS managed pool in human readable text. The text is not NULL terminated.

Steel-Belted Radius allows zero or one variable length pool name to be specified for each local user. The server authentication logic validates the pool name on extraction from the database and includes the proper number of Framed-IPv6-Pool attributes in Access-Accept packets. The server accounting logic writes these pool names to the accounting logs in a human readable format.

Example

Human readable:ipv6-pool

RADIUS attribute:64 0b 69 70 76 36 2d 70 6f 6f 6c

Framed-IPv6-Route

The Framed-IPv6-Route attribute specifies the IPv6 routing information to be configured for the user on the RAS. The RAS is expected to be able to plumb the routes specified by the Framed-IPv6-Route attributes in addition to those that may already be implied by separate Framed-IPv6-Prefix attributes. The Framed-IPv6-Route attribute may not be suggested by the RAS and is always determined by the RADIUS server.

The Framed-IPv6-Route attribute may be specified by the RAS in accounting request packets, and by the RADIUS server in Access-Accept packets. Zero or more Framed-IPv6-Route attributes may be specified. If present, the variable-length Framed-IPv6-Route attribute contains IPv6 routing information in human readable text. The text is not NULL terminated. The format of the text (destination prefix, gateway address, metrics) is described in RFC- 3162.

Steel-Belted Radius allows zero or more variable-length IPv6 routes to be specified for each local user or attribute profile. The server authentication logic validates these routes on extraction from the database and includes the proper number of Framed-IPv6-Route attributes in Access-Accept packets. The server accounting logic writes these routes to the accounting logs in a human readable format.

Example

Human readable:2000:0:0:106::/64 2000::106:a00:20ff:fe99:a998 1

RADIUS attribute:63 32 32 30 30 30 3a 30 3a 30 ... 39 3a 61 39 39 38 20 31

Enabling IPv6 Networking

To enable IPv6 networking in Steel-Belted Radius, you must modify the radius.ini file and then restart your Steel-Belted Radius server. For information on the settings in the radius.ini file, refer to the Steel-Belted Radius Reference Guide.



Note: Steel-Belted Radius can process IPv6 attributes even if IPv6 networking is not enabled, provided that the IPv6 attributes are described in the RADIUS dictionary files.

Configuring IPv6 Scope IDs

Some types of IPv6 addresses requires an IPv6 scope ID to avoid address ambiguity. In some cases, the Steel-Belted Radius server can select a scope ID automatically.

The [IPv6] section of the radius.ini file can specify how scope IDs are selected for each IPv6 address type that is recognized by the server. If the parameter value is 0, the Steel-Belted Radius server selects a scope ID automatically. If the parameter value is not 0, then the Steel-Belted Radius server uses that value as the scope ID when establishing network connections involving that IPv6 address type.



Note: You can use the output of the **ifconfig -a/ip a** shell command on Linux platforms, and the output of the **ipconfig /all** shell command on Windows platforms (ipv6 if on Windows XP platforms) to determine the proper host specific scope ID for an address type. The scope ID is identical to the interface index on which the address type is supported and on which the desired destinations are reachable. On Linux platforms, the server accepts traditional interface names, such as hme0, instead of numeric scope IDs.

Configuring IPv6 Addresses for RADIUS Client Connections

You can configure the [Addresses] section of the radius.ini file if you want to specify the local address or addresses on which Steel-Belted Radius listens for RADIUS client connections. By default, Steel-Belted Radius automatically discovers and configures all available IPv4 interfaces on the local host. If IPv6 is enabled, Steel-Belted Radius discovers and configures both IPv4 and IPv6 interfaces.

You can configure Steel-Belted Radius to configure IPv4 automatically by entering **AutoConfigureIPv4** in the [Addresses] section. Similarly, you can configure Steel-Belted Radius to configure IPv6 automatically by entering **AutoConfigureIPv6** in the [Addresses] section. If you configure specific IPv4 or IPv6 addresses, Steel-Belted Radius listens for RADIUS traffic on only those interfaces.

The IPv6 unspecified address :: allows connections on any IPv6 address or IPv4 address, with IPv4 connections represented as IPv6 IPv4 mapped addresses. Because IPv6 IPv4 mapped addresses are not currently supported by the Windows IPv6 protocol stack, you must enter the IPv4 unspecified address 0.0.0.0 with the IPv6 unspecified address :: to approximate the desired behavior on Windows platforms.

Configuring DNSv6 Support


Enabling Domain Name Service Version 6 (DNSv6) support lets Steel-Belted Radius communicate with a DNSv6 server to resolve host names. By default, Steel-Belted Radius uses DNS unless IPv6 is enabled and DNSv6 support is configured by means of the DynamicNameResolution parameter in the [IPv6] section of the radius.ini file.

- If DynamicNameResolution is set to 0, Steel-Belted Radius uses IPv4 DNS, which means it does not query DNSv6 services.
- If DynamicNameResolution is set to 1, Steel-Belted Radius uses IPv6 DNS (DNSv6), which means it does not query IPv4 DNS services and ignores IPv4-specific information returned by DNSv6 services.
- If DynamicNameResolution is set to 2, Steel-Belted Radius queries DNSv6 services for IPv6-specific information, and then queries IPv4 DNS services for IPv4 specific information if DNSv6 fails to resolve a host name.

Chapter 3

Using SBR Administrator

This chapter presents an overview of how to use the SBR Administrator, which is a Java-based application that lets you configure settings for Steel-Belted Radius. In minutes, you can set up new users, alter standard profiles, or configure new network access devices from any computer on the network.

 **Note:** Administrators making large-scale changes to the Steel-Belted Radius database might prefer to use the LDAP command line interface. See “[LDAP Configuration Interface](#)”.

Launching SBR Admin GUI

The SBR Admin GUI can be launched using the Internet Explorer version 8.0 and above or the latest version of Mozilla Firefox.

Before you launch, prepare the system by:

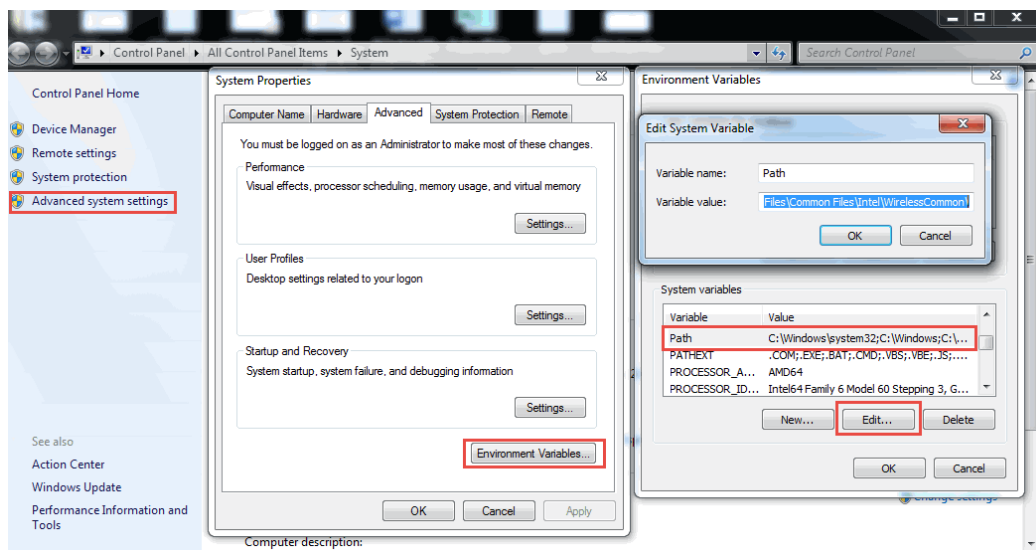
1. Installing Java for SBR Admin
2. Enabling Java Runtime Environment on Internet Explorer Browser (ActiveX deprecated)
3. Enabling Java on Mozilla Firefox Browser for Java Applet

You can launch Admin GUI of SBR 6.1.7 and SBR 6.2/above on the same machine. For detailed procedure, see [Launching Admin GUI of SBR 6.1.7 and SBR 6.2/above on the same Machine](#).

Installing Java for SBR Admin

SBR Admin supports any 32 bit version of JRE (Java 7_u79 or above). For improved security, it is recommended to install Java 8.

Figure 8: IP Address Pools in a Replication Environment



Windows maintains a registry which holds Java PATH and updates it when Java is installed. If for any reason the java path is not set, then set the bin path of JRE to System Environmental Variable "PATH".

If there are more than one version of JRE installed in the system, then set the Java path that should be used for SBR GUI in the System Environmental variables as the first one among all installed Java versions.

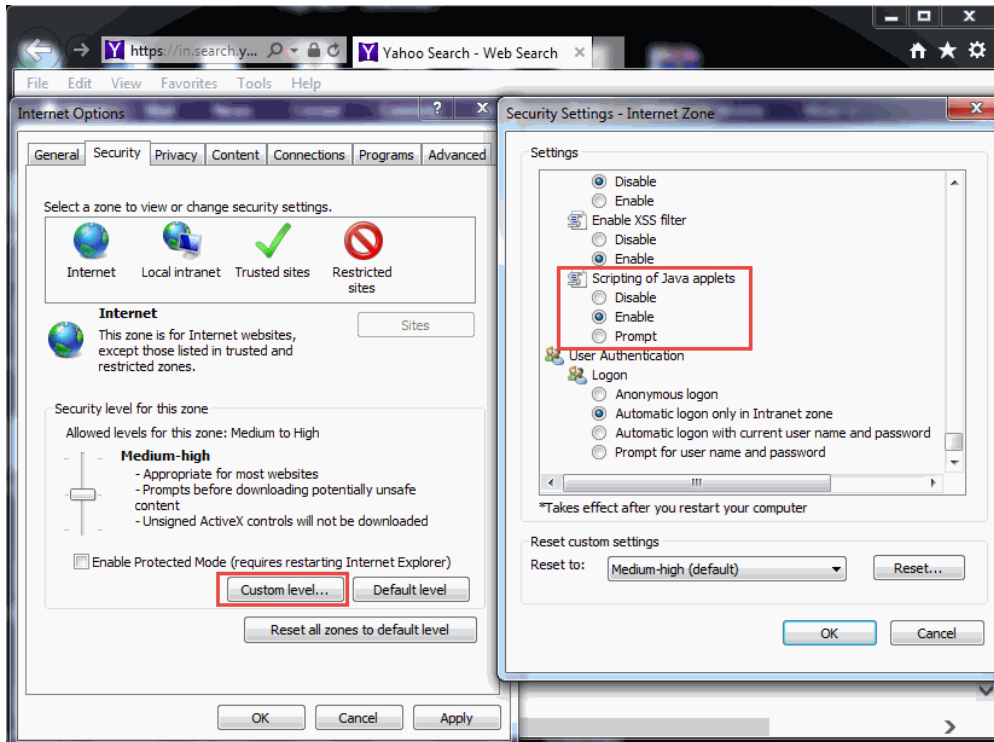
Enabling Java Runtime Environment on Internet Explorer Browser (ActiveX deprecated)

Internet Explorer browser versions 8 and above does not support ActiveX. Though ActiveX is deprecated on IE8, it is not disabled on Windows 7 system. So ActiveX would work for IE8 on Windows7 and older operating systems.

To enable Java on IE8 and above on Windows 8 and later:

1. Open **Internet Explorer**.
2. On the **Tools** menu, select **Internet Options**.
3. In the Internet Options window, select the **Security** tab, and click the **Custom Level** button.
4. In the Security Settings window, scroll down to the **Scripting of Java applets** setting.

Figure 9: Internet Options in IE 8



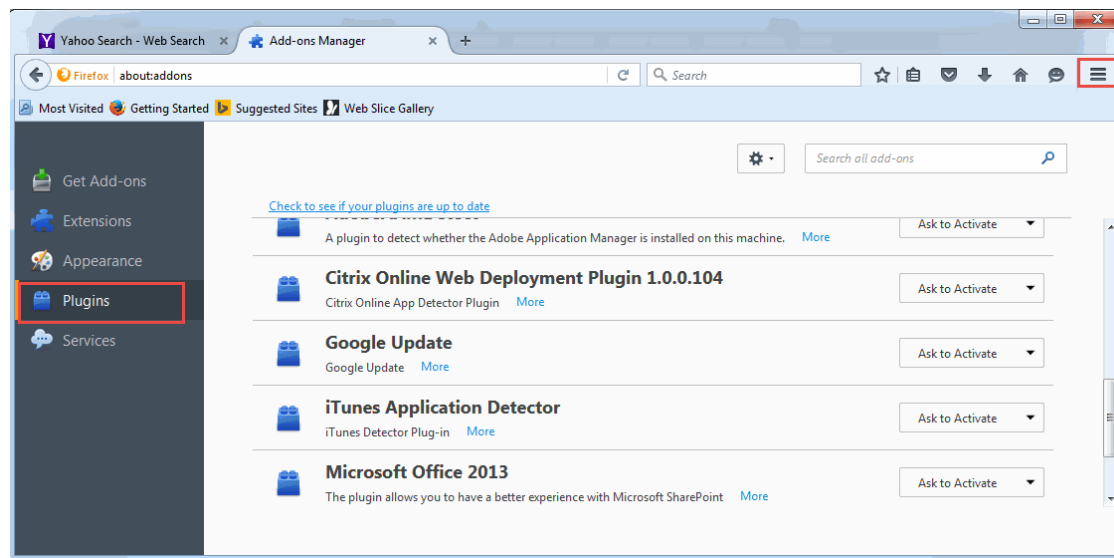
5. Make sure the **Enable** radio button is selected.
6. Click **OK** to save the setting.

Enabling Java on Mozilla Firefox Browser for Java Applet

Ensure you have installed the latest version of Mozilla Firefox.

1. Install JRE 32 bit (64 bit is not supported).
2. Verify if JRE plugin is installed and enabled for Firefox by selecting Add-ons -> Plugins.

Figure 10: Plugins in Firefox



3. Select **Ask to Activate** or **Always Activate** if it is not enabled.

Launching Admin GUI of SBR 6.1.7 and SBR 6.2/above on the same Machine

Deployment of SBR admin GUI has been changed in SBR 6.2 for supporting latest version of java so that the UI is more interactive and visible.

The following issues are observed when both versions of admin GUI are launched on the same machine:

- Conflict between deployer of SBR admin 6.1.7 and SBR 6.2 on Internet Explorer.
- SBR admin 6.1.7 did not launch on Firefox.

For the first issue on IE, see the work around in section “Clearing Cache Directories while Launching New GUI”.

For the second issue on Firefox, back merge the fix from SBR 6.2 to SBR 6.1.7.

To launch SBR 1.7 and 6.2 Admin GUI on the same machine, it is also recommended to use IE browser for SBR 6.1.7 and Firefox for SBR 6.2.

Clearing Cache Directories while Launching New GUI

Due to the changes to the deployment files in SBR 6.2, the older files present in the system will lead to conflict of files.

To clear the cache:

1. Close Internet Explorer.
2. Delete following files for ActiveX deployment:
 - C:\Windows\Downloaded Program Files\deploy.dll
 - C:\Windows\Downloaded Program Files\deploy.inf
 - C:\Windows\Downloaded Program Files\deployer.exe

Running the SBR Administrator

You start the SBR Administrator by running a browser and opening a connection to the Steel-Belted Radius server you want to configure.

To log into a Steel-Belted Radius server:

1. Open a browser connection to the Steel-Belted Radius server you want to administer.
 - To administer a Steel-Belted Radius server running on your local host, enter `http://localhost:port/`, where port is the TCP port on which the server is listening for administration connections. For example, to open a connection on a local host listening on port 1812, use the following URL:

`http://localhost:1812/`

- To administer a Steel-Belted Radius server running on a remote host, enter `http://server:port/`, where server is the DNS name or IPv4/IPv6 address of the server, and port is the TCP port on which the server is listening for administration connections. For example, to open a connection on a remote host at IP address 192.168.24.15 listening on port 1812, use the following URL, where ipaddress is the IP address or DNS name of the remote server:

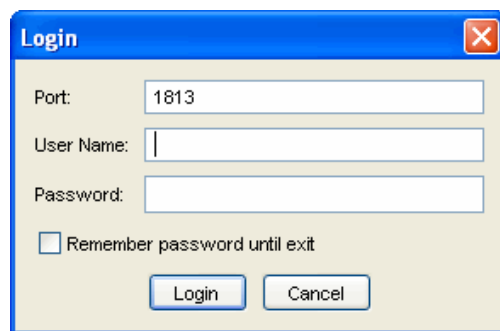
`http://192.168.24.15:1812/`

When the Steel-Belted Radius Administrator page opens, click the Launch link to download and start the SBR Administrator.

2. When the Login dialog (Figure 11) opens, specify the TCP port you want to use for communication between SBR Administrator and the Steel-Belted Radius server.

The value you enter in the Port field must match the value specified in the `SecureTcpAdminPort` parameter in the [Ports] section of the `radius.ini` file on the Steel-Belted Radius server. The default value is 1813.

Figure 11: Login Dialog



1. Enter your administrator username in the **User Name** field.
2. Enter your login password in the **Password** field.
3. Click **Login**.

When you click Login, SBR Administrator establishes an HTTPS connection with the local or remote server. If it cannot establish a connection in 10 seconds, SBR Administrator times out and displays an error message.

Note: If a timeout occurs, verify that the Steel-Belted Radius service/daemon is running on the target server and that it is listening on the administration port you are specifying in the Login dialog.

SBR Administrator verifies that the username you entered is present in the `access.ini` file. If the username is found, SBR Administrator validates the password you entered against a local or remote password database.

When you connect to a server, the Status panel lists various features of the running server, such as version, platform on which it is running, IP address, available authentication methods, license information, and any initialization errors that might have occurred.

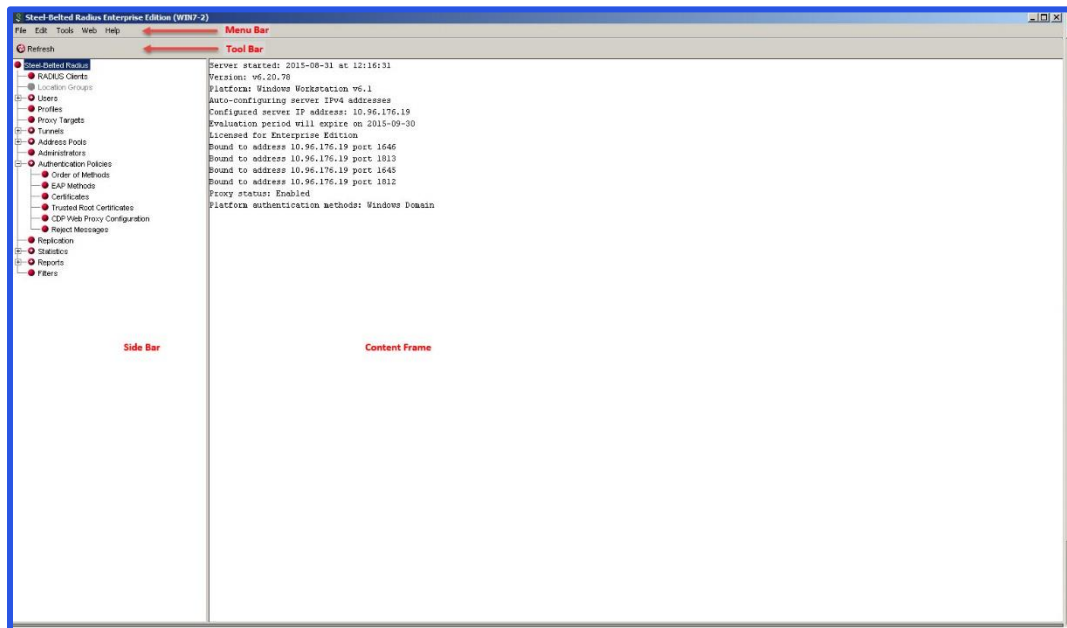
Navigating in SBR Administrator

This section describes how to use the SBR Administrator panels, menus, dialogs, and toolbar.

SBR Administrator Panels

SBR Administrator uses a series of framed windows (panels) to configure server settings and display statistics and logs in SBR Administrator. Figure 12 illustrates the components of an SBR Administrator panel. To display a panel, you click an entry in the Sidebar. SBR Administrator displays the specified panel in the Content frame.

Figure 12: SBR Administrator Panel Layout



SBR Administrator Sidebar

You use the entries in the sidebar in the SBR Administrator to select which panel you want to display; for example, to display the **RADIUS Clients** panel, you click Radius Clients in the sidebar.

Some entries in the sidebar are expandable. For example, when you click the **Users** entry in the sidebar, the entry displays subentries such as **Local** and **Domain**.

SBR Administrator Menus

The SBR Administrator has four menus: File, Edit, Web, and Help.

File Menu

Table 11 describes the functions of each entry in the File menu in the SBR Administrator.

Table 11: File Menu Options

Menu Entry	Function
License	Opens the Add a License for Server dialog, which lets you add a license string for your Steel-Belted Server software. For more information, see “Adding License Keys” .
Import	Opens the Import dialog, which lets you import information from an XML file into the Steel-Belted Radius database. The Import dialog is described in Appendix E , “Importing and Exporting Data.”
Export	Opens the Export dialog, which lets you export selected information from the Steel-Belted Radius to an XML file. The Export dialog is described in Appendix E , “Importing and Exporting Data.”
Backup/Restore	Opens the Backup/Restore dialog, which lets you back up the Steel-Belted Radius database to an archive file or restore Steel-Belted Radius from an archive file. The Backup/Restore dialog is described in xref.
Login	Opens the Login dialog, which lets you log in to a Steel-Belted Radius server. The Login dialog is described in “Running the SBR Administrator” . The Login menu entry is dimmed if you are logged into a Steel-Belted Radius server.
Logout	Terminates your connection to a Steel-Belted Radius server. The Logout menu entry is dimmed if you are not logged into a Steel-Belted Radius server.
Exit	Exits the Steel-Belted Radius application.

Edit Menu

Table 12 describes the functions of each entry in the Edit menu in the SBR Administrator.

Table 12: Edit Menu Options

Menu Entry	Function
Cut	Deletes an existing object from the Steel-Belted Radius database and copies its information to the Clipboard. Active only when an object is selected in an SBR Admin panel.
Copy	Copies the selected object from the Steel-Belted Radius database to the Clipboard. Active only when an object is selected in an SBR Admin panel.
Paste	Pastes an object from the Clipboard to the Steel-Belted Radius database. Active only after a Cut or Copy command has been used.
Delete	Deletes an object from the Steel-Belted Radius database.

Tools Menu

Table 13 describes the function of the entry in the Tools menu in the SBR Administrator.

Table 13: Tools Menu Options

Menu Entry	Function
Options	Opens the Options dialog, which lets you specify whether you want Steel-Belted Radius to refresh configuration data automatically.

Web Menu

Table 14 describes the functions of each entry in the Web menu in the SBR Administrator.

Table 14: Web Menu Options

Menu Entry	Function
Steel-Belted Radius Home Page	Opens the support page for Steel-Belted Radius in a browser window. This page lets you review product information, download documentation and technical notes, and access other resources.
Pulse Secure Home Page	Opens the home page for Pulse Secure (https://www.pulsesecure.net/) in a browser window.

Help Menu

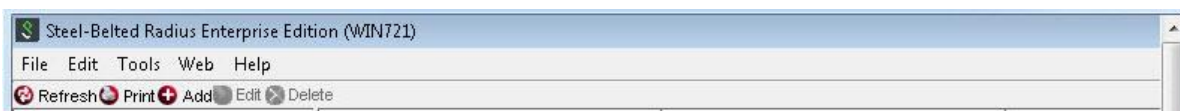
Table 15 describes the functions of each entry in the Help menu in the SBR Administrator.

Table 15: Help Menu Options

Menu Entry	Function
Contents	Opens the online help for the SBR Administrator
About	Displays the About SBR Administrator dialog, which lists version information for the SBR Administrator. For more information, see “ Displaying Version Information ”.

SBR Administrator Toolbar

After you log into Steel-Belted Radius, you can use the toolbar to manipulate SBR Administrator objects, such as users or RADIUS clients. The buttons on the SBR Administrator toolbar change when you change panels to provide buttons appropriate for your current context.

Figure 13: SBR Administrator Toolbar**Table 16: SBR Administrator Toolbar**

Toolbar Button	Function
Refresh	Refreshes the displayed list of items in the SBR Administrator dialog.
Print	Prints the contents of the active panel.
Add	Adds an object to the Steel-Belted Radius database.
Edit	Edits an existing object in the Steel-Belted Radius database. Active only when an object is selected in the active panel.
Delete	Deletes an existing object from the Steel-Belted Radius database.
Apply	In the Order of Methods dialog, applies any changes you have made to the authentication policy settings.
Reset	Restores the default values for controls in the active panel.
Clear (System Statistics only)	Resets statistics other than Server Up Time to zero.
Search (Filters only)	Opens the Search Filters window, which is described in “Searching the Filter List” .
EAP Setup (Order of Methods panel only)	Opens the EAP Setup dialog, which lets you specify the active EAP methods that will be used for an authentication method. For more information, see “Configuring EAP Settings” .

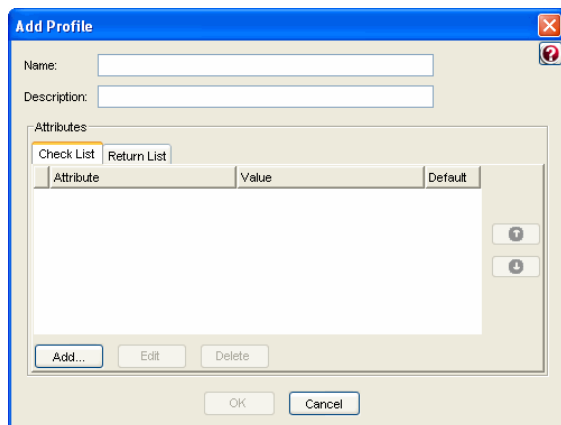
SBR Administrator Dialogs

This section summarizes how to use SBR Administrator dialogs and controls.

Adding an Entry

To add an entry to the Steel-Belted Radius database, open the appropriate panel and click the **Add** button on the SBR Administrator toolbar. The SBR Administrator displays an Add dialog (Figure 14).

Figure 14: Sample Add Dialog




Every object of the same type must have a unique name. If the name you assign to an item is already being used

by another item of the same type, the SBR Administrator displays a warning.

Editing an Entry

To edit an existing entry to the Steel-Belted Radius database, open the appropriate panel and double-click the item you want to change (or select the item and click the **Edit** button on the SBR Administrator toolbar). The SBR Administrator displays the settings for the item you selected in an Edit dialog. The **Save** button remains disabled until the contents of a field in the Edit dialog changes.

 **Note:** You cannot change the name associated with an item in an Edit dialog. To change an item's name, you must cut/paste the item and assign it the name you want it to have.

Cutting/Copying/Pasting Records

When you select an item from a panel displaying tables of items, you can choose **Edit > Cut** or **Edit > Copy** to cut or copy the item to the Clipboard, and then add a new record to the display by pasting it from the Clipboard by choosing **Edit > Paste**.

The Clipboard can contain one item of each type (RADIUS client, user, etc.) If you copy an item to the Clipboard and then copy another item of the same type, the information for the second item overwrites the information for the first item. Clipboard contents are preserved until you exit the SBR Administrator.

Resizing Columns

You can resize columns in an SBR Administrator table by dragging the column header boundary to the left or right.

Changing Column Sequence

You can change the sequence of columns in an SBR Administrator table by dragging the column headers left and right.

Sorting Information

By default, items in SBR Administrator tables are sorted by Name. You can sort items in any order by clicking a column header.

Previously sorted tables retain their order when the table is sorted on another column. If you want to sort a table by more than one column (for example, sort by address pool and sub-sort by IP address), click the least-significant column (here, IP Address), and then click the more significant columns (here, Address Pool).

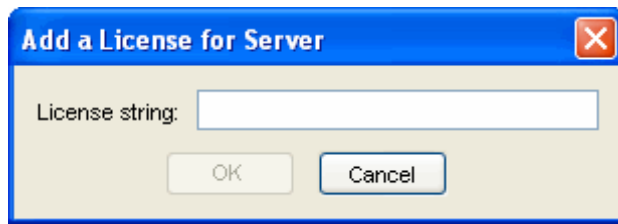
Adding License Keys

Depending upon your purchasing arrangements, your Steel-Belted Radius software might require a new license key at some point after its initial installation.

If you are provided with a new license key by your reseller or by Steel-Belted Radius, you can add the key to an existing Steel-Belted Radius installation as follows:

1. Start the SBR Administrator program and connect to your Steel-Belted Radius server.
2. Select **File > License**.
3. When the Add a License for Server dialog (Figure 15) appears, enter the license key and click **OK**.

Figure 15: Add a License for Server Dialog



If the license key you have entered is invalid, the server displays an error message. If this occurs, click **OK** in the message dialog and enter the correct license key.

4. After you have entered a valid license key, the server displays a confirmation message and reminds you that you must restart the server. Click **OK**.

The server does not restart itself automatically after a new license key is added. You must restart Steel-Belted Radius manually to activate the new license key.

Note: The Steel-Belted Radius audit log does not record an entry when you enter license keys through SBR Administrator.

Accessing Online Help

To get help with the SBR Administrator, click the ? (help) button, press F1, or select **Help > Contents**.

Displaying Version Information

To identify the current version of the SBR Administrator, select **Help > About** to open the SBR Administrator dialog (Figure 16).

Figure 16: About SBR Administrator Dialog



Exiting the SBR Administrator


To exit the SBR Administrator, choose **File > Exit**.

Closing the SBR Administrator has no impact on the Steel-Belted Radius service or daemon.

Chapter 4

Using Web Graphic User Interface (GUI)

WebGUI is an application that enables you to configure settings for SBR Enterprise using a web browser. This chapter presents an overview of how to use the WebGUI to configure Steel Belted Radius Server.

 **Note:** Administrators making large-scale changes to the SBR Enterprise Server database might prefer to use the LDAP command line interface. For more information, see [LDAP Configuration Interface](#).

Running the WebGUI

You launch the WebGUI by running a web browser on your management workstation and opening a connection to the SBR Enterprise server which you want to configure. The WebGUI is designed to support any Web 2.0 browser.

A Hypertext Transfer Protocol over Secure Sockets Layer (HTTPS) connection is established between the web browser in the management workstation and SBR Enterprise Server. This connection is used to communicate configuration data to the server.

 **Note:** Steel Belted Radius server must be running to use WebGUI.

For information on starting the RADIUS server, refer “Starting the Steel-Belted Radius Server” section in the Install and Upgrade Guide.

While using HTTPS, SBR Enterprise provides a Secure Sockets Layer (SSL) certificate to prove its identity and requires credentials when accessing the server. The SSL certificate is self-generated inside the Java Web Server or you can provide a custom SSL certificate by configuring path and password in the application.properties file. For more information, refer to Appendix H - Use Custom SSL Certificate for Launching SBR-E Web UI.

To log in to a SBR Enterprise server:

1. Open a browser connection to the SBR Enterprise server you want to administer:
 - a. To administer a SBR Enterprise server running on your local host, enter <https://localhost:1810/sbweb/login.html>, where the port assignment of 1810 is the SBR Enterprise's default TCP port for administration connections through WebGUI.
 - b. To administer a SBR Enterprise server running on a remote host, enter <https://server:1810/sbweb/login.html>, where the port assignment of 1810 is the SBR Enterprise's default TCP port for administration connections through WebGUI.
For example: <https://192.168.24.15:1810/sbweb/login.html>

 **Note:** You must access the WebGUI using HTTPS instead of HTTP.

2. The Login page appears as

Figure 17: Login Page

3. Enter your administrator username in the **Username**.
4. Enter your login password in the **Password**.
5. Click **Sign-In**.

When you click **Sign-In**, WebGUI establishes an HTTPS connection with the local or remote server. The WebGUI displays an error message if the connection cannot be established.

When you connect to a server, the Home page displays the list of status of the running server, IP addresses, available authentication methods, license information and any initialization errors that might have occurred.

Tested Browsers

WebGUI can be launched in different browsers across different platforms. The following table describes the tested browser versions and the operating systems.

Table 17: WebGUI – Tested Browsers

Browser	Version	Operating System
Google Chrome	73	Windows
Opera	60	Windows
Mozilla Firefox	66	Windows
Edge	42	Windows

Navigating in the WebGUI

This section describes how to use the WebGUI menus and pages.

WebGUI Menus

The WebGUI has following five menus:

- System

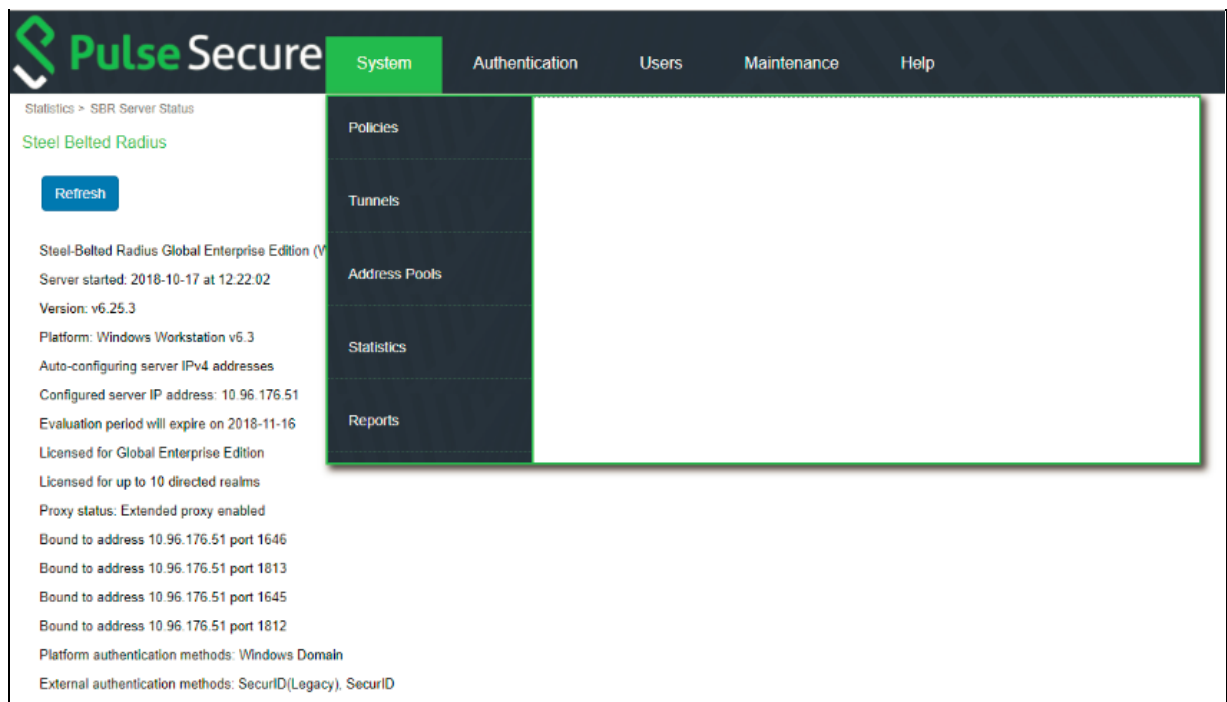
- Authentication
- Users
- Maintenance
- Help

1. System Menu

The System Menu is logically grouped to contain the following:

- Policies
- Tunnels
- Address Pools
- Statistics
- Reports

Figure 18: System Menu

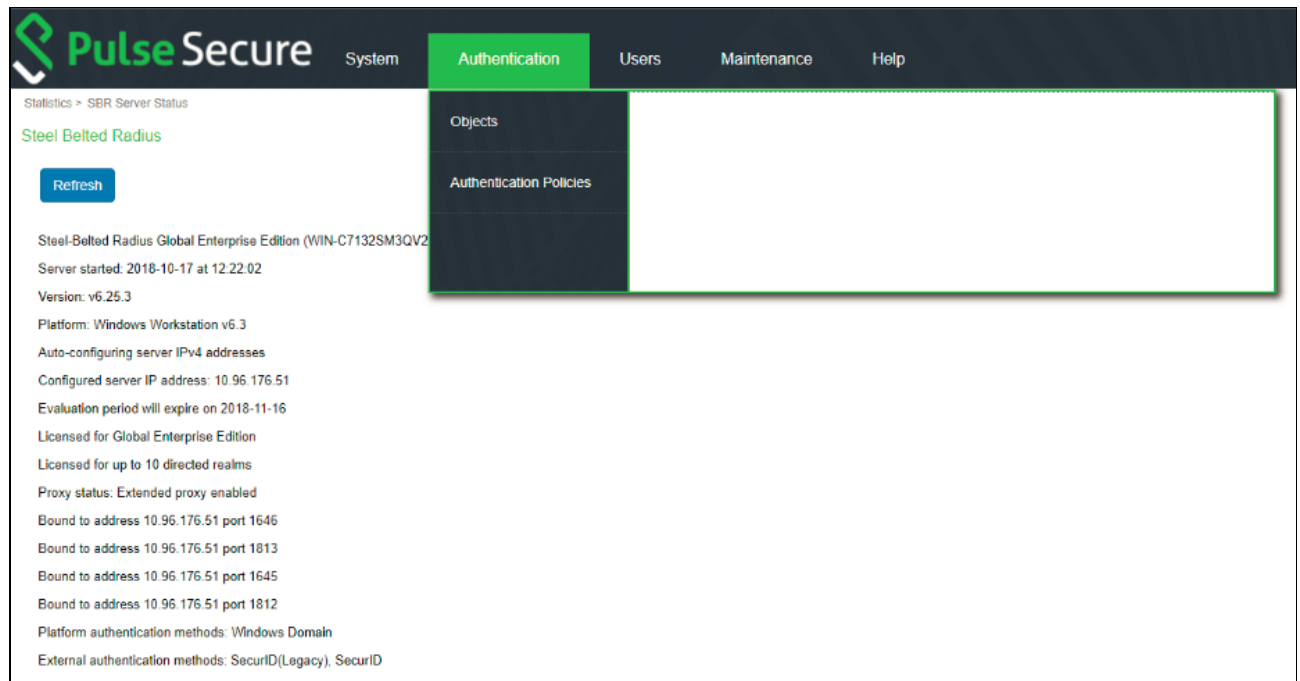


2. Authentication Menu

The System Menu is logically grouped to contain the following:

- Objects
- Authentication Policies

Figure 19: Authentication Menu

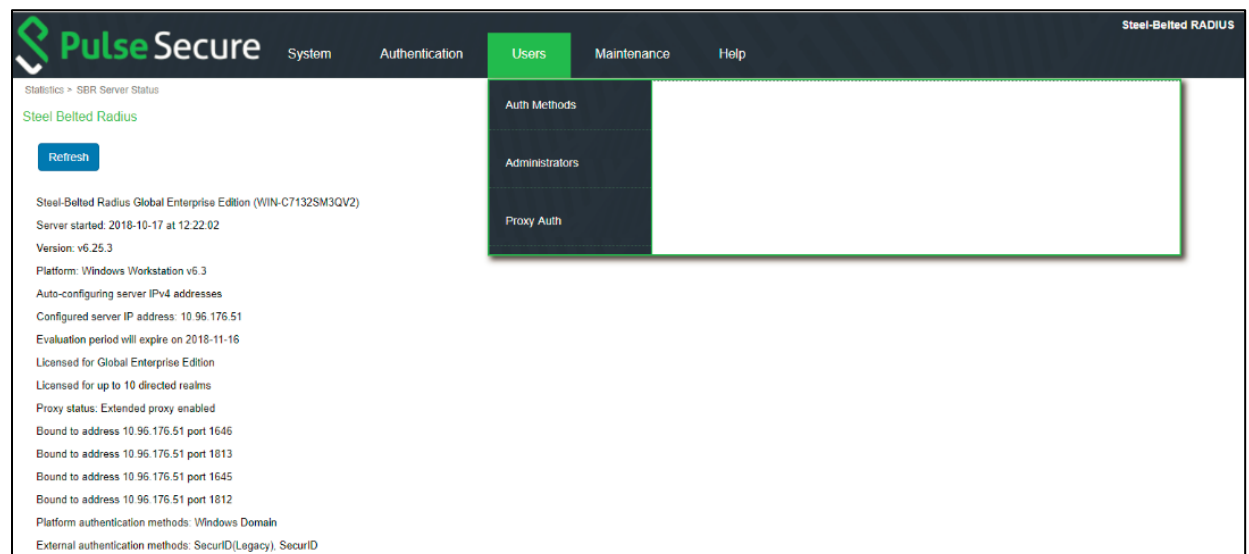


3. Users Menu

The System Menu is logically grouped to contain the following:

- Auth Methods
- Administrators
- Proxy Auth

Figure 20: User Menu

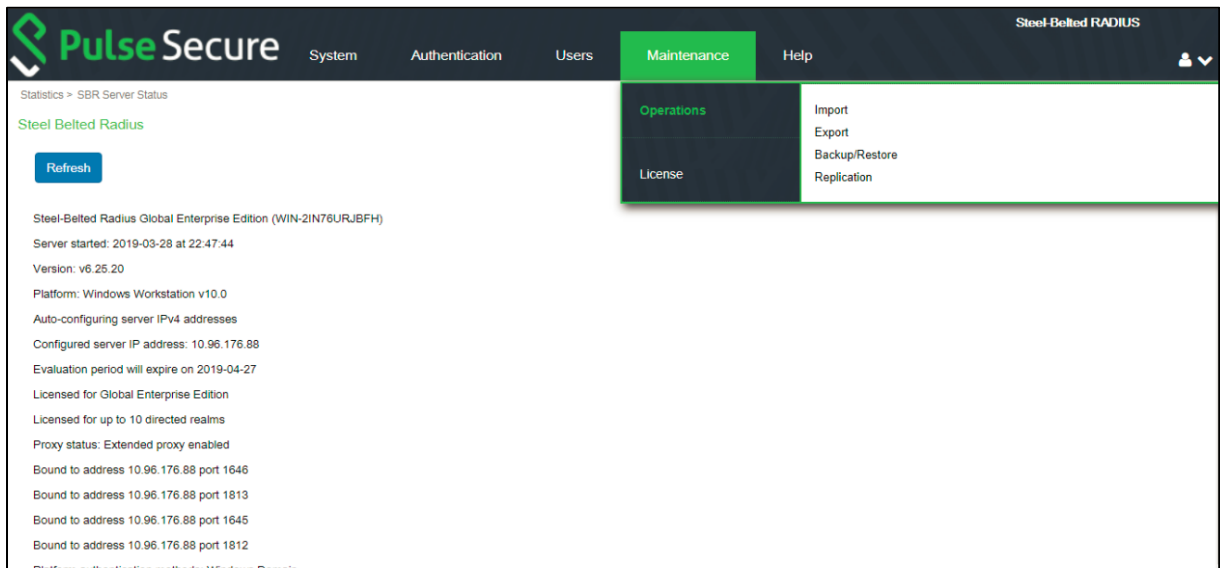


4. Maintenance Menu

The System Menu is logically grouped to contain the following:

- Operations
- Licensing

Figure 21: Maintenance Menu



WebGUI Pages

This section summarizes how to use WebGUI pages and controls.

1. Adding an Entry

To add an entry to the SBR Enterprise database, open the appropriate WebGUI page and click **New**. The WebGUI page displays the Add page.

Figure 22: Adding an Entry

 The screenshot shows the 'Add IP Address Pool' page in the Pulse Secure web interface. The page has a dark header with the Pulse Secure logo and navigation tabs for 'System', 'Authentication', 'Users', 'Maintenance', and 'Help'. The breadcrumb trail is 'Address Pools > Add IP Address Pool'. The main form includes:

- Name:** A text input field.
- Description:** A text input field.
- Address Ranges:** A section with a green arrow icon and the text 'Address Ranges'.
- Starting Address:** A text input field.
- Size:** A text input field.
- Buttons:** At the bottom, there are four buttons: 'Add', 'Edit', 'Delete', and 'OK'. Below these are two more buttons: 'OK' and 'Cancel'.

2. Editing an Entry

To edit an entry to the SBR Enterprise database, open the appropriate WebGUI page and click **Edit**. The WebGUI page displays the Edit page.

Figure 23: Editing an Entry

Pulse Secure System Authentication Users Maintenance Help

Address Pools > Edit IP Address Pool

Edit IP Address Pool

Name: ADDRESS POOL

Description: Description - IP Pool

▼ Address Range

Starting Address	Size
10.1.1.1	100

Add Edit Delete

OK Cancel

3. Deleting an Entry

To delete an entry to the SBR Enterprise database, open the appropriate WebGUI page and click **Delete**. The WebGUI page displays the Delete page.

Figure 24: Deleting an Entry

Pulse Secure System Authentication

Address Pools > IP

IP

Refresh New Delete Edit

Name

ADDRESS POOL 1

Addr Pool - 20 network

Confirm Delete

Delete the selected item?

Yes No

Adding License Keys

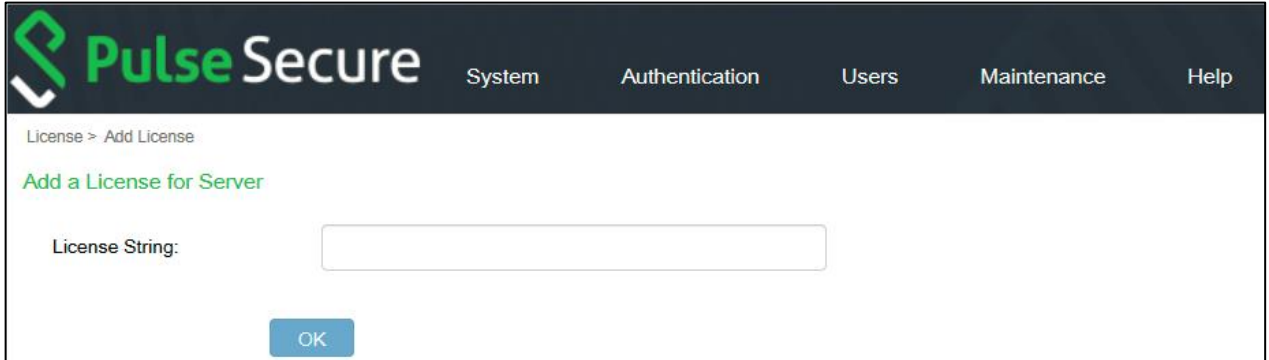
Your SBR Enterprise software may require a new license key at some point after its initial installation, Depending upon your purchasing arrangements.

If you are provided with a new license key, you can add the key to an existing SBR Enterprise

installation as follows:

1. Start the WebGUI program and connect to your SBR Enterprise server.
2. Select **Maintenance > License > Add License**.
The License Registration page appears.

Figure 25: License Registration



The screenshot shows the Pulse Secure web interface. The header is dark blue with the Pulse Secure logo on the left and navigation tabs: System, Authentication, Users, Maintenance, and Help. Below the header, the breadcrumb 'License > Add License' is displayed. The main content area is titled 'Add a License for Server' in green. It contains a text input field labeled 'License String:' and an 'OK' button.

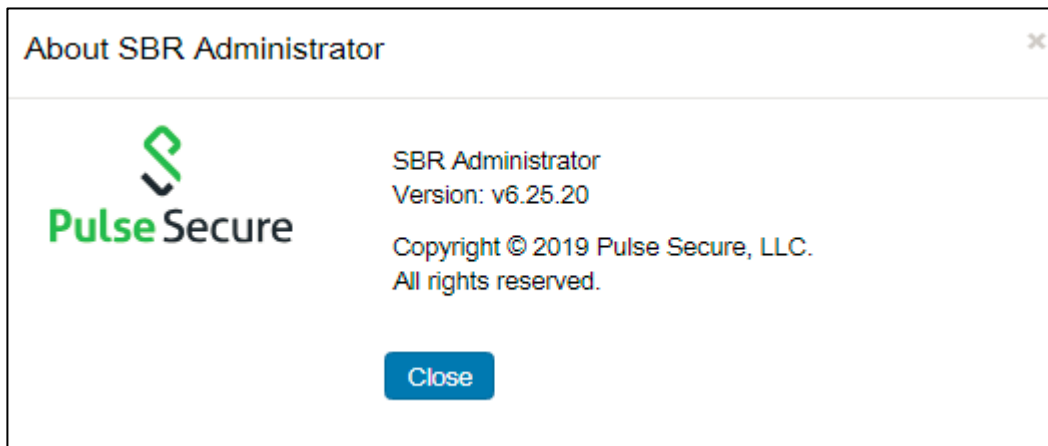
3. Enter the license key in the **License String**.
4. Click **OK**.
If the entered license key is invalid, the server displays an error message.
Click **OK** in the message dialog box and enter the valid license key.
5. SBR server displays a confirmation message.
6. Click **OK**.

- Note:** The server does not restart automatically once a new license key is added.
 - You must restart Steel Belted Radius Server manually to activate the new license key.
For more information, refer to [When to Stop and Restart Steel-Belted Radius Enterprise Server](#).
 - Refresh and log in again to the WebGUI running on the management workstation to reflect the changes.
- Note:** The SBR Enterprise audit log does not record an entry when you enter license keys through WebGUI.

Displaying Version Information

To identify the current version of SBR Administrator, select **Help > Home Page > About to open the SBR Administrator Dialog**. Refer to the following figure:

Figure 26: About SBR Administrator



Exiting the WebGUI

To close the WebGUI,

1. Click **Logout**.
2. Close the WebGUI browser.

 **Note:** Closing the WebGUI has no impact on the SBR Enterprise daemon.

Chapter 5

Administering RADIUS Clients via Legacy SBR Administrator

This chapter describes how to set up RADIUS clients and client groups via SBR administrator.

A RADIUS client is a network device or software application that contacts Steel-Belted RADIUS when it needs to authenticate a user or to record accounting information about a network connection.

A RADIUS client group is a collection of network devices or software applications that contacts Steel-Belted Radius to authenticate a user or to record accounting information about a network connection. Members of a RADIUS client group use a contiguous range of IP addresses and use identical settings, such as a shared secret or an IP address pool.

IPv4 – IPv6 Dual stack support for RADIUS clients: two IP addresses can be configured for a RADIUS client; one with IPv4 and another with IPv6. User can add the IP addresses in the “Add RADIUS Client” UI.

Note: If RADIUS client is in IPv6 network, then ensure that IPv6 Networking is enabled in Steel-Belted RADIUS Server. For information on the settings in the radius.ini file, refer to the Steel-Belted RADIUS Reference Guide.

RADIUS Clients Panel

The RADIUS Clients panel lets you identify the devices that you want to define as clients of Steel-Belted RADIUS.

Adding a RADIUS Client or Client Group

To add a RADIUS client or client group:

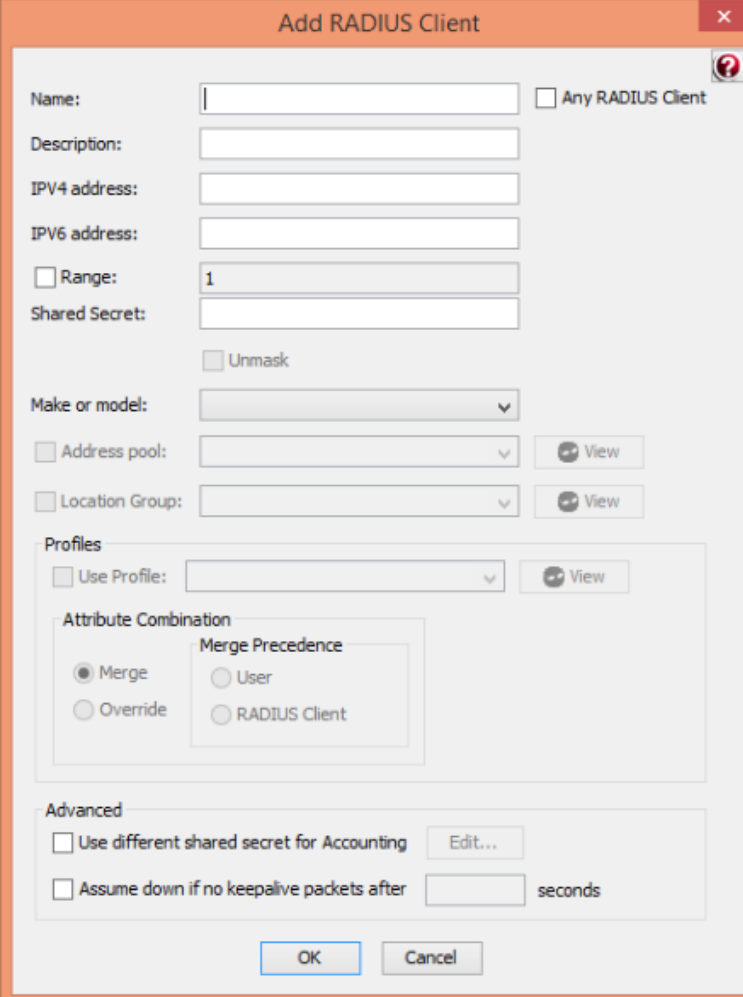
1. Choose **RADIUS Clients** in the sidebar.

Figure 27: RADIUS Clients Panel

Name	Description	IPv4 Address	IPv6 Address	Make or M...	Address Pool
TEST2			fe::2d	- Standard Ra...	
TEST_IP		10.96.176.40	fe80::206:5bff:fedd:4e2d	- Standard Ra...	
<ANY>				- Standard Ra...	
TEST_1		10.96.176.2		- Standard Ra...	
TEST_V4		10.96.176.25		- Standard Ra...	

2. Click the **Add** button.
The Add RADIUS Client dialog (Figure 28) appears.

Figure 28: Add RADIUS Client Dialog

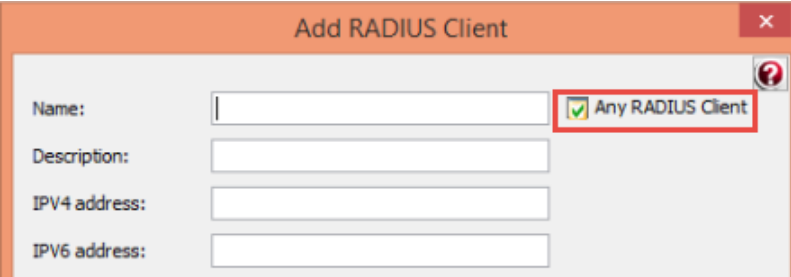


The "Add RADIUS Client" dialog box contains the following fields and options:

- Name:** Text input field.
- Description:** Text input field.
- IPv4 address:** Text input field.
- IPv6 address:** Text input field.
- Range:** Check box (unchecked) and text input field containing "1".
- Shared Secret:** Text input field.
- Unmask:** Check box (unchecked).
- Make or model:** Dropdown menu.
- Address pool:** Check box (unchecked) and dropdown menu, with a "View" button.
- Location Group:** Check box (unchecked) and dropdown menu, with a "View" button.
- Profiles:** Check box (unchecked) and dropdown menu, with a "View" button.
- Attribute Combination:**
 - Merge Precedence:**
 - Merge:** Radio button (selected).
 - Override:** Radio button (unchecked).
 - User:** Radio button (unchecked).
 - RADIUS Client:** Radio button (unchecked).
- Advanced:**
 - Use different shared secret for Accounting:** Check box (unchecked) and "Edit..." button.
 - Assume down if no keepalive packets after:** Check box (unchecked), text input field, and "seconds" label.
- Buttons:** "OK" and "Cancel" at the bottom.
- Any RADIUS Client:** Check box (unchecked) in the top right corner.

- Enter the name of the RADIUS client or client group in the Name field. Although you can assign any name to a RADIUS client entry, you should use the device's IP address or DNS hostname to avoid confusion. You can create a special RADIUS client entry called **<ANY>** by clicking the **Any RADIUS Client** check box (Figure 29). The **<ANY>** RADIUS client allows Steel-Belted Radius to accept requests from any network access device or proxy RADIUS server, as long as the shared secret is correct.

Figure 29: Creating an <ANY> RADIUS Client



The "Add RADIUS Client" dialog box is shown with the **Any RADIUS Client** check box checked and highlighted by a red rectangle. The other fields are the same as in Figure 28.

Note: **IPv4 Address** or **IPv6 Address** fields for an **<ANY>** RADIUS Client cannot be edited. **<ANY>** implies that the server accepts requests from any IP address, provided that the shared secret is correct.

4. Optionally, enter a description of the RADIUS client in the **Description** field.
The description you associate with a RADIUS client is not used during processing.
5. Enter the IPv4 address of the RADIUS client in the **IPv4 Address** field.
6. Enter the IPv6 address of the RADIUS client in the **IPv6 Address** field.

Alternatively, you can enter the DNS name of the device; the SBR Administrator resolves the name you enter to its corresponding IP address and displays the result in the **IPv4 Address/IPv6 Address** fields.

Note: For a specific RADIUS client entry, it is mandatory to have either IPv4 address or IPv6 address.

If you want the RADIUS client to use an IPv4 address range, enter the starting address for the range in the **IPv4 Address** field, click the **Range** check box, and enter the number of addresses in the range in the **Range** field (Figure 30). You can create an address range of as many as 500 addresses in an address range.

Note: Range is not supported for IPv6 addresses.

For more information on IPv4 address ranges for RADIUS clients, see [“RADIUS Client Groups”](#).

Figure 30: Entering an IPv4 Address Range for a RADIUS Client

7. Enter the authentication shared secret for the RADIUS client in the **Shared secret** field.

For privacy, asterisks are echoed as you type. You can check **Unmask** to display the characters in the shared secret.

After you complete configuration of the authentication shared secret on the server side, you must enter the same authentication shared secret when you configure the network access device.

Note: There will be only one Shared secret field per RADIUS client, and it would be used for both IPv4 and IPv6 addresses.

8. Use the **Make or model** list to select the make and model of your RADIUS client device.

The **Make or model** selection tells Steel-Belted Radius which dictionary of RADIUS attributes to use when communicating with this client. If you are not sure which make and model you are using or if your device is not in the list, select - **Standard RADIUS** -.

9. If you want the RADIUS client to obtain its IPv4 address from an address pool, click the **Address pool** check box and use the **Address pool** list to specify which address pool to use when authenticating an access request from this RADIUS client.

Click the **View** button to display details for the address pool you select.

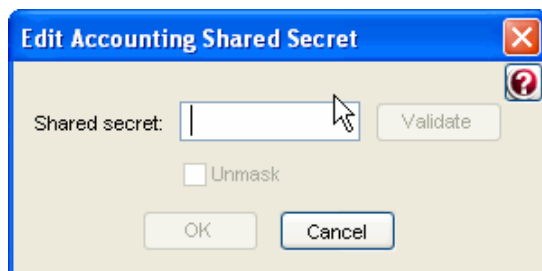
Note: You must configure IP address pools before you set up RADIUS clients if you want the clients to use address pools. For more information, see [“Setting Up IP Address Pools”](#).

10. If you want to associate a profile with the RADIUS client, click the Use Profile check box and use the drop-down list to select the profile you want the RADIUS client to use.

After you select a profile, you can click the **View** button to display the settings configured for the profile.

11. Specify how you want the profile to interact with the user settings.
 - If you want attributes in the profile to override identically-named attributes configured for the user, click the **Override User Attributes** check box.
 - If you want attributes in the profile to be merged with identically-named attributes configured for the user, clear the **Override User Attributes** check box and specify whether user or RADIUS client attributes should be used in the event they specify different values for the same attribute.
12. Optionally, specify an accounting secret for the RADIUS client.
By default, Steel-Belted Radius uses the same shared secret for authentication and accounting. If you want the RADIUS client to use different shared secrets for authentication and accounting:
 - a. Click the Use different shared secret for accounting check box.
 - b. Click the **Edit** button.
 - c. When the Accounting Shared Secret dialog (Figure 31) opens, enter the shared secret you want the RADIUS client to use for accounting.


Figure 31: Accounting Shared Secret Dialog



For privacy, asterisks are echoed as you type. You can click the Unmask check box to display the characters in the shared secret.

- d. Click **OK**.
You must enter the same accounting shared secret when you configure the RADIUS client.
13. Optionally, indicate whether you want to enable keepalive processing and specify how long the server should wait for RADIUS packets from the client before assuming connectivity has been lost.

If you check the Assume down if no keepalive packets after check box, you can enter a value in the (seconds) field. If the server does not receive any RADIUS packets from this client after the specified number of seconds, the server assumes that the connection to the client is lost or that the client device has failed. When this happens, Steel-Belted Radius gracefully closes any user or tunnel connections it has authenticated for the client. Steel-Belted Radius releases any pooled IP or IPX addresses and adjusts the counts of concurrent user or tunnel connections appropriately.

 **Note:** If the value you enter in the (seconds) field is too low, valid user or tunnel connections can be lost. For example, during low usage periods, a network access device might send no RADIUS packets to the Steel-Belted Radius server, even though the device is still “up.”

14. When you are finished, click **OK**.

Verifying a Shared Secret

To verify a shared secret on Steel-Belted Radius:

1. Open the RADIUS Clients panel.
2. Select the RADIUS client whose shared secret you want to verify and click the **Edit** button (or double-click the RADIUS client entry).
The Edit RADIUS Client dialog opens.
3. Enter the shared secret you think is assigned to the RADIUS client in the Shared secret field.
4. Click the **Validate** button.
The SBR Administrator displays a message indicating whether you entered the correct shared secret.

Deleting a RADIUS Client

To delete a RADIUS client:

1. Open the RADIUS Clients panel.
2. Select the RADIUS client entry you want to delete.
3. Click the **Delete** button on the SBR Administrator toolbar.
4. When you are prompted to confirm the deletion request, click **Yes**.

Chapter 6

Administering RADIUS Clients via WebGUI

This chapter describes how to set up RADIUS clients and client groups via WebGUI.

A RADIUS client is a network device or software application that contacts Steel-Belted RADIUS when it needs to authenticate a user or to record accounting information about a network connection.

A RADIUS client group is a collection of network devices or software applications that contacts Steel-Belted Radius to authenticate a user or to record accounting information about a network connection. Members of a RADIUS client group use a contiguous range of IP addresses and use identical settings, such as a shared secret or an IP address pool.

IPv4 – IPv6 Dual stack support for RADIUS clients: two IP addresses can be configured for a RADIUS client; one with IPv4 and another with IPv6. User can add the IP addresses in the “Add RADIUS Client” UI.

Note: If RADIUS client is in IPv6 network, then ensure that IPv6 Networking is enabled in Steel-Belted RADIUS Server. For information on the settings in the radius.ini file, refer to the Steel-Belted RADIUS Reference Guide.

RADIUS Clients Page

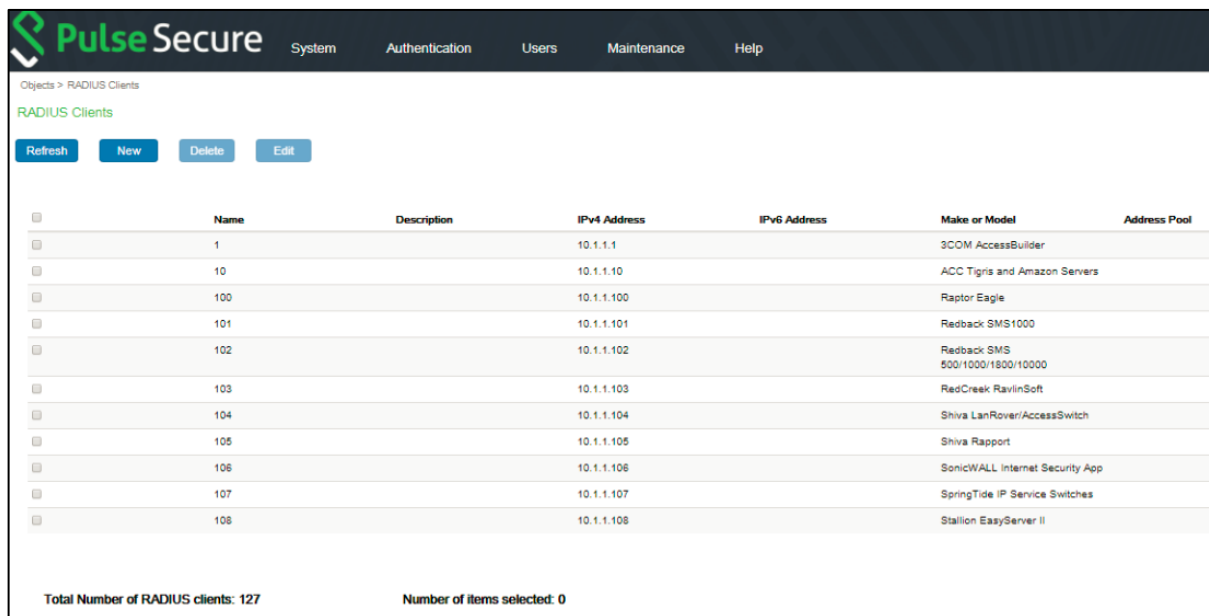
The RADIUS Clients page lets you identify the devices that you want to define as clients of Steel-Belted RADIUS.

Adding a RADIUS Client or Client Group

To add a RADIUS client or client group:

1. Choose **Radius Clients** from the main menu **Authentication** and sub menu **Objects**.

Figure 32: RADIUS Clients Page



	Name	Description	IPv4 Address	IPv6 Address	Make or Model	Address Pool
<input type="checkbox"/>	1		10.1.1.1		3COM AccessBuilder	
<input type="checkbox"/>	10		10.1.1.10		ACC Tigris and Amazon Servers	
<input type="checkbox"/>	100		10.1.1.100		Raptor Eagle	
<input type="checkbox"/>	101		10.1.1.101		Redback SMS1000	
<input type="checkbox"/>	102		10.1.1.102		Redback SMS 500/1000/1800/10000	
<input type="checkbox"/>	103		10.1.1.103		RedCreek RavlinSoft	
<input type="checkbox"/>	104		10.1.1.104		Shiva LanRover/AccessSwitch	
<input type="checkbox"/>	105		10.1.1.105		Shiva Rapport	
<input type="checkbox"/>	106		10.1.1.106		SonicWALL Internet Security App	
<input type="checkbox"/>	107		10.1.1.107		SpringTide IP Service Switches	
<input type="checkbox"/>	108		10.1.1.108		Stallion EasyServer II	

Total Number of RADIUS clients: 127 Number of items selected: 0

2. Click the **Add** button.
The Add RADIUS Client page (Figure 32: RADIUS Clients Page) appears.

Figure 33: Add RADIUS Clients Page

Objects > Add RADIUS Clients

Add RADIUS Clients

Name: ☐ Any RADIUS Client

Description:

IPv4 address: [Resolve DNS](#)

☐ Range:

IPv6 address:

Shared Secret:

☐ Unmask

Make or Model:

☐ Address Pool: [View](#)

☐ Location Group: [View](#)

▼ Profiles

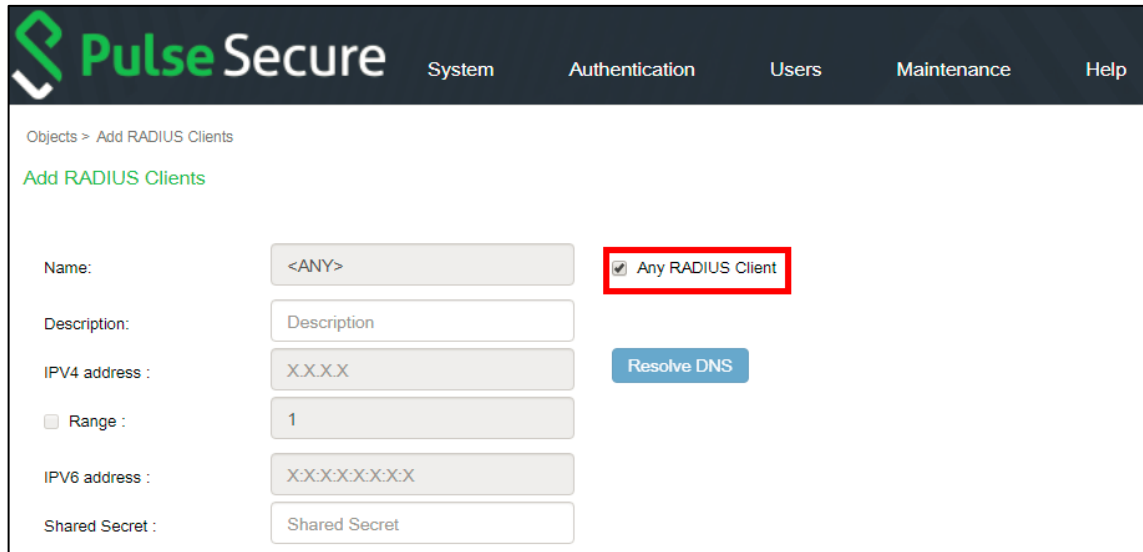
☐ Use Profile: [View](#)

▼ Attribute Combination

☐ Merge ☒ Merge Precedence

- Enter the name of the RADIUS client or client group in the Name field.
Although you can assign any name to a RADIUS client entry, you should use the device's IP address or DNS hostname to avoid confusion.
You can create a special RADIUS client entry called **<ANY>** by clicking the Any **RADIUS Client** check box (Figure 34: Creating an <ANY> RADIUS Client). The **<ANY>** RADIUS client allows Steel-Belted Radius to accept requests from any network access device or proxy RADIUS server, as long as the shared secret is correct.

Figure 34: Creating an <ANY> RADIUS Client



Objects > Add RADIUS Clients

Add RADIUS Clients

Name: <ANY> ☒ Any RADIUS Client

Description: Description

IPv4 address : X.X.X.X [Resolve DNS](#)

☐ Range : 1

IPv6 address : X:X:X:X:X:X:X

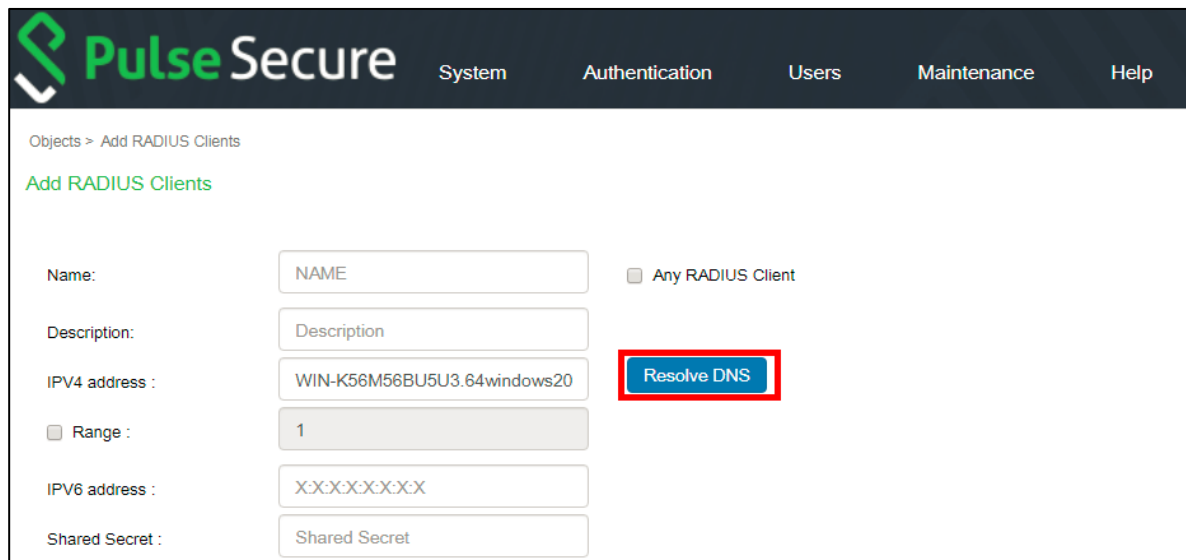
Shared Secret : Shared Secret

Note: IPv4 Address or IPv6 Address fields for an <ANY> RADIUS Client cannot be edited. <ANY> implies that the server accepts requests from any IP address, provided that the shared secret is correct.

4. Optionally, enter a description of the RADIUS client in the **Description** field.
The description you associate with a RADIUS client is not used during processing.
5. Enter the IPv4 address of the RADIUS client in the **IPv4 Address** field.
6. Enter the IPv6 address of the RADIUS client in the **IPv6 Address** field.

Alternatively, you can enter the DNS name of the device and click the Resolve DNS button; the SBR WebGUI resolves the name you enter to its corresponding IP address and displays the result in the **IPv4 Address** fields. Refer to the following figure:

Figure 35: Resolve DNS



Objects > Add RADIUS Clients

Add RADIUS Clients

Name: NAME ☐ Any RADIUS Client

Description: Description

IPv4 address : WIN-K56M56BU5U3.64windows20 [Resolve DNS](#)

☐ Range : 1

IPv6 address : X:X:X:X:X:X:X

Shared Secret : Shared Secret

Note: For a specific RADIUS client entry, it is mandatory to have either IPv4 address or IPv6 address.

If you want the RADIUS client to use an IPv4 address range, enter the starting address for the range in the **IPv4 Address** field, click the **Range** check box, and enter the number of addresses in the range in the **Range** field (Figure 30). You can create an address range of as many as 500 addresses in an address range.

Note: Range is not supported for IPv6 addresses.

For more information on IPv4 address ranges for RADIUS clients, see [“RADIUS Client Groups”](#).

Figure 36: Entering an IPv4 Address Range for a RADIUS Client

The screenshot shows the Pulse Secure web interface. The top navigation bar includes the Pulse Secure logo and links for System, Authentication, Users, Maintenance, and Help. Below the navigation bar, the breadcrumb trail reads 'Objects > Add RADIUS Clients'. The main heading is 'Add RADIUS Clients'. The form contains the following fields and controls:

- Name:** A text input field with the placeholder 'NAME'.
- Description:** A text input field with the placeholder 'Description'.
- IPv4 address :** A text input field with the placeholder 'X.X.X.X'.
- Range :** A checked checkbox followed by a text input field with the value '1'.
- IPv6 address :** A text input field with the placeholder 'X:X:X:X:X:X:X:X'.
- Shared Secret :** A text input field with the placeholder 'Shared Secret'.
- Any RADIUS Client:** An unchecked checkbox.
- Resolve DNS:** A blue button.

7. Enter the authentication shared secret for the RADIUS client in the **Shared secret** field.

For privacy, asterisks are echoed as you type. You can check **Unmask** to display the characters in the shared secret.

After you complete configuration of the authentication shared secret on the server side, you must enter the same authentication shared secret when you configure the network access device.

Note: There will be only one Shared secret field per RADIUS client, and it would be used for both IPv4 and IPv6 addresses.

8. Use the **Make or model** list to select the make and model of your RADIUS client device.

The **Make or model** selection tells Steel-Belted Radius which dictionary of RADIUS attributes to use when communicating with this client. If you are not sure which make and model you are using or if your device is not in the list, select **- Standard RADIUS -**.

9. If you want the RADIUS client to obtain its IPv4 address from an address pool, click the **Address pool** check box and use the **Address pool** list to specify which address pool to use when authenticating an access request from this RADIUS client.

Click the **View** button to display details for the address pool you select.

Note: You must configure IP address pools before you set up RADIUS clients if you want the clients to use address pools. For more information, see “Setting Up IP Address Pools”.

10. If you want to associate a profile with the RADIUS client, click the Use Profile check box and use the drop-down list to select the profile you want the RADIUS client to use.

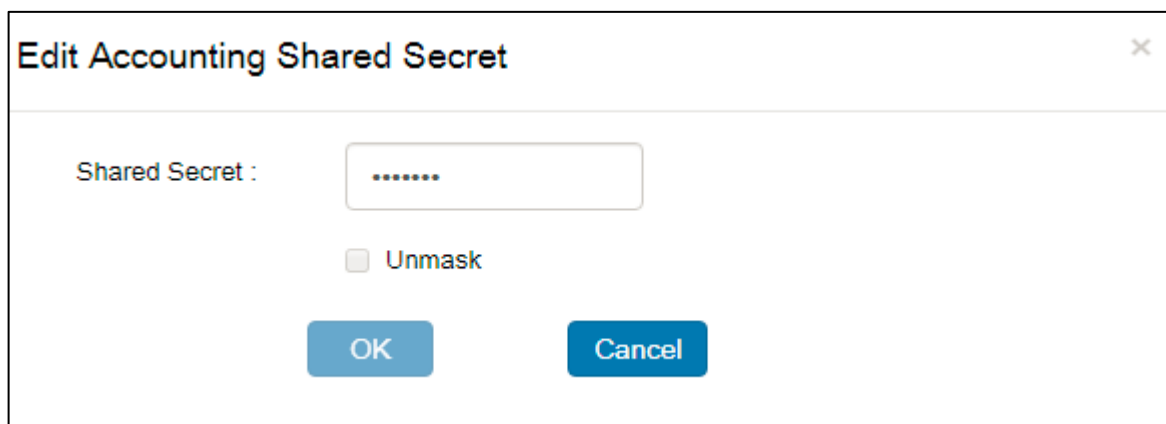
After you select a profile, you can click the **View** button to display the settings configured for the profile.

11. Specify how you want the profile to interact with the user settings.
 - If you want attributes in the profile to override identically-named attributes configured for the user, click the **Override User Attributes** check box.
 - If you want attributes in the profile to be merged with identically-named attributes configured for the user, clear the **Override User Attributes** check box and specify whether user or RADIUS client attributes should be used in the event they specify different values for the same attribute.
12. Optionally, specify an accounting secret for the RADIUS client.

By default, Steel-Belted Radius uses the same shared secret for authentication and accounting. If you want the RADIUS client to use different shared secrets for authentication and accounting:

 - a. Click the Use different shared secret for accounting check box.
 - b. Click the **Edit** button.
 - c. When the Accounting Shared Secret dialog (Figure 37: Accounting Shared Secret Page) opens, enter the shared secret you want the RADIUS client to use for accounting.

Figure 37: Accounting Shared Secret Page




For privacy, asterisks are echoed as you type. You can click the Unmask check box to display the characters in the shared secret.

- d. Click **OK**.

You must enter the same accounting shared secret when you configure the RADIUS client.
13. Optionally, indicate whether you want to enable keepalive processing and specify how long the server should wait for RADIUS packets from the client before assuming connectivity has been lost.

If you check the Assume down if no keepalive packets after check box, you can enter a value in the (seconds) field. If the server does not receive any RADIUS packets from this client after the specified number of seconds, the server assumes that the connection to the client is lost or that the client device has failed. When this happens, Steel-Belted Radius gracefully closes any user or tunnel connections it has authenticated for the client. Steel-Belted Radius releases any pooled IP or IPX addresses and adjusts the counts of concurrent user or tunnel connections appropriately.

 **Note:** If the value you enter in the (seconds) field is too low, valid user or tunnel connections can be lost. For example, during low usage periods, a network access device might send no RADIUS packets to the Steel-Belted Radius server, even though the device is still “up.”

14. When you are finished, click **OK**.

Verifying a Shared Secret

To verify a shared secret on Steel-Belted Radius:

1. Open the RADIUS Clients page.
2. Select the RADIUS client whose shared secret you want to verify and click the **Edit**.
The Edit RADIUS Client page opens.
3. Enter the shared secret you think is assigned to the RADIUS client in the Shared secret field.
4. Click the **Validate** button.
The WebGUI displays a message indicating whether you entered the correct shared secret.

Deleting a RADIUS Client

To delete a RADIUS client:

1. Open the RADIUS Clients page.
2. Select the RADIUS client entry you want to delete.
3. Click the **Delete** button on RADIUS Client page.
4. When you are prompted to confirm the deletion request, click **Yes**.

Chapter 7

Administering Users via Legacy SBR Administrator

This chapter describes how to add users to the Steel-Belted Radius database via legacy SBR administrator.

User Files

The following files establish settings for setting up users. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

Table 18: User Account Files

File Name	Function
logout.ini	Configures settings for when Steel-Belted Radius should lock user accounts after repeated failed login attempts.
redirect.ini	Configures settings for when Steel-Belted Radius should redirect users after repeated failed login attempts.
radius.ini	Specifies (among other things) the settings relating to RSA SecurID support in Steel-Belted Radius.
securid.ini	Specifies the prompt strings returned to SecurID users during login and authentication.
tacplus.ini	Specifies the name of the TACACS+ server and the shared secret used to validate communication between the Steel-Belted Radius server and the TACACS+ server.

Users Panels

The Users entry in the sidebar has as many as five sub-entries, as described in **Table 19**. Each user entry in the Steel-Belted Radius database identifies one method by which the server can authenticate a specific user.

Table 19: User Panels

User Panel	Function	Available On Server Running OS
Local	Lists the native users in the local Steel-Belted Radius database. You must display the Native User panel to add, edit, and delete native users.	Windows Linux
Domain	Lists the users authenticated using Windows Domain authentication. You must display the Domain tab to add, edit, and delete Domain users.	Windows

User Panel	Function	Available On Server Running OS
SecurID	Lists the users authenticated using RSA SecurID authentication. You must display the SecurID tab to add, edit, and delete SecurID users	Windows Linux
TACACS+	Lists the users authenticated using TACACS+. You must display the TACACS+ tab to add, edit, and delete TACACS+ users.	Windows Linux
UNIX	Lists the users and groups authenticated using UNIX authentication. You must display the UNIX tab to add, edit, and delete UNIX users.	Linux

Note: You can populate the user database for Steel-Belted Radius by entering information in the Users panel or by importing data from other servers. For more information on importing user information, see [Appendix E](#), "Importing and Exporting Data."

Setting Up Native Users

Native user entries require you to enter the user's name and password into the Steel-Belted Radius database. For all other types of user entry, the server relies on another database to confirm the user's password.

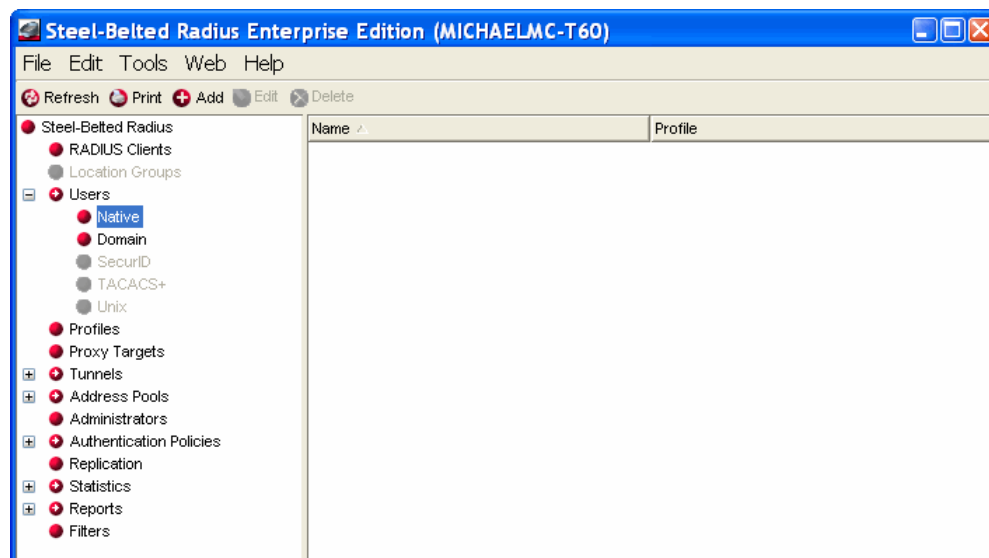
Note: You must define a native user entry for every user who requires remote access to a Windows network. For example, you can accommodate Linux or Macintosh users by adding them as native users.

Adding a Native User

To add a native user to the Steel-Belted Radius database:

1. Choose **Users > Native** in the sidebar.
The Native Users panel appears.

Figure 38: Native Users Panel



2. Click **Add**.
The Add Native User dialog appears.

Figure 39: Add Native User Dialog

Add Native User

Name:

Description:

Password:

☐ Unmask ☐ Store hash of password

Attributes

☐ Use Profile: View

Check List Return List

Attribute	Value	Default

☐ Maximum concurrent connections

3. Enter the user's login name in the **Name** field.

Native user entries in the Steel-Belted Radius database have all-uppercase names; names are converted to all-uppercase letters when the native user entry is created, and they remain all-uppercase for the life of the entry. For example, a native username entered as **realLife1** is stored as **REALLIFE1** in the Steel-Belted Radius database.

4. Optionally, enter a description of the user in the **Description** field.

The description you associate with a native user is not used during processing.

5. Enter the user's login password in the **Password** field.
If you want the characters in the password (rather than asterisks) to appear as you type, click the **Unmask** check box. Note that passwords are case-sensitive: swordfish, SwordFish, and SWORDFISH are three different passwords.
6. Specify whether you want the user's password to be encrypted before it is stored.
 - If this user requires only PAP authentication and you want to **store the hash of the password** in the Steel-Belted Radius database, click the Store hash of password check box. This option allows the user to authenticate using only PAP.
 - If this user requires CHAP authentication, do not click the **Store hash of password** check box.

7. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

For more information on profiles, refer to Chapter 7, “Administering Profiles.”

8. If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

9. After you have added the appropriate checklist and return list attributes for a user, select an attribute and use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
10. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
11. Click **OK**

Editing a Native User

After you have added a user, you can modify any setting for that user except the username. To edit a native user who already exists in the Steel-Belted Radius database:

1. Choose **Users > Native** in the sidebar.

The Native Users panel (Figure 38: Native Users Panel) appears.

2. Select the user entry you want to edit and click the **Edit** button (or right-click an entry and choose **Edit** from the context menu).
The Edit Native User dialog opens.

Figure 40: Edit Native User Dialog

Edit Local User

Name:

Description:

Password:

☐ Unmask ☐ Store hash of password

Attributes

☒ Use Profile:

Attribute	Value	Default

☐ Maximum concurrent connections

3. Edit the settings for the user as appropriate.

Refer to “Adding a Native User” for information on the fields in the native user dialogs.

You can modify any setting except the user’s name. To edit a user’s name, you must copy the user record to a new user entry.

4. Click **Save**.

Deleting a Native User

To delete a native user:

1. Choose **Users > Native** in the sidebar.
The Native Users panel (Figure 38) appears.
2. Select the user entry you want to delete and click the **Delete** button (or right-click an entry and choose **Delete** from the context menu).
3. When you are asked to confirm the deletion, click **Yes**.

Adding a Checklist or Return List Attribute for a User

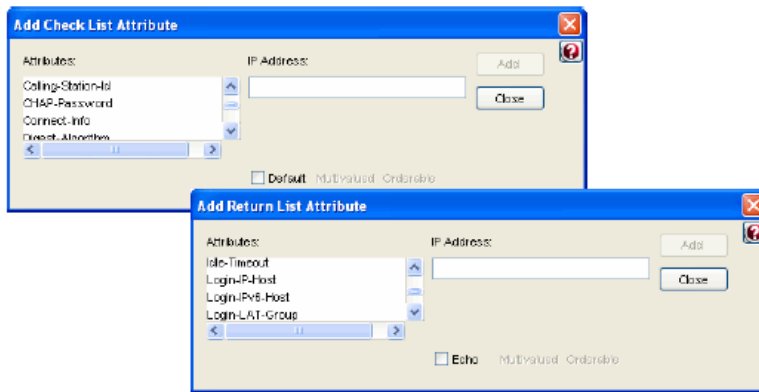
A checklist attribute is an item of information that must accompany a request for connection before the connection can be authenticated.

A return list attribute is an item of information that Steel-Belted Radius includes in the Access-Accept message when a connection request is approved.

To add a checklist or return list attribute to a user’s entry:

1. Open the appropriate user entry.
2. Click the **Checklist** tab or the **Return list** tab.
3. Click **Add**. The Add Checklist Attribute dialog or the Add Return List Attribute dialog opens.

Figure 41: Add Checklist Attribute and Add Return List Attribute Dialogs



4. Select the attribute you want to add from the **Attributes** list.
5. Select or enter a value for the attribute.
The dialog changes according to the attribute you choose. Some attributes require that you enter a value, string, or IP address. Other attributes require that you choose from a fixed list of values. If the **Multivalued** indicator is dimmed, an attribute can have only one value. If the **Multivalued** attribute is undimmed, you can add multiple values for the attribute.

(Checklist attributes only) To set this value to the default value for the attribute (which is useful in situations where the attribute is not included in the RADIUS request), check the **Default value** check box.

(Return list single-valued attributes only) If you do not want to specify a particular value, but want to make sure that whatever value of the attribute appears in the RADIUS request is echoed to the client in the RADIUS response, click the **Echo** check box.

6. Click **Add** to add this attribute/value pair to the list.
7. When you are finished adding attribute/value pairs, click **Close** to return to the Add User dialog.

Setting Up Windows Domain Users

To use the Windows Domain Authentication plug-in, the RADIUS service must be run under the LocalSystem account on a Windows XP computer that is part of a domain. (The LocalSystem account is a standard authenticated domain user account in Windows.) Groups and users to be authenticated can reside in any domain within the forest, as well as in those domains outside the forest for which a trust relationship exists.

When you use Windows domain authentication, the domain name can be present in the User-Name attribute of the Access Request, which can be of the form \\domain\user, domain\user, or simply user. Additionally, the form user@domain can be used.

Prequalification Checklists

By default, when Steel-Belted Radius uses Windows domain membership to authenticate a user, it processes attributes for the first group that the user matches. The attributes consist of checklist and reply-list attributes, and checklist processing is performed to determine the user's authorization rights after authentication succeeds.

If an enterprise sets up separate Windows domain groups for different access methods (for example, one domain group for users accessing the network through a VPN and another domain group for users accessing the network through a WLAN Access Point) and then assigns users to more than one domain group (so that the users get different permissions based on what access method they use), Steel-Belted Radius can authenticate the user against the first group the user matches and process the wrong attributes for that user, causing checklist processing to fail and the user's access to be rejected.

Prequalification checklists allow a site to perform checklist processing before it authenticates a user, so that the attributes returned by every group a user belongs to can be evaluated (and the appropriate membership chosen) before authentication proceeds.

Example: CandyCorp sets up two groups (WLAN_USERS and VPN_USERS) in the CORP domain and creates access policies for each. Mary is a member of both groups; when she accesses the corporate network through a WLAN Access Point, her traffic should be tagged for a specific VLAN, and when she accesses the corporate network through a VPN, an Ascend-Data-Filt

- Without prequalification checklist processing, Steel-Belted Radius responds to Mary's connection through an Access Point by using the first domain group membership it finds (which might be VPN_USERS), authenticating Mary and returning the attributes associated with that group, and then rejecting Mary because post-authentication checklist processing fails when the group used for authentication (VPN_USERS) didn't provide the appropriate access attributes.
- With prequalification checklist processing enabled, Steel-Belted Radius responds to Mary's connection through the Access Point by running checklist processing before it authenticates Mary: Steel-Belted Radius tests each group to which Mary belongs to see if authentication and authorization will ultimately be successful. If checklist processing for a domain group fails, that group is skipped and the next group is tried; if checklist processing for all groups fails, Mary's access request is denied. If checklist processing successfully matches Mary to a domain group, authentication proceeds, and Mary's traffic is processed according to corporate policies (that is, it is tagged with the VLAN identifier appropriate for her WLAN access).

The application of prequalification checklist processing is not limited to domain groups. Prequalification checklists can be used to direct a user request to an appropriate domain user entry based on the presence of attributes in the user's request. For example, if a user's name ("ADMIN") is specified in an Access-Request and both \CORP\ADMIN and \LAB\ADMIN are listed in the Steel-Belted Radius database with the same password, prequalification checklist processing could be used to select the appropriate domain user object for authentication and authorization.



Note: Prequalification checklist processing can be relatively expensive in terms of processing time. Each access request might entail multiple database operations, since Steel-Belted Radius must potentially review every domain group to find one with attributes that match the user's checklist requirements.

Prequalification processing is enabled through the PrequalifyChecklist argument in the [Windows Domain] section of the winauth.aut file.

MS-CHAP Considerations

If the user is successfully authenticated, any appropriate encryption keys (obtained through either MS-CHAP or MS-CHAP-V2) are returned to Steel-Belted Radius and the user's profile is retrieved from the Steel-Belted Radius

database. To enable encryption, the appropriate attributes, such as Mppe-Send-Key and Mppe-Recv-Key, must be included in the user's profile. You do not need to prepend the username with the domain name to avoid timeout problems when dealing with a large number of domains.

The Windows Domain Authentication plug-in does not support EAP pre-fetch.

Expired Domain Passwords

The Windows domain authentication method allows users to be authenticated against domain security using an expired domain password. This lets Steel-Belted Radius handle security policies that force domain passwords to be changed automatically after a certain number of days. Typically, after the password expires, at the next attempt to log in, the domain recognizes the password supplied by the user as expired. The domain then returns a special status code to its client application indicating these conditions. Typically, the user is then prompted to change his or her domain password, but the client application (for example, Microsoft Remote Access Client) must support the ability to change passwords.

When Steel-Belted Radius passes a username/password pair through to a domain for authentication, the domain can indicate to Steel-Belted Radius that the password is expired. If so, Steel-Belted Radius's default response is to issue an Access-Reject. You can configure it to respond instead with an Access-Accept.

Windows Domain Authentication Configuration

As with other authentication plug-ins, winauth.dll is configured through a single .aut file (winauth.aut). The winauth.aut file must contain [Bootstrap] and [Windows Domain] sections:

```
[Bootstrap]

LibraryName=winauth.dll

Enable=1

InitializationString=Windows domain authentication
```

Processing for users with expired passwords is configured in the [Windows Domain] section:

```
[Windows Domain]

AllowExpiredPasswordsForUsers = no

AllowExpiredPasswordsForGroups = no


RetryFailedAuthentications = no

AllowMachineLogin = yes

;ProfileForExpiredUsers = Profile

;ProfileForExpiredUsersInGroups = Profile

PrequalifyChecklist = no
```

 **Note:** MS-CHAP and MS-CHAP-V2 users with expired passwords are not accepted. They might be prompted to change password if their login application supports password changing.

Adding a Domain User or Domain Group

To use domain authentication, the Steel-Belted Radius service must run on a Windows workstation or server that belongs to a domain. The Windows host running Steel-Belted Radius does not need to be a domain controller.

It is possible to authenticate against domains other than the one in which the Steel-Belted Radius service is running, provided that the other domain is trusted by the domain of the RADIUS service. The trust relationship might not be mutual; the other domain does not have to trust the RADIUS domain.

Example: An enterprise has three domains: A, B, and C, and Steel-Belted Radius is running in A. A trusts B and C trusts A. You can use Domains A and B for authentication, but not C, because A does not trust C.

You can add a Domain User entry to provide for the authentication of a specific user defined within a specific domain under Microsoft networking. For more flexibility, you can add a Domain Group, to provide for the authentication of all users that belong to a specific group defined within a specific domain.

To add a domain user or domain group:

1. Choose Users > Domain in the sidebar.
2. Click the Add button on the SBR Administrator toolbar to display the Add Domain User dialog.

Figure 42: Add Domain User Dialog

The screenshot shows the 'Add Domain User' dialog box. It includes fields for Domain, User, Name (with a Browse button), and Description. There are radio buttons for User and Group. Below is an Attributes section with a Use Profile dropdown and a View button. A Check List tab is active, showing a table with columns Attribute, Value, and Default. At the bottom are Add, Edit, and Delete buttons, and a checkbox for Maximum concurrent connections.

3. Specify the domain and username for the user you want to add.

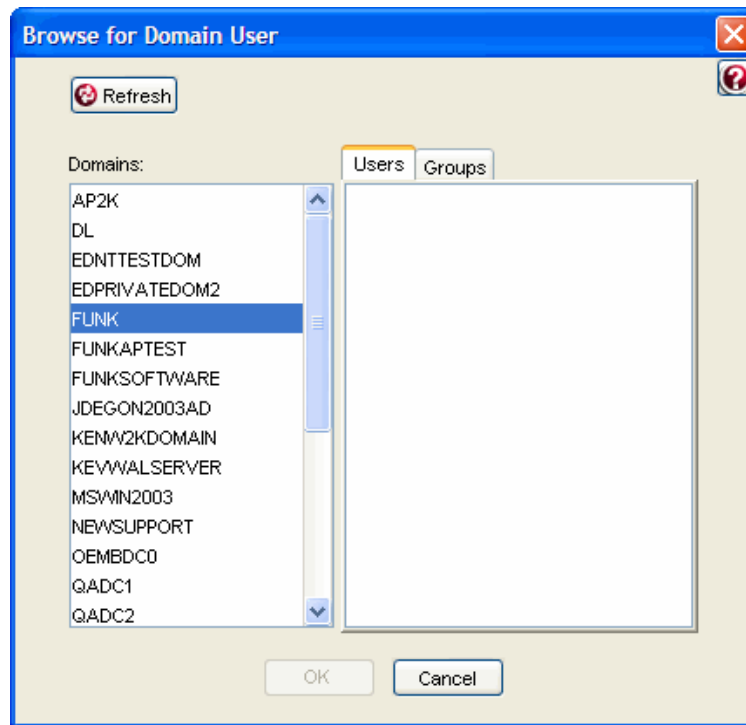
You can enter the user's domain in the **Domain** field and the user's login name in the **User** field.

Domain usernames must be in the format \\domain\user. Domain usernames cannot contain the following characters:

\ / " [] : | < > + = , ; , ? * @

If you want to browse for an existing user or group, click the **Browse** button. When the Browse for Domain User dialog (Figure 43) opens, click the name of the appropriate domain, and then click the name of the user or group in that domain you want to use. Click **OK** to finish.

Figure 43: Browse for Domain User Dialog



4. Optionally, enter a description of the domain user or group in the **Description** field.

The description you associate with a native user is not used during processing.

5. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

For more information on profiles, refer to Chapter 7, "Administering Profiles."

6. If you want to specify checklist attributes or return list attributes for the domain user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

See ["Adding a Checklist or Return List Attribute for a User"](#) for information on how to add checklist and return list attributes.

7. After you have added the appropriate checklist and return list attributes for a user, select an attribute and use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
8. If you want to specify the maximum number of concurrent connections this user can maintain, click the Maximum concurrent connections check box and enter a number in the accompanying field.
9. Click **OK**.

Setting Up SecurID Users

Username are case-sensitive. The case in which names are recorded depends on whether usernames are being stored in a local or external database. Usernames stored in an external database (UNIX, RSA SecurID, TACACS+) retain their case as stored in that database.

Adding a SecurID User

You can configure Steel-Belted Radius to use RSA SecurID authentication for your users by setting up communication between the RSA server and the RADIUS server (described in “Configuring SecurID Authentication”), and then adding SecurID users to the Steel-Belted Radius database using the instructions that follow.


Steel-Belted Radius attempts SecurID authentication only on usernames that match a SecurID entry in its User database. Steel-Belted Radius offers four types of SecurID entry, each providing a different matching rule:

- You can enter the name of a specific user.


For example, you might create a SecurID user entry for the specific user George. This tells Steel-Belted Radius that SecurID can be used as an authentication method when an authentication request is received for username George. If username George is authenticated, the attributes of the user entry apply.

- You can enter a prefix.

For example, you might create a SecurID user entry for the prefix sales\$. This tells Steel-Belted Radius that SecurID can be used as an authentication method when an authentication request is received for a username such as sales\$Harry or sales\$Cynthia. Using a prefix lets you group multiple SecurID users into a single user entry instead of creating a separate entry for each SecurID user. If the sales\$ user is authenticated, the attributes of the user entry apply.

 **Note:** Only the part of the username after the prefix (Harry or Cynthia in the example above) is sent to the RSA SecurID server.

You can use different settings for different groups.

 **Note:** The user must type in the prefix as part of the username when dialing in and requesting a connection.

- You can enter a suffix.

A suffix works like a prefix, but appears at the end of the username; for example, if the suffix were !sales, you might have usernames such as Harry!sales or Cynthia!sales.

- You can create an entry for Any user.

This creates a single user entry named <ANY> that matches any username to be authenticated. SecurID can be used as an authentication method for any username, and, if successful, the attributes of the <ANY> entry apply.

The <ANY> entry makes sense if a single set of attributes apply to all your SecurID users and if you want to make SecurID either the only authentication method used or the authentication method of last resort if other authentication methods fail.

To add a SecurID user entry:

1. Choose **Users > SecurID** in the sidebar.
2. Click the **Add** button on the SBR Administrator toolbar to display the Add SecurID User dialog.

Figure 44: Add SecurID User Dialog

3. Enter the specific username, a prefix, or a suffix in the **Name** field.
4. Select the user type: **Specific user**, **Prefix**, **Suffix**, or **Any user**.
5. Optionally, enter a description of the user in the **Description** field.
6. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the Profile list to select the **profile** you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

7. If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

8. After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
9. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
10. Click **OK**.

Each new suffix or prefix entry that you add appears in the Users dialog with the username represented by the string USERNAME; for example, !USERNAME or SALES<USERNAME>.

Setting Up TACACS+ Users

You can configure Steel-Belted Radius to authenticate your users by querying a TACACS+ server.

Note: Before you add TACACS+ users, you must configure communication between the Steel-Belted Radius server and the TACACS+ server by editing the `tacplus.ini` file. For more information on the `tacplus.ini` file, refer to the Steel-Belted Radius Reference Guide.

Steel-Belted Radius attempts TACACS+ authentication only on usernames that match a TACACS+ entry in its user database. Each type of TACACS+ entry specifies a different matching rule:

- You can enter the name of a specific user.

For example, you might create a TACACS+ user entry for the specific user George. This tells Steel-Belted Radius that when an authentication request is received for username George, TACACS+ can be used as an authentication method and, if successful, the attributes of this user entry apply.

- You can enter a prefix.

For example, you might create a TACACS+ user entry for the prefix `sales$`. This tells Steel-Belted Radius that when an authentication request is received for a username such as `sales$Harry` or `sales$Cynthia`, TACACS+ can be used as an authentication method and, if successful, the attributes of this user entry apply.

Note: Only the part of the username after the prefix (Harry or Cynthia in the example above) is sent to the TACACS+ server.

Using a prefix lets you group multiple TACACS+ into a single user entry instead of creating a separate entry for each TACACS+ user. You can use different settings for different groups.

Note: The user must type in the prefix as part of the username he or she is using to dial in and request a connection.

- You can enter a suffix.

A suffix works like a prefix, but appears at the end of the username; for example, if the suffix were `!sales`, you might have usernames such as `Harry!sales` or `Cynthia!sales`.

- You can create an entry for Any user.

This creates a single user entry named `<ANY>` that matches any username to be authenticated. TACACS+ can be used as an authentication method for any username, and, if successful, the attributes of the `<ANY>` entry apply. The `<ANY>` entry makes sense if a single set of attributes apply to all your TACACS+ users and if you want to make TACACS+ either the only authentication method used or the authentication method of last resort if other authentication methods fail.

To add a TACACS+ user:

- Choose Users > TACACS+ in the sidebar.
- Click the Add button on the SBR Administrator toolbar to display the Add TACACS+ User dialog.

Figure 45: Add TACACS+ User Dialog

3. Enter the specific username, a prefix, or a suffix in the Name field.
4. Select the user type: Specific user, Prefix, Suffix, or Any user.
5. Optionally, enter a description of the user in the Description field.
6. If you want to use a profile to assign checklist and return list attributes to the user, click the Use profile check box and use the Profile list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

7. If you want to specify checklist attributes or return list attributes for the user, click the Checklist tab or the Return list tab, and then click the Add button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

8. After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
9. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
10. Click **OK**.

Each new suffix or prefix entry that you add appears in the Users dialog with the username represented by the string USERNAME; for example, !USERNAME or SALES<USERNAME>.

Setting Up UNIX Users

You can add a UNIX user entry to provide for the authentication of a specific user defined on a Linux server. For more flexibility, you can add a UNIX group to provide for the authentication of all users that belong to a specific group defined on the server.

To add a UNIX user or group:

1. Choose **Users > UNIX** in the sidebar.
2. Click the **Add** button on the SBR Administrator toolbar to display the Add UNIX User dialog.

Figure 46: Add UNIX User Dialog

3. Click the **Browse** button and select a user or group from the list. Click **OK**.
4. Optionally, enter a description of the user in the **Description** field.
5. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

6. If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

7. After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
8. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
9. Click **OK**.

Editing User Settings

This section describes fields that you can set for any user entry, regardless of user type. For more information, see “[User Attribute Lists](#)” and “[About Profiles](#)”.

Selecting a Profile

To select a profile for a user:

1. Open the appropriate user panel by clicking a **User** > entry in the sidebar.
2. Select the user whose entry you want to modify.
3. Click **Edit** (or double-click the user entry).
4. Click the **Use Profile** check box.
5. Select the list to select the profile you want to use.

To display the settings associated with the selected profile, click the **View** button.

6. When you are finished, click **Save**.

Setting Attribute Values

To change the value of an attribute already in the checklist or return list for a user entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Select the attribute whose value you want to change.
3. Click **Edit** or double-click the attribute.
4. When the Change dialog opens, enter or select the new value.

Depending on the attribute, you can enter a new value or select a value from a list. For some attributes, Steel-Belted Radius retrieves the value from the server and you cannot enter a value in this dialog.

5. Click **OK**.

Removing Attribute/Value Pairs

To remove an attribute/value pair already in the checklist or return list for a User entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Select the attribute/value pair you'd like to remove.
3. Click **Delete**.

Reordering Attributes

Certain attributes are multi-valued and orderable; that is, the attribute/value pair can appear more than once in a RADIUS response, and the order in which the attribute/value pairs appear is significant. To reorder attributes in a User entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Highlight an attribute/value pair in the list.
3. Click the Up or Down arrow to move the selected attribute within the list.
 - The Up arrow moves the selected attribute/value up in the list. If the attribute is not orderable, or if the selected item already the first value for this attribute, the button is disabled.
 - The Down arrow moves the selected attribute/value down in the list. If the attribute is not orderable, or if the selected item is already the last value for this attribute, the button is

disabled.

Changing Attributes Inherited from a Profile

Checklist and return list attributes can be specified for a user, or they can be inherited from a profile associated with a user. Attributes inherited from a profile are overridden by attributes assigned to a specific user.

Concurrent Connection Limits

A maximum number of open connections can be set for each user entry by checking the **Maximum concurrent connections** check box and entering a number in the accompanying field. When the user requests access, the user can be authenticated using the given authentication method only if fewer than this number of connections are currently open for this user.

Allowed Access Hours

The user's allowed access hours can be specified by adding the Funk-Allowed-Access-Hours attribute to the user's checklist.

Funk-Allowed-Access-Hours is a variable-length string that identifies time periods in a 7-day week of 24-hour days. This string consists of one or more day specifiers (each of which can list one or more days and/or ranges of days) followed by one or more ranges of 24-hour times, in minutes.

Figure 47: Sample Funk-Allowed-Access-Hours Attribute Value

```
Funk-Allowed-Access-Hours M-W 0100-1400 2300-2400 M, Tu,Th, F
0530-1500, Sa-Su 0000-2400
```

The syntax rules for Funk-Allowed-Access-Hours are as follows:

- Time ranges can be inclusive (1000–1100 allows access only between 10 a.m. and 11 a.m.) or exclusive (1100–1000 allows access any time except between 10 a.m. and 11 a.m.).
- Day specifiers, and ranges of days and times can be separated by commas or spaces; ranges of days or times are indicated by hyphens (m–w or 0239–1459).
- Days can be specified by the minimum number of case-insensitive letters necessary to distinguish them (Su, M, Tu, W, Th, F, Sa) and can wrap around the end of the week (Sa-Su).
- At least one time period is required for each day; that is, each day, list, or range of days must be followed by one or more ranges of times.
- Times are specified using four digits, with leading zeroes where needed (0001 for 12:01 a.m., 0630 for 6:30 a.m., and so forth).

When assigned to a user's checklist, the Funk-Allowed-Access-Hours value in **Figure 47** allows the user access during the following time periods:

- 1 a.m. to 2 p.m. and 11:00 p.m. to midnight, Monday through Wednesday
- 5:30 a.m. to 3:00 p.m. Monday, Tuesday, Thursday, and Friday
- Any time Saturday or Sunday

The total access times Monday are 1 a.m. to 3:00 p.m. and 11:00 p.m. to midnight

If the user attempts access on Sunday at 11:30 p.m., access would be allowed and a Session-Timeout attribute specifying a value of 1800 seconds (30 minutes, until midnight Sunday, when the access period ends) would be

returned. However, if the user's return list includes a Session-Timeout with a value less than 1800, this lesser value would be returned.

Deleting a User

To delete a user:

1. Open the appropriate user panel by clicking a User > entry in the sidebar.
2. Select the user you want to delete.
3. Click the **Delete** button from the SBR Administrator toolbar (or right-click the user entry and choose Delete from the context menu).
4. When you are prompted to confirm the deletion, click **Yes**.

Chapter 8

Administering Users via WebGUI

This chapter describes how to add users to the Steel-Belted Radius database via webGUI.

User Files

The following files establish settings for setting up users. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

Table 20: User Account Files

File Name	Function
logout.ini	Configures settings for when Steel-Belted Radius should lock user accounts after repeated failed login attempts.
redirect.ini	Configures settings for when Steel-Belted Radius should redirect users after repeated failed login attempts.
radius.ini	Specifies (among other things) the settings relating to RSA SecurID support in Steel-Belted Radius.
securid.ini	Specifies the prompt strings returned to SecurID users during login and authentication.
tacplus.ini	Specifies the name of the TACACS+ server and the shared secret used to validate communication between the Steel-Belted Radius server and the TACACS+ server.

Users Pages

The Users entry in the menubar has as many as five sub-entries, as described in Table 21. Each user entry in the Steel-Belted Radius database identifies one method by which the server can authenticate a specific user.

Table 21: User Pages


User Page	Function	Available On Server Running OS
Local	Lists the native users in the local Steel-Belted Radius database. You must display the Native User page to add, edit, and delete native users.	Windows Linux
Domain	Lists the users authenticated using Windows Domain authentication. You must display the Domain tab to add, edit, and delete Domain users.	Windows

User Page	Function	Available On Server Running OS
SecurID	Lists the users authenticated using RSA SecurID authentication. You must display the SecurID tab to add, edit, and delete SecurID users.	Windows Linux
TACACS+	Lists the users authenticated using TACACS+. You must display the TACACS+ tab to add, edit, and delete TACACS+ users.	Windows Linux
UNIX	Lists the users and groups authenticated using UNIX authentication. You must display the UNIX tab to add, edit, and delete UNIX users.	Linux

 **Note:** You can populate the user database for Steel-Belted Radius by entering information in the Users page or by importing data from other servers. For more information on importing user information, see [Appendix E](#), “Importing and Exporting Data.”

Setting Up Native Users

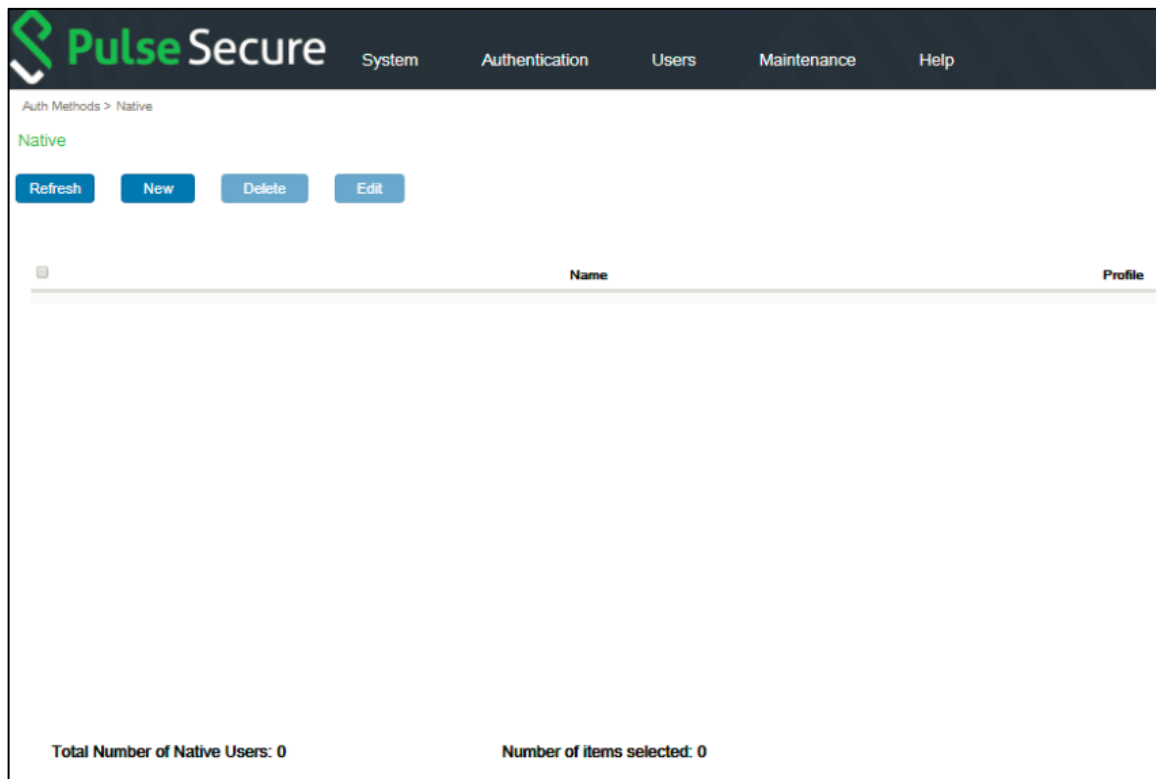
Native user entries require you to enter the user’s name and password into the Steel-Belted Radius database. For all other types of user entry, the server relies on another database to confirm the user’s password.

 **Note:** You must define a native user entry for every user who requires remote access to a Windows network. For example, you can accommodate Linux or Macintosh users by adding them as native users.

Adding a Native User

To add a native user to the Steel-Belted Radius database:

1. Choose **Users > Auth Methods > Native** in the menubar.
The Native Users Page appears.

Figure 48: Native Users Page

2. Click **New**.
The Add Native User page appears.

Figure 49: Add Native User Page

Auth Methods > Add Native User

Add Native User

Name:

Description:

Password:

☐ Unmask ☐ Store hash of password

▼ Attributes

☐ Use Profile:

[Return List](#)

Attribute	Value	Default

☐ Maximum concurrent connections:

3. Enter the user's login name in the **Name** field.

Native user entries in the Steel-Belted Radius database have all-uppercase names; names are converted to all-uppercase letters when the native user entry is created, and they remain all-uppercase for the life of the entry. For example, a native username entered as **realLife1** is stored as **REALLIFE1** in the Steel-Belted Radius database.

4. Optionally, enter a description of the user in the **Description** field.

The description you associate with a native user is not used during processing.

5. Enter the user's login password in the **Password** field.

If you want the characters in the password (rather than asterisks) to appear as you type, click the **Unmask** check box. Note that passwords are case-sensitive: swordfish, SwordFish, and SWORDFISH are three different passwords.

6. Specify whether you want the user's password to be encrypted before it is stored.

- If this user requires only PAP authentication and you want to **store the hash of the password**

in the Steel-Belted Radius database, click the Store hash of password check box. This option allows the user to authenticate using only PAP.

- If this user requires CHAP authentication, do not click the **Store hash of password** check box.
7. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

For more information on profiles, refer to “Administering Profiles via WebGUI.”

8. If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

9. After you have added the appropriate checklist and return list attributes for a user, select an attribute and use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
10. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
11. Click **OK**

Editing a Native User

After you have added a user, you can modify any setting for that user except the username. To edit a native user who already exists in the Steel-Belted Radius database:

1. Choose **Users > Auth Methods > Native** in the menubar.

The Native Users page appears.

2. Select the user entry you want to edit and click the **Edit** button.
The Edit Native User Page opens.

Figure 50: Edit Native User Page

Auth Methods > Edit Native User

Edit Native User

Name:

Description:

Password:

☐ Unmask ☐ Store hash of password

[Validate](#)

▼ Attributes

☒ Use Profile: [View](#)

[Check List](#) [Return List](#)

Attribute	Value	Default
-----------	-------	---------

[Add](#) [Edit](#) [Delete](#)

☐ Maximum concurrent connections:

[OK](#) [Cancel](#)

3. Edit the settings for the user as appropriate.

Refer to “Adding a Native User” for information on the fields in the native user pages.

You can modify any setting except the user’s name.

4. Click **OK**.

Deleting a Native User

To delete a native user:

1. Choose **Users > Auth Methods > Native** in the menubar.
The Native Users page (Figure 48: Native Users Page) appears.
2. Select the user entry you want to delete and click the **Delete** button.
3. When you are asked to confirm the deletion, click **Yes**.

Adding a Checklist or Return List Attribute for a User

A checklist attribute is an item of information that must accompany a request for connection before the connection can be authenticated.

A return list attribute is an item of information that Steel-Belted Radius includes in the Access-Accept message when a connection request is approved.

To add a checklist or return list attribute to a user's entry:

1. Open the appropriate user entry.
2. Click the **Checklist** tab or the **Return list** tab.
3. Click **Add**. The Add Checklist Attribute page or the Add Return List Attribute page opens.

Figure 51: Add Checklist Attribute and Add Return List Attribute Pages

Add Check List Attribute

Attributes

- 3GPP-CG-Address
- 3GPP-CG-IPv6-Address
- 3GPP-Charging-Characteristics
- 3GPP-Charging-Id

String IP Address IPv6 Address Value

Hexadecimal Integer IP IPv6-Prefix

IPv6-Interface

IP Address:

☐ Default ☐ Multivalued ☐ Orderable

Add Return List Attribute

Attributes

- 3GPP-CG-Address
- 3GPP-CG-IPv6-Address**
- 3GPP-Charging-Characteristics
- 3GPP-Charging-Id

String IP Address **IPv6 Address** Value

Hexadecimal Integer IP IPX IPv6-Prefix

IPv6-Interface Date/time Echo Constant

IPv6 Address:

☒ **Echo** Multivalued Orderable

Add **Close**

- Select the attribute you want to add from the **Attributes** list.
- Select or enter a value for the attribute.
The dialog changes according to the attribute you choose. Some attributes require that you enter a value, string, or IP address. Other attributes require that you choose from a fixed list of values. If the **Multivalued** indicator is dimmed, an attribute can have only one value. If the **Multivalued** attribute is undimmed, you can add multiple values for the attribute.

(Checklist attributes only) To set this value to the default value for the attribute (which is useful in situations where the attribute is not included in the RADIUS request), check the **Default value** check box.

(Return list single-valued attributes only) If you do not want to specify a particular value, but want to make sure that whatever value of the attribute appears in the RADIUS request is echoed to the client in the RADIUS response, click the **Echo** check box.

- Click **Add** to add this attribute/value pair to the list.
- When you are finished adding attribute/value pairs, click **Close** to return to the Add User page.

Setting Up Windows Domain Users

To use the Windows Domain Authentication plug-in, the RADIUS service must be run under the LocalSystem account on a Windows computer that is part of a domain. (The LocalSystem account is a standard authenticated domain user account in Windows.) Groups and users to be authenticated can reside in any domain within the forest, as well as in those domains outside the forest for which a trust relationship exists.

When you use Windows domain authentication, the domain name can be present in the User-Name attribute of the Access Request, which can be of the form \\domain\\user, domain\\user, or simply user. Additionally, the form user@domain can be used.

Prequalification Checklists

By default, when Steel-Belted Radius uses Windows domain membership to authenticate a user, it processes attributes for the first group that the user matches. The attributes consist of checklist and reply-list attributes, and checklist processing is performed to determine the user's authorization rights after authentication succeeds.

If an enterprise sets up separate Windows domain groups for different access methods (for example, one domain group for users accessing the network through a VPN and another domain group for users accessing the network through a WLAN Access Point) and then assigns users to more than one domain group (so that the users get different permissions based on what access method they use), Steel-Belted Radius can authenticate the user against the first group the user matches and process the wrong attributes for that user, causing checklist processing to fail and the user's access to be rejected.

Prequalification checklists allow a site to perform checklist processing before it authenticates a user, so that the attributes returned by every group a user belongs to can be evaluated (and the appropriate membership chosen) before authentication proceeds.

Example: CandyCorp sets up two groups (WLAN_USERS and VPN_USERS) in the CORP domain and creates access policies for each. Mary is a member of both groups; when she accesses the corporate network through a WLAN Access Point, her traffic should be tagged for a specific VLAN, and when she accesses the corporate network through a VPN, an Ascend-Data-Filt

- Without prequalification checklist processing, Steel-Belted Radius responds to Mary's connection through an Access Point by using the first domain group membership it finds (which might be VPN_USERS), authenticating Mary and returning the attributes associated with that group, and then rejecting Mary because post-authentication checklist processing fails when the group used for authentication (VPN_USERS) didn't provide the appropriate access attributes.
- With prequalification checklist processing enabled, Steel-Belted Radius responds to Mary's connection through the Access Point by running checklist processing before it authenticates Mary: Steel-Belted Radius tests each group to which Mary belongs to see if authentication and authorization will ultimately be successful. If checklist processing for a domain group fails, that group is skipped and the next group is tried; if checklist processing for all groups fails, Mary's access request is denied. If checklist processing successfully matches Mary to a domain group, authentication proceeds, and Mary's traffic is processed according to corporate policies (that is, it is tagged with the VLAN identifier appropriate for her WLAN access).

The application of prequalification checklist processing is not limited to domain groups. Prequalification checklists can be used to direct a user request to an appropriate domain user entry based on the presence of attributes in the user's request. For example, if a user's name ("ADMIN") is specified in an Access-Request and both \\CORP\\ADMIN and \\LAB\\ADMIN are listed in the Steel-Belted Radius database with the same password, prequalification checklist processing could be used to select the appropriate domain user object for authentication and authorization.

Note: Prequalification checklist processing can be relatively expensive in terms of processing time. Each access request might entail multiple database operations, since Steel-Belted Radius must potentially review every domain group to find one with attributes that match the user's checklist requirements.

Prequalification processing is enabled through the `PrequalifyChecklist` argument in the `[Windows Domain]` section of the `winauth.aut` file.

MS-CHAP Considerations

If the user is successfully authenticated, any appropriate encryption keys (obtained through either MS-CHAP or MS-CHAP-V2) are returned to Steel-Belted Radius and the user's profile is retrieved from the Steel-Belted Radius database. To enable encryption, the appropriate attributes, such as `Mppe-Send-Key` and `Mppe-Recv-Key`, must be included in the user's profile. You do not need to prepend the username with the domain name to avoid timeout problems when dealing with a large number of domains.

The Windows Domain Authentication plug-in does not support EAP pre-fetch.

Expired Domain Passwords

The Windows domain authentication method allows users to be authenticated against domain security using an expired domain password. This lets Steel-Belted Radius handle security policies that force domain passwords to be changed automatically after a certain number of days. Typically, after the password expires, at the next attempt to log in, the domain recognizes the password supplied by the user as expired. The domain then returns a special status code to its client application indicating these conditions. Typically, the user is then prompted to change his or her domain password, but the client application (for example, Microsoft Remote Access Client) must support the ability to change passwords.

When Steel-Belted Radius passes a username/password pair through to a domain for authentication, the domain can indicate to Steel-Belted Radius that the password is expired. If so, Steel-Belted Radius's default response is to issue an `Access-Reject`. You can configure it to respond instead with an `Access-Accept`.

Windows Domain Authentication Configuration

As with other authentication plug-ins, `winauth.dll` is configured through a single `.aut` file (`winauth.aut`). The `winauth.aut` file must contain `[Bootstrap]` and `[Windows Domain]` sections:

```
[Bootstrap]

LibraryName=winauth.dll

Enable=1

InitializationString=Windows domain authentication
```

Processing for users with expired passwords is configured in the `[Windows Domain]` section:

```
[Windows Domain]

AllowExpiredPasswordsForUsers = no

AllowExpiredPasswordsForGroups = no

RetryFailedAuthentications = no

AllowMachineLogin = yes

;ProfileForExpiredUsers = Profile

;ProfileForExpiredUsersInGroups = Profile
```

PrequalifyChecklist = no



Note: MS-CHAP and MS-CHAP-V2 users with expired passwords are not accepted. They might be prompted to change password if their login application supports password changing.

Adding a Domain User or Domain Group

To use domain authentication, the Steel-Belted Radius service must run on a Windows workstation or server that belongs to a domain. The Windows host running Steel-Belted Radius does not need to be a domain controller.

It is possible to authenticate against domains other than the one in which the Steel-Belted Radius service is running, provided that the other domain is trusted by the domain of the RADIUS service. The trust relationship might not be mutual; the other domain does not have to trust the RADIUS domain.

Example: An enterprise has three domains: A, B, and C, and Steel-Belted Radius is running in A. A trusts B and C trusts A. You can use Domains A and B for authentication, but not C, because A does not trust C.

You can add a Domain User entry to provide for the authentication of a specific user defined within a specific domain under Microsoft networking. For more flexibility, you can add a Domain Group, to provide for the authentication of all users that belong to a specific group defined within a specific domain.

To add a domain user or domain group:

1. Choose Users > Auth Methods > Domain in the menubar.
2. Click the New button on the Domain User Page. The Add Domain User page appears:

Figure 52: Add Domain User Page

Auth Methods > Add Domain User

Add Domain User

Domain:

User:

Name: [Browse](#)

☒ User ☐ Group

Description:

▼ Attributes

☐ Use Profile: [View](#)

[Check List](#) [Return List](#)

Attribute	Value	Default
-----------	-------	---------

[Add](#) [Edit](#) [Delete](#)

☐ Maximum concurrent connections:

[OK](#) [Cancel](#)

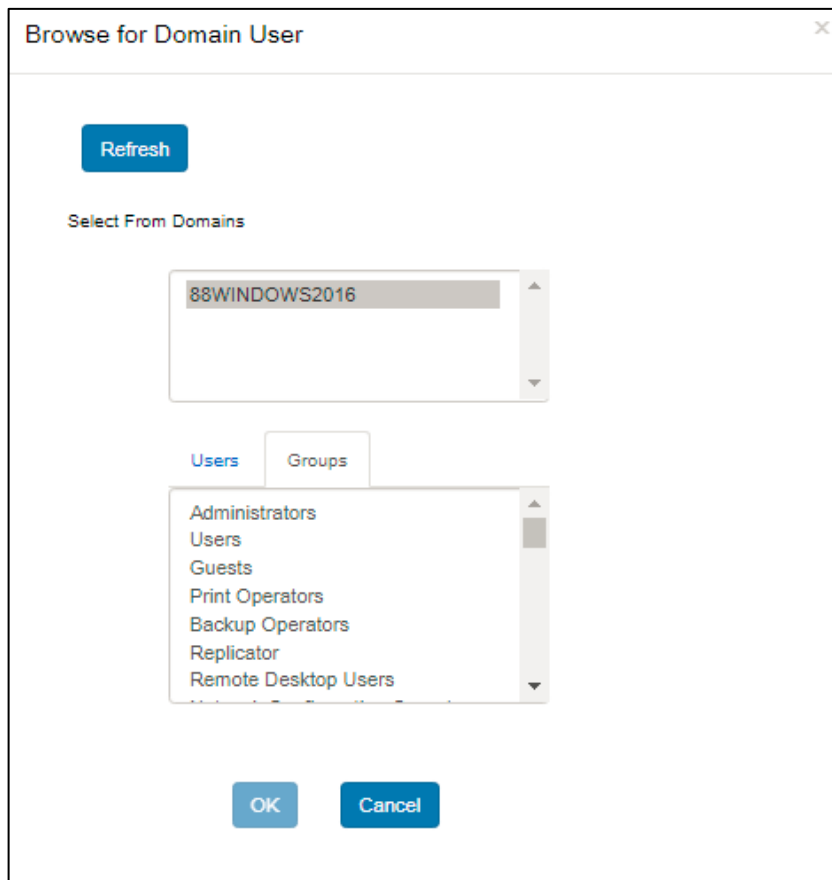
- Specify the domain and username for the user you want to add.

Domain usernames must be in the format \\domain\user. Domain usernames cannot contain the following characters:

\ / " [] : | < > + = ; , ? * @

If you want to browse for an existing user or group, click the **Browse** button. When the Browse for Domain User dialog (Figure 43) opens, click the name of the appropriate domain, and then click the name of the user or group in that domain you want to use. Click **OK** to finish.

Figure 53: Browse for Domain User Page



4. Optionally, enter a description of the domain user or group in the **Description** field.

The description you associate with a native user is not used during processing.

5. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

For more information on profiles, refer to Chapter 7, "Administering Profiles."

6. If you want to specify checklist attributes or return list attributes for the domain user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

See "Adding a Checklist or Return List Attribute for a User" for information on how to add checklist and return list attributes.

7. After you have added the appropriate checklist and return list attributes for a user, select an attribute and use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
8. If you want to specify the maximum number of concurrent connections this user can maintain, click the Maximum concurrent connections check box and enter a number in the accompanying field.
9. Click **OK**.

Setting Up SecurID Users

Username are case-sensitive. The case in which names are recorded depends on whether usernames are being stored in a local or external database. Usernames stored in an external database (UNIX, RSA SecurID, TACACS+) retain their case as stored in that database.

Adding a SecurID User

You can configure Steel-Belted Radius to use RSA SecurID authentication for your users by setting up communication between the RSA server and the RADIUS server (described in “Configuring SecurID Authentication”), and then adding SecurID users to the Steel-Belted Radius database using the instructions that follow.

Steel-Belted Radius attempts SecurID authentication only on usernames that match a SecurID entry in its User database. Steel-Belted Radius offers four types of SecurID entry, each providing a different matching rule:

- You can enter the name of a specific user.

For example, you might create a SecurID user entry for the specific user George. This tells Steel-Belted Radius that SecurID can be used as an authentication method when an authentication request is received for username George. If username George is authenticated, the attributes of the user entry apply.

- You can enter a prefix.

For example, you might create a SecurID user entry for the prefix sales\$. This tells Steel-Belted Radius that SecurID can be used as an authentication method when an authentication request is received for a username such as sales\$Harry or sales\$Cynthia. Using a prefix lets you group multiple SecurID users into a single user entry instead of creating a separate entry for each SecurID user. If the sales\$ user is authenticated, the attributes of the user entry apply.



Note: Only the part of the username after the prefix (Harry or Cynthia in the example above) is sent to the RSA SecurID server.

You can use different settings for different groups.



Note: The user must type in the prefix as part of the username when dialing in and requesting a connection.

- You can enter a suffix.

A suffix works like a prefix, but appears at the end of the username; for example, if the suffix were !sales, you might have usernames such as Harry!sales or Cynthia!sales.

- You can create an entry for Any user.

This creates a single user entry named <ANY> that matches any username to be authenticated. SecurID can be used as an authentication method for any username, and, if successful, the attributes of the <ANY> entry apply.

The <ANY> entry makes sense if a single set of attributes apply to all your SecurID users and if you want to make SecurID either the only authentication method used or the authentication method of last resort if other authentication methods fail.

To add a SecurID user entry:

1. Choose **User > Auth Methods > SecurID**.
2. Click the **New** button on the SecureID User Page. The Add SecureID User page appears:

Figure 54: Add SecurID User Page

3. Enter the specific username, a prefix, or a suffix in the **Name** field.
4. Select the user type: **Specific user**, **Prefix**, **Suffix**, or **Any user**.
5. Optionally, enter a description of the user in the **Description** field.
6. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the Profile list to select the **profile** you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

7. If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab

or the **Return list** tab, and then click the **Add** button.


Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

8. After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
9. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
10. Click **OK**.

Each new suffix or prefix entry that you add appears in the Users dialog with the username represented by the string USERNAME; for example, !USERNAME or SALES<USERNAME>.

Setting Up TACACS+ Users

You can configure Steel-Belted Radius to authenticate your users by querying a TACACS+ server.

 **Note:** Before you add TACACS+ users, you must configure communication between the Steel-Belted Radius server and the TACACS+ server by editing the tacplus.ini file. For more information on the tacplus.ini file, refer to the Steel-Belted Radius Reference Guide.


Steel-Belted Radius attempts TACACS+ authentication only on usernames that match a TACACS+ entry in its user database. Each type of TACACS+ entry specifies a different matching rule:

- You can enter the name of a specific user.


For example, you might create a TACACS+ user entry for the specific user George. This tells Steel-Belted Radius that when an authentication request is received for username George, TACACS+ can be used as an authentication method and, if successful, the attributes of this user entry apply.

- You can enter a prefix.

For example, you might create a TACACS+ user entry for the prefix sales\$. This tells Steel-Belted Radius that when an authentication request is received for a username such as sales\$Harry or sales\$Cynthia, TACACS+ can be used as an authentication method and, if successful, the attributes of this user entry apply.

 **Note:** Only the part of the username after the prefix (Harry or Cynthia in the example above) is sent to the TACACS+ server.

Using a prefix lets you group multiple TACACS+ into a single user entry instead of creating a separate entry for each TACACS+ user. You can use different settings for different groups.

 **Note:** The user must type in the prefix as part of the username he or she is using to dial in and request a connection.

- You can enter a suffix.

A suffix works like a prefix, but appears at the end of the username; for example, if the suffix were !sales, you might have usernames such as Harry!sales or Cynthia!sales.

- You can create an entry for Any user.

This creates a single user entry named <ANY> that matches any username to be authenticated. TACACS+ can be used as an authentication method for any username, and, if successful, the attributes of the <ANY> entry apply. The <ANY> entry makes sense if a single set of attributes apply to all your TACACS+ users and if you want to make TACACS+ either the only authentication method used or the authentication method of last resort if other authentication methods fail.

To add a TACACS+ user:

- Choose **Users > Auth Methods > TACACS+** in the menubar.
- Click the New button on the TACACS+ User Page. The Add TACACS+ User Page appears. .

Figure 55: Add TACACS+ User Page

- Enter the specific username, a prefix, or a suffix in the Name field.
- Select the user type: Specific user, Prefix, Suffix, or Any user.
- Optionally, enter a description of the user in the Description field.
- If you want to use a profile to assign checklist and return list attributes to the user, click the Use profile check box and use the Profile list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

7. If you want to specify checklist attributes or return list attributes for the user, click the Checklist tab or the Return list tab, and then click the Add button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

8. After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
9. If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.
10. Click **OK**.

Each new suffix or prefix entry that you add appears in the Users dialog with the username represented by the string USERNAME; for example, !USERNAME or SALES<USERNAME>.


Setting Up UNIX Users

You can add a UNIX user entry to provide for the authentication of a specific user defined on a Linux server. For more flexibility, you can add a UNIX group to provide for the authentication of all users that belong to a specific group defined on the server.

To add a UNIX user or group:

1. Choose **Users > Auth Methods > UNIX** in the menubar.
2. Click the **New** button on the UNIX User Page. The Add UNIX User page appears.

Figure 56: Add UNIX User Page

Pulse Secure

[System](#)[Authentication](#)[Users](#)[Maintenance](#)[Help](#)

[Auth Methods](#) > [Add Unix User](#)

Add Unix User

Name:

☒ User☐ Group

Description:

▼ Attributes

☐ Use Profile:

Select Profile

▼

Check List

[Return List](#)

Attribute	Value	Default
<div><div></div><div></div></div>		

↑

↓

☐ Maximum concurrent connections:

3. Click the **Browse** button and select a user or group from the list. Click **OK**.
4. Optionally, enter a description of the user in the **Description** field.
5. If you want to use a profile to assign checklist and return list attributes to the user, click the **Use profile** check box and use the **Profile** list to select the profile you want.

After you select a profile, you can click the **View** button to display the checklist and return list attributes in that profile.

- If you want to specify checklist attributes or return list attributes for the user, click the **Checklist** tab or the **Return list** tab, and then click the **Add** button.

Refer to “Adding a Checklist or Return List Attribute for a User” for information on how to add checklist and return list attributes.

- After you have added the appropriate checklist and return list attributes for a user, use the Up and Down buttons to the right of the attribute list to put the attributes in the correct sequence.
- If you want to specify the maximum number of concurrent connections this user can maintain, click the **Maximum concurrent connections** check box and enter a number in the accompanying field.

9. Click **OK**.

Editing User Settings

This section describes fields that you can set for any user entry, regardless of user type. For more information, see ["User Attribute Lists"](#) and ["Administering Profiles via WebGUI"](#).

Selecting a Profile

To select a profile for a user:

1. Open the appropriate user page by clicking a **User** > entry in the menubar.
2. Select the user whose entry you want to modify.
3. Click **Edit**.
4. Click the **Use Profile** check box.
5. Select the list to select the profile you want to use.

To display the settings associated with the selected profile, click the **View** button.

6. When you are finished, click **OK**.

Setting Attribute Values

To change the value of an attribute already in the checklist or return list for a user entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Select the attribute whose value you want to change.
3. Click **Edit** or double-click the attribute.
4. When the Change page opens, enter or select the new value.

Depending on the attribute, you can enter a new value or select a value from a list. For some attributes, Steel-Belted Radius retrieves the value from the server and you cannot enter a value in this page.

5. Click **OK**.

Removing Attribute/Value Pairs

To remove an attribute/value pair already in the checklist or return list for a User entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Select the attribute/value pair you'd like to remove.
3. Click **Delete**.

Reordering Attributes

Certain attributes are multi-valued and orderable; that is, the attribute/value pair can appear more than once in a RADIUS response, and the order in which the attribute/value pairs appear is significant. To reorder attributes in a User entry:

1. Click the **Checklist** tab or **Return List** tab.
2. Highlight an attribute/value pair in the list.
3. Click the Up or Down arrow to move the selected attribute within the list.
 - The Up arrow moves the selected attribute/value up in the list. If the attribute is not orderable, or if the selected item already the first value for this attribute, the button is disabled.
 - The Down arrow moves the selected attribute/value down in the list. If the attribute is not orderable, or if the selected item is already the last value for this attribute, the button is disabled.

Changing Attributes Inherited from a Profile

Checklist and return list attributes can be specified for a user, or they can be inherited from a profile associated with a user. Attributes inherited from a profile are overridden by attributes assigned to a specific user.

Concurrent Connection Limits

A maximum number of open connections can be set for each user entry by checking the **Maximum concurrent connections** check box and entering a number in the accompanying field. When the user requests access, the user can be authenticated using the given authentication method only if fewer than this number of connections are currently open for this user.

Allowed Access Hours

The user's allowed access hours can be specified by adding the Funk-Allowed-Access-Hours attribute to the user's checklist.

Funk-Allowed-Access-Hours is a variable-length string that identifies time periods in a 7-day week of 24-hour days. This string consists of one or more day specifiers (each of which can list one or more days and/or ranges of days) followed by one or more ranges of 24-hour times, in minutes.

Figure 57: Sample Funk-Allowed-Access-Hours Attribute Value

```
Funk-Allowed-Access-Hours M-W 0100-1400 2300-2400 M, Tu,Th, F
0530-1500, Sa-Su 0000-2400
```

The syntax rules for Funk-Allowed-Access-Hours are as follows:

- Time ranges can be inclusive (1000–1100 allows access only between 10 a.m. and 11 a.m.) or exclusive (1100–1000 allows access any time except between 10 a.m. and 11 a.m.).
- Day specifiers, and ranges of days and times can be separated by commas or spaces; ranges of days or times are indicated by hyphens (m–w or 0239–1459).
- Days can be specified by the minimum number of case-insensitive letters necessary to distinguish them (Su, M, Tu, W, Th, F, Sa) and can wrap around the end of the week (Sa-Su).
- At least one time period is required for each day; that is, each day, list, or range of days must be followed by one or more ranges of times.
- Times are specified using four digits, with leading zeroes where needed (0001 for 12:01 a.m., 0630 for 6:30 a.m., and so forth).

When assigned to a user's checklist, the Funk-Allowed-Access-Hours value in [Figure 47](#) allows the user access during the following time periods:

- 1 a.m. to 2 p.m. and 11:00 p.m. to midnight, Monday through Wednesday
- 5:30 a.m. to 3:00 p.m. Monday, Tuesday, Thursday, and Friday
- Any time Saturday or Sunday

The total access times Monday are 1 a.m. to 3:00 p.m. and 11:00 p.m. to midnight

If the user attempts access on Sunday at 11:30 p.m., access would be allowed and a Session-Timeout attribute specifying a value of 1800 seconds (30 minutes, until midnight Sunday, when the access period ends) would be returned. However, if the user's return list includes a Session-Timeout with a value less than 1800, this lesser value would be returned.

Deleting a User

To delete a user:

1. Open the appropriate user page by clicking a User > entry in the menubar.
2. Select the user you want to delete.
3. Click the **Delete** button in the appropriate User page.
4. When you are prompted to confirm the deletion, click **Yes**.

Chapter 9

Administering Profiles via Legacy SBR Administrator

This chapter describes how to set up and administer user profiles via legacy SBR administrator.

About Profiles

Steel-Belted Radius lets you define default templates of checklist and return list pairs called profiles. A profile provides specific attributes for one or both lists. You can define as many profiles as you require. Profiles provide a powerful means of managing and configuring accounts.

When you edit a User entry, you can assign a profile to the User; the checklist and return list attributes of that profile then become the default settings for the User entry. After you assign a profile to a User entry, you can modify the new entries on the user's checklist and return list. Changes you make apply only to the specific user entry; they do not affect the profile itself. Assigning a profile and then overriding individual attributes is a convenient way to leverage Steel-Belted Radius's features to your advantage.

To change attributes settings across many users immediately, edit the profile that you have assigned to these users. The changes you make to a profile are automatically reflected in each user's checklist and return list.

Adding a Checklist or Return List Attribute for a Profile

A checklist attribute is an item of information that must accompany a request for connection before the connection can be authenticated. A return list attribute is an item of information that Steel-Belted Radius includes in the Access-Accept message when a connection request is approved.

Resolving Profile and User Attributes

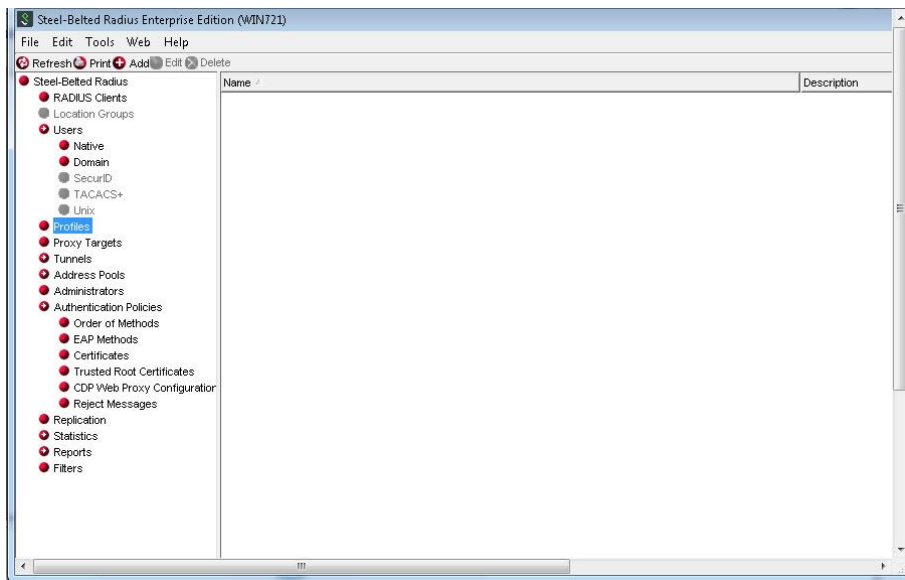
If user-specific attributes are stored in an external database, Steel-Belted Radius determines the final set of attributes for a user by merging the attributes stored in the native database with those retrieved from the external database. This calculation is performed as follows:

1. The attributes from the profile (or Alias user) assigned to the user are first retrieved.
2. These attributes are then merged with the user-specific modifications to the attributes in the following manner:
 - If the attribute is multi-valued, then the attribute(s) retrieved from the external database is added to the overall list of attributes.
 - If the attribute is single-valued, then the attribute(s) retrieved from the external database replaces any attribute of the same name in the profile or associated with the alias.
 - If the attribute is orderable, then the attribute(s) retrieved from the external database replaces any orderable attribute of the same name in the profile or associated with the alias.

Setting Up Profiles

The Profiles panel (Figure 58) lets you define sets of checklists and return list attributes. You can then assign these profiles to users to simplify user administration.

Figure 58: Profiles Panel



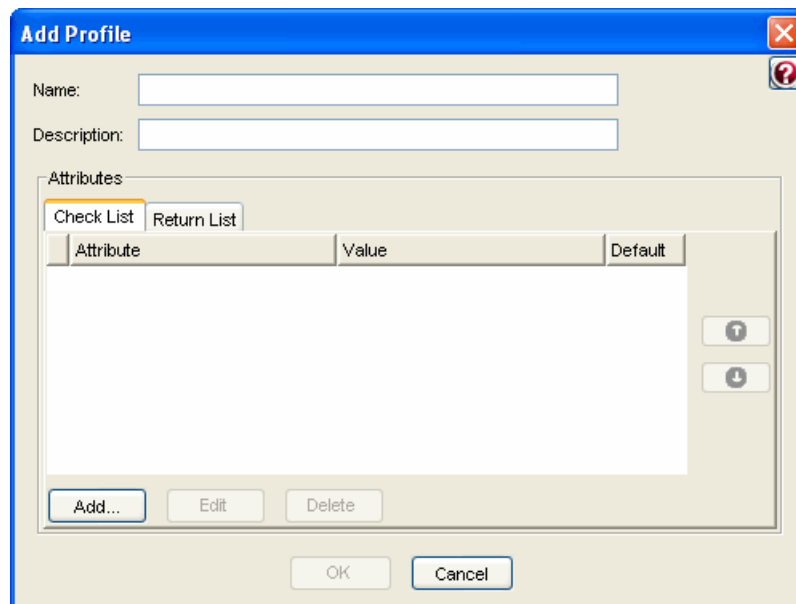
Adding a Profile

To add a profile:

1. Click **Profiles** to open the Profiles panel.
2. Click the **Add** button on the SBR Administrator toolbar.

The Add Profile dialog appears.

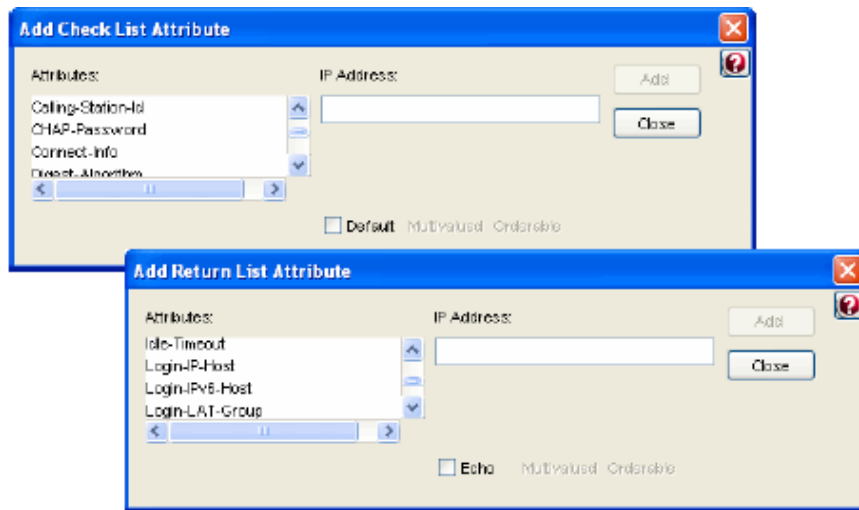
Figure 59: Add Profile Dialog



3. Enter a name for the new profile in the Name field.
4. Optionally, enter a description for the profile in the Description field.
5. Add checklist and return list attributes to the profile.

- a. Click the **Checklist** tab or the **Return list** tab.
- b. Click **Add**. The Add Checklist Attribute dialog or the Add Return List Attribute dialog opens.

Figure 60: Add Checklist Attribute and Add Return List Attribute Dialogs



- c. Select the attribute you want to add from the Attributes list.
- d. Select or enter a value for the attribute.

The dialog changes according to the attribute you choose. Some attributes require that you enter a value, string, or IP address. Other attributes require that you choose from a fixed list of values.

If the **Multivalued** indicator is dimmed, an attribute can have only one value. If the **Multivalued** attribute is undimmed, you can add multiple values for the attribute.

(Checklist attributes only) To set this value to the default value for the attribute (which is useful in situations where the attribute is not included in the RADIUS request), check the **Default value** check box.

(Return list single-valued attributes only) If you do not want to specify a particular value, but want to make sure that whatever value of the attribute appears in the RADIUS request is echoed to the client in the RADIUS response, click the **Echo** check box.

- e. Click **Add** to add this attribute/value pair to the list.
 - f. When you are finished adding attribute/value pairs, click **Close** to return to the Add Profile dialog.
6. Click **OK** to save the profile.

Removing a Profile

To remove a profile:

1. Open the Profiles panel.
2. Select the entry for the profile you want to remove.
3. Click the **Delete** button on the SBR Administrator toolbar (or right-click the profile entry and choose

Delete from the context menu).

4. When you are prompted to confirm the deletion, click **Yes**.



Note: Do not delete a profile that is assigned to a user. If you delete an active profile, the attributes defined in the profile are removed from users settings, possibly resulting in authentication failures.

Chapter 10

Administering Profiles via WebGUI

This chapter describes how to set up and administer user profiles via WebGUI.

About Profiles

Steel-Belted Radius lets you define default templates of checklist and return list pairs called profiles. A profile provides specific attributes for one or both lists. You can define as many profiles as you require. Profiles provide a powerful means of managing and configuring accounts.

When you edit a User entry, you can assign a profile to the User; the checklist and return list attributes of that profile then become the default settings for the User entry. After you assign a profile to a User entry, you can modify the new entries on the user's checklist and return list. Changes you make apply only to the specific user entry; they do not affect the profile itself. Assigning a profile and then overriding individual attributes is a convenient way to leverage Steel-Belted Radius's features to your advantage.

To change attributes settings across many users immediately, edit the profile that you have assigned to these users. The changes you make to a profile are automatically reflected in each user's checklist and return list.

Adding a Checklist or Return List Attribute for a Profile

A checklist attribute is an item of information that must accompany a request for connection before the connection can be authenticated. A return list attribute is an item of information that Steel-Belted Radius includes in the Access-Accept message when a connection request is approved.

Resolving Profile and User Attributes

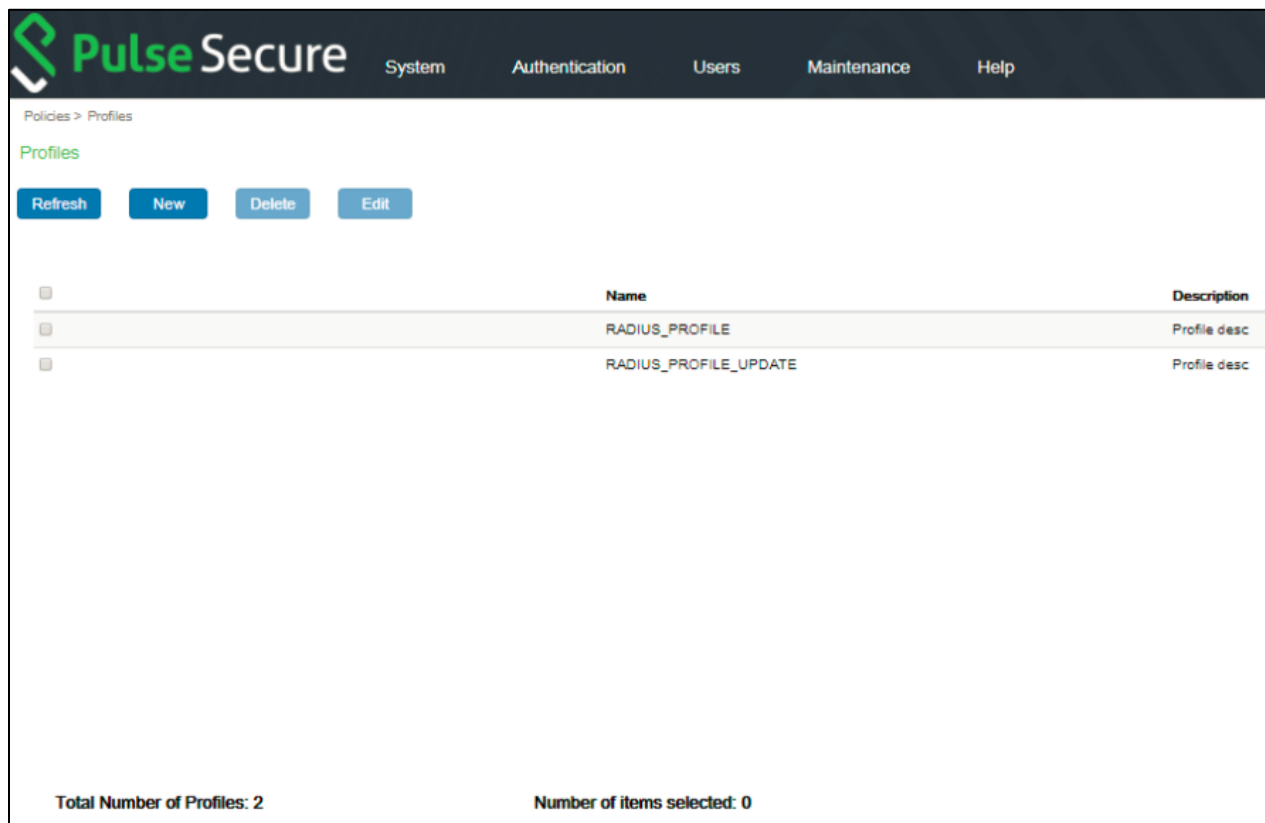
If user-specific attributes are stored in an external database, Steel-Belted Radius determines the final set of attributes for a user by merging the attributes stored in the native database with those retrieved from the external database. This calculation is performed as follows:

1. The attributes from the profile (or Alias user) assigned to the user are first retrieved.
2. These attributes are then merged with the user-specific modifications to the attributes in the following manner:
 - If the attribute is multi-valued, then the attribute(s) retrieved from the external database is added to the overall list of attributes.
 - If the attribute is single-valued, then the attribute(s) retrieved from the external database replaces any attribute of the same name in the profile or associated with the alias.
 - If the attribute is orderable, then the attribute(s) retrieved from the external database replaces any orderable attribute of the same name in the profile or associated with the alias.

Setting Up Profiles

The Profiles page (Figure 61: Profiles Page) lets you define sets of checklists and return list attributes. You can then assign these profiles to users to simplify user administration.

Figure 61: Profiles Page



Pulse Secure

System Authentication Users Maintenance Help

Policies > Profiles

Profiles

Refresh New Delete Edit

	Name	Description
<input type="checkbox"/>	RADIUS_PROFILE	Profile desc
<input type="checkbox"/>	RADIUS_PROFILE_UPDATE	Profile desc

Total Number of Profiles: 2 Number of items selected: 0

Adding a Profile

To add a profile:

1. Choose **System > Policies > Profiles** to open the Profiles page.
2. Click the **New** button on the Profile Page. The Add profile page appears.

Figure 62: Add Profile Page

Policies > Add Profile

Add Profile

Name:

Description:

▼ Attributes

Check List Return List

Attribute	Value	Default
-----------	-------	---------

Add Edit Delete

OK Cancel

3. Enter a name for the new profile in the Name field.
4. Optionally, enter a description for the profile in the Description field.
5. Add checklist and return list attributes to the profile.
 - a. Click the **Checklist** tab or the **Return list** tab.
 - b. Click **Add**. The Add Checklist Attribute page or the Add Return List Attribute page opens.

Figure 63: Add Checklist Attribute and Add Return List Attribute Pages

Add Check List Attribute

Attributes

3GPP-CG-Address

3GPP-CG-IPv6-Address

3GPP-Charging-Characteristics

3GPP-Charging-Id

String

IP Address

IPv6 Address

Value

Hexadecimal

Integer

IP

IPv6-Prefix

IPv6-Interface

IP Address:

Resolve DNS

☐ Default

Multivalued

Orderable

Add

Close

Add Return List Attribute

Attributes

- 3GPP-CG-Address
- 3GPP-CG-IPv6-Address**
- 3GPP-Charging-Characteristics
- 3GPP-Charging-Id

String IP Address **IPv6 Address** Value

Hexadecimal Integer IP IPX IPv6-Prefix

IPv6-Interface Date/time Echo Constant

IPv6 Address:

☐ **Echo** Multivalued Orderable

Add **Close**

- c. Select the attribute you want to add from the Attributes list.
- d. Select or enter a value for the attribute.

The dialog changes according to the attribute you choose. Some attributes require that you enter a value, string, or IP address. Other attributes require that you choose from a fixed list of values.

If the **Multivalued** indicator is dimmed, an attribute can have only one value. If the **Multivalued** attribute is undimmed, you can add multiple values for the attribute.

(Checklist attributes only) To set this value to the default value for the attribute (which is useful in situations where the attribute is not included in the RADIUS request), check the **Default value** check box.

(Return list single-valued attributes only) If you do not want to specify a particular value, but want to make sure that whatever value of the attribute appears in the RADIUS request is echoed to the client in the RADIUS response, click the **Echo** check box.

- e. Click **Add** to add this attribute/value pair to the list.
- f. When you are finished adding attribute/value pairs, click **Close** to return to the Add Profile


page.

6. Click **OK** to save the profile.

Removing a Profile

To remove a profile:

1. Choose **System > Policies > Profiles** to open the Profiles page.
2. Select the entry for the profile you want to remove.
3. Click the **Delete** button.
4. When you are prompted to confirm the deletion, click **Yes**.

 **Note:** Do not delete a profile that is assigned to a user. If you delete an active profile, the attributes defined in the profile are removed from users settings, possibly resulting in authentication failures.

Chapter 11

Administering Proxy RADIUS via legacy SBR Administrator

This chapter presents an overview of proxy RADIUS and describes how to set up proxy targets via legacy SBR administrator.

About Proxy RADIUS

Steel-Belted Radius can forward a RADIUS request to another server for processing and relay the other server's result back to its client. Steel-Belted Radius is acting as a proxy for the target server, and that Steel-Belted Radius is proxy-forwarding the request to the target server.

Any Steel-Belted Radius server can act as proxy or target for authentication or accounting messages (or both).

Proxy RADIUS Authentication

Figure 64 illustrates how RADIUS authentication messages are proxy-forwarded:

1. A network access device (RADIUS client) sends an authentication request to a RADIUS proxy server.
2. The proxy RADIUS server forwards the message to a RADIUS target server.
3. The target RADIUS server performs the authentication services indicated by the message, then returns a response message to the proxy RADIUS server.
4. The proxy RADIUS server relays the response message to the RADIUS client.

Figure 64: RADIUS Proxy Forwarding



Proxy RADIUS Accounting

RADIUS accounting messages are proxy-forwarded as follows:

1. A RADIUS server receives an accounting request.
2. Depending on its configuration, the RADIUS server forwards the accounting message to a target server, records accounting attributes locally on the proxy server, or records the information in both places.
3. If the proxy server does not receive an acknowledgement of the forwarded packet, it periodically re-sends the packet according to its retry policy.

Adding a Proxy Target

This section explains how to set up proxy forwarding from the Steel-Belted Radius server (the proxy) to another

RADIUS server (the target).

To add a proxy target:

1. Choose **Proxy Targets** to open the Proxy Target panel.
2. Click the **Add** button on the SBR Administrator toolbar.

The Add Proxy Target dialog appears.

Figure 65: Add Proxy Target Dialog

3. Enter the name of the proxy target in the **Name** field.

The target name must not duplicate any other target name, realm name, or tunnel name in your Steel-Belted Radius configuration. The name you record for a proxy target is not used in processing; Steel-Belted Radius uses the proxy target's IP address to route RADIUS packets.

4. Enter a description for the proxy target in the **Description** field.
5. Enter the IP address or DNS name of the proxy target in the **IP Address** field.

If you enter the DNS name of the proxy target, the SBR Administrator resolves the name you enter to an IP address automatically.

6. Enter the shared secret for the proxy target in the **Shared Secret** field.



Note: Shared secrets are case-sensitive.

If you want the characters in the shared secret (rather than asterisks) to appear as you type, click the **Unmask** check box.

The shared secret configured for the proxy target in Steel-Belted Radius must match the shared secret configured on the proxy target.

7. Specify how many times Steel-Belted Radius should try to reach the proxy target and how long to wait between attempts in the **Number of retries** and **Milliseconds** between retries fields.

When Steel-Belted Radius acts as a proxy, it emulates the characteristics of a network access device. This includes the ability to retransmit a request if the first attempt does not get a timely response from the proxy target.

- The **Number of retries** field specifies the number of times a request is retransmitted if an acknowledgment from the target is not received; if the number of retries is exhausted, then the original request is rejected. By default, Steel-Belted Radius retries three times before giving up.
 - The **Milliseconds between retries** field specifies the time interval between each retry in milliseconds (thousandths of a second). By default, Steel-Belted Radius waits 5000 milliseconds (5 seconds) between retries.
8. If the proxy target uses ports different from what the proxy intermediary uses for authentication or accounting, click the **Authentication or Accounting** check box and enter the port number you want Steel-Belted Radius to use when exchanging RADIUS authentication or accounting information with the proxy target.

The port numbers configured for the proxy target in Steel-Belted Radius must match the port numbers configured on the proxy target. By default, Steel-Belted Radius uses port 1645 for authentication and port 1646 for accounting.

9. Specify whether you want accounting requests to be forwarded or recorded locally.
- If you click the **Forward** check box, Steel-Belted Radius forwards the accounting transaction to the same proxy target that received the authentication transaction.
 - If you click the **Record locally** check box, Steel-Belted Radius logs the accounting transaction locally (regardless of whether an authentication request was forwarded to the proxy target).

You can click both check boxes if you want accounting requests to be forwarded and logged locally.


10. If you want Steel-Belted Radius to use a different shared secret for accounting when communicating with the proxy target, click the **Use different shared secret for accounting** check box and click the **Edit** button to specify an accounting shared secret.

See [“Maintaining an Accounting Shared Secret”](#) for information on using the Edit Accounting Shared Secret dialog.

11. If you want to use a proxy target as an authentication method, click the **Make available as an authentication method check box**.

If you enable this option, the name of the proxy target appears in the Authentication Methods tab of the Authentication Policies panel as proxy:name. This is useful if you have user records defined on an older RADIUS server and you want to provide a seamless migration to Steel-Belted Radius. Using the older server as a proxy RADIUS target means that RADIUS requests that arrive addressed to this target are handled by Steel-Belted Radius automatically, without requiring end users to change their addressing conventions.

12. Click **OK**.

 **Note:** If the proxy target that you are configuring is a member of a proxy RADIUS realm, you should ensure that the Make available as an authentication method check box is unchecked.

Ask the administrator at the target site to log into the target server’s RADIUS configuration program and add

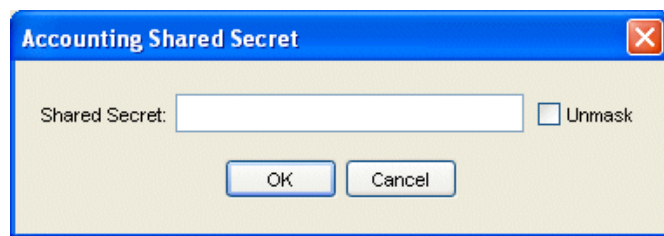
Steel-Belted Radius as a RADIUS client of the target server. You will need to provide this administrator with the IP address of the Steel-Belted Radius server.

Maintaining an Accounting Shared Secret

To specify a shared secret for accounting:

1. Click the Use **different shared secret for accounting** check box.
2. Click the **Edit** button.
3. When the Accounting Shared Secret dialog (Figure 66) opens, enter the shared secret you want Steel-Belted Radius to use.

Figure 66: Accounting Shared Secret Dialog



If you want the characters in the shared secret (rather than asterisks) to appear as you type, click the **Unmask** check box. Note that shared secrets are case-sensitive.

4. Click **OK**.

Deleting a Proxy Target

To remove a target server from the proxy target list:

1. In the Proxy Target panel, select the target server you'd like to remove.
2. Click **Delete**.

Steel-Belted Radius as a Target

This section describes how to set up proxy forwarding from some other RADIUS server (the proxy) to the Steel-Belted Radius server (the target):

1. Set up the proxy as a RADIUS client of Steel-Belted Radius.
Add the entry using the RADIUS Clients panel. Specify the proxy's name, its IP address, and the shared secret that you want to use for encryption between the proxy and Steel-Belted Radius.
2. Ask the administrator at the target site to log into the proxy's RADIUS configuration program and set up Steel-Belted Radius as a proxy RADIUS target. You will need to provide this administrator with the IP address of the Steel-Belted Radius server.

Note: Make sure that the same UDP port and shared secret are entered on both proxy and target sides.

Dictionaries when Steel-Belted Radius is the Target

When Steel-Belted Radius receives a proxy-forwarded packet, it consults its RADIUS client entry for that proxy server. The **Make/model** field of this entry determines which attribute dictionary Steel-Belted Radius uses.

At various different times, Steel-Belted Radius can receive requests from the same proxy server that have originated from different network access devices, possibly of different types. The single **Make/model** field that was entered for the proxy might not be adequate to handle the variety of RASs on the “other side” of the transaction.

One way to handle this problem is to add the originating network access devices to Steel-Belted Radius’s list of RADIUS clients. Steel-Belted Radius can be configured to examine each proxy-forwarded packet for clues as to the make and model of the originating device. If clues are found, Steel-Belted Radius does everything it can to map this information to a vendor-specific dictionary, and uses this dictionary in preference to the one for the proxy.

Accepting Packets from Any Proxy

If you’d like Steel-Belted Radius to be able to accept proxy requests from any IP address, you can use the RADIUS Clients panel to add a special entry called **<ANY>**, and specify a shared secret. The **<ANY>** entry permits forwarded requests from any proxy to be accepted, provided the shared secret is correct.

 **Note:** This feature requires that proxies are configured to use the shared secret you provide in the **<ANY>** entry.

Proxy RADIUS as an Authentication Method

Any target proxy RADIUS server can be configured as a Steel-Belted Radius authentication method by enabling the **Make available as an authentication method** check box in the Add Proxy Target/Edit Proxy Target dialog.

A target server can be set up as an authentication method even if the end users do not know anything about the target. That is, a user does not need to log in using a decorated username such as User@TargetName to be authenticated by the target server.

If you prioritize the proxy: TargetName authentication method above the Native User authentication method in the authentication methods list, the user can log in as User and Steel-Belted Radius automatically sends the request to the target for authentication. The authentication succeeds if the Username and password are stored on the target, but if not, Steel-Belted Radius reaches the Native User method eventually, and the user can then be authenticated.

This technique is useful as a migration path to Steel-Belted Radius from other RADIUS servers. You can set up Steel-Belted Radius as the proxy and the old RADIUS server as the target. After proxy authentication is enabled (in the Proxy Targets panel) and prioritized (in the Authentication Policies panel), Steel-Belted Radius can authenticate users against the old RADIUS server, either as an automatic “first choice” or as an alternative when authentication against the new server’s “local” database fails.

Chapter 12

Administering Proxy RADIUS via WebGUI

This chapter presents an overview of proxy RADIUS and describes how to set up proxy targets via WebGUI administrator.

About Proxy RADIUS

Steel-Belted Radius can forward a RADIUS request to another server for processing and relay the other server's result back to its client. Steel-Belted Radius is acting as a proxy for the target server, and that Steel-Belted Radius is proxy-forwarding the request to the target server.

Any Steel-Belted Radius server can act as proxy or target for authentication or accounting messages (or both).

Proxy RADIUS Authentication

Figure 67: RADIUS Proxy Forwarding illustrates how RADIUS authentication messages are proxy-forwarded:

1. A network access device (RADIUS client) sends an authentication request to a RADIUS proxy server.
2. The proxy RADIUS server forwards the message to a RADIUS target server.
3. The target RADIUS server performs the authentication services indicated by the message, then returns a response message to the proxy RADIUS server.
4. The proxy RADIUS server relays the response message to the RADIUS client.

Figure 67: RADIUS Proxy Forwarding



Proxy RADIUS Accounting

RADIUS accounting messages are proxy-forwarded as follows:

1. A RADIUS server receives an accounting request.
2. Depending on its configuration, the RADIUS server forwards the accounting message to a target server, records accounting attributes locally on the proxy server, or records the information in both places.
3. If the proxy server does not receive an acknowledgement of the forwarded packet, it periodically re-sends the packet according to its retry policy.

Adding a Proxy Target

This section explains how to set up proxy forwarding from the Steel-Belted Radius server (the proxy) to another RADIUS server (the target).

To add a proxy target:

1. Choose **Users > Proxy Auth > Proxy Targets** to open the Proxy Target page.
2. Click the **New** button on the Proxy Target page. The Add Proxy Target page appears.

Figure 68: Add Proxy Target Page

3. Enter the name of the proxy target in the **Name** field.

The target name must not duplicate any other target name, realm name, or tunnel name in your Steel-Belted Radius configuration. The name you record for a proxy target is not used in processing; Steel-Belted Radius uses the proxy target's IP address to route RADIUS packets.

4. Enter a description for the proxy target in the **Description** field.
5. Enter the IP address or DNS name of the proxy target in the **IP Address** field.

If you enter the DNS name of the proxy target, the click Resolve DNS option, SBR Administrator resolves the name you enter to an IP address automatically.

6. Enter the shared secret for the proxy target in the **Shared Secret** field.

 **Note:** Shared secrets are case-sensitive.

If you want the characters in the shared secret (rather than asterisks) to appear as you type, click the **Unmask** check box.

The shared secret configured for the proxy target in Steel-Belted Radius must match the shared secret configured on the proxy target.

7. Specify how many times Steel-Belted Radius should try to reach the proxy target and how long to wait between attempts in the **Number of retries and Milliseconds** between retries fields.

When Steel-Belted Radius acts as a proxy, it emulates the characteristics of a network access device. This includes the ability to retransmit a request if the first attempt does not get a timely response from the proxy target.

- The **Number of retries** field specifies the number of times a request is retransmitted if an acknowledgment from the target is not received; if the number of retries is exhausted, then the original request is rejected. By default, Steel-Belted Radius retries three times before giving up.
 - The **Milliseconds between retries** field specifies the time interval between each retry in milliseconds (thousandths of a second). By default, Steel-Belted Radius waits 5000 milliseconds (5 seconds) between retries.
8. If the proxy target uses ports different from what the proxy intermediary uses for authentication or accounting, click the **Authentication or Accounting** check box and enter the port number you want Steel-Belted Radius to use when exchanging RADIUS authentication or accounting information with the proxy target.

The port numbers configured for the proxy target in Steel-Belted Radius must match the port numbers configured on the proxy target. By default, Steel-Belted Radius uses port 1645 for authentication and port 1646 for accounting.

9. Specify whether you want accounting requests to be forwarded or recorded locally.
 - If you click the **Forward** check box, Steel-Belted Radius forwards the accounting transaction to the same proxy target that received the authentication transaction.
 - If you click the **Record locally** check box, Steel-Belted Radius logs the accounting transaction locally (regardless of whether an authentication request was forwarded to the proxy target).

You can click both check boxes if you want accounting requests to be forwarded and logged locally.

10. If you want Steel-Belted Radius to use a different shared secret for accounting when communicating with the proxy target, click the **Use different shared secret for accounting** check box and click the **Edit** button to specify an accounting shared secret.

See “Maintaining an Accounting Shared Secret” for information on using the Edit Accounting Shared Secret dialog.

11. If you want to use a proxy target as an authentication method, click the **Make available as an authentication method check box**.

If you enable this option, the name of the proxy target appears in the Authentication Methods tab of the Authentication Policies page as proxy:name. This is useful if you have user records defined on an older RADIUS server and you want to provide a seamless migration to Steel-Belted Radius. Using the older server as a proxy RADIUS target means that RADIUS requests that arrive addressed to this target are handled by Steel-Belted Radius automatically, without requiring end users to change their addressing conventions. Click **OK**.



Note: If the proxy target that you are configuring is a member of a proxy RADIUS realm, you should ensure

that the **Make available as an authentication method** check box is unchecked.

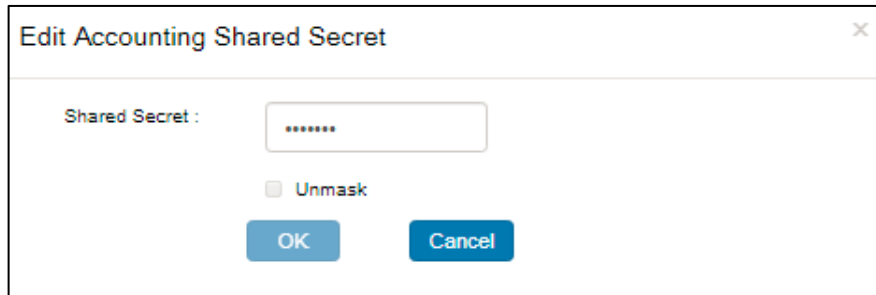
Ask the administrator at the target site to log into the target server's RADIUS configuration program and add Steel-Belted Radius as a RADIUS client of the target server. You will need to provide this administrator with the IP address of the Steel-Belted Radius server.

Maintaining an Accounting Shared Secret

To specify a shared secret for accounting:

1. Click the **Use different shared secret for accounting** check box.
2. Click the **Edit** button.
3. When the Accounting Shared Secret page (Figure 69: Accounting Shared Secret Page) opens, enter the shared secret you want Steel-Belted Radius to use.

Figure 69: Accounting Shared Secret Page



If you want the characters in the shared secret (rather than asterisks) to appear as you type, click the **Unmask** check box. Note that shared secrets are case-sensitive.

4. Click **OK**.

Deleting a Proxy Target

To remove a target server from the proxy target list:


1. In the Proxy Target page, select the target server you'd like to remove.
2. Click **Delete**.

Steel-Belted Radius as a Target

This section describes how to set up proxy forwarding from some other RADIUS server (the proxy) to the Steel-Belted Radius server (the target):

1. Set up the proxy as a RADIUS client of Steel-Belted Radius.
Add the entry using the RADIUS Clients page. Specify the proxy's name, its IP address, and the shared secret that you want to use for encryption between the proxy and Steel-Belted Radius.
2. Ask the administrator at the target site to log into the proxy's RADIUS configuration program and set up Steel-Belted Radius as a proxy RADIUS target. You will need to provide this administrator with the

IP address of the Steel-Belted Radius server.

 **Note:** Make sure that the same UDP port and shared secret are entered on both proxy and target sides.

Dictionaries when Steel-Belted Radius is the Target

When Steel-Belted Radius receives a proxy-forwarded packet, it consults its RADIUS client entry for that proxy server. The **Make/model** field of this entry determines which attribute dictionary Steel-Belted Radius uses.

At various different times, Steel-Belted Radius can receive requests from the same proxy server that have originated from different network access devices, possibly of different types. The single **Make/model** field that was entered for the proxy might not be adequate to handle the variety of RASs on the “other side” of the transaction.

One way to handle this problem is to add the originating network access devices to Steel-Belted Radius’s list of RADIUS clients. Steel-Belted Radius can be configured to examine each proxy-forwarded packet for clues as to the make and model of the originating device. If clues are found, Steel-Belted Radius does everything it can to map this information to a vendor-specific dictionary, and uses this dictionary in preference to the one for the proxy.

Accepting Packets from Any Proxy

If you’d like Steel-Belted Radius to be able to accept proxy requests from any IP address, you can use the RADIUS Clients page to add a special entry called **<ANY>**, and specify a shared secret. The **<ANY>** entry permits forwarded requests from any proxy to be accepted, provided the shared secret is correct.

 **Note:** This feature requires that proxies are configured to use the shared secret you provide in the **<ANY>** entry.

Proxy RADIUS as an Authentication Method

Any target proxy RADIUS server can be configured as a Steel-Belted Radius authentication method by enabling the **Make available as an authentication method** check box in the Add Proxy Target/Edit Proxy Target dialog.

A target server can be set up as an authentication method even if the end users do not know anything about the target. That is, a user does not need to log in using a decorated username such as User@TargetName to be authenticated by the target server.

If you prioritize the proxy: TargetName authentication method above the Native User authentication method in the authentication methods list, the user can log in as User and Steel-Belted Radius automatically sends the request to the target for authentication. The authentication succeeds if the UserName and password are stored on the target, but if not, Steel-Belted Radius reaches the Native User method eventually, and the user can then be authenticated.

This technique is useful as a migration path to Steel-Belted Radius from other RADIUS servers. You can set up Steel-Belted Radius as the proxy and the old RADIUS server as the target. After proxy authentication is enabled (in the Proxy Targets page) and prioritized (in the Authentication Policies page), Steel-Belted Radius can authenticate users against the old RADIUS server, either as an automatic “first choice” or as an alternative when authentication against the new server’s “local” database fails.


Chapter 13

Administering RADIUS Tunnels via Legacy SBR Administrator

This chapter describes how to set up and administer RADIUS tunnels via legacy SBR administrator.

About RADIUS Tunnels

A tunnel is a uniquely secure type of remote connection. A tunnel passes data between a remote site and an enterprise site, providing an additional layer of encrypted protocol “wrapper” around the data. A tunnel offers authentication and encryption features that help secure the connection against network vandals and eavesdroppers. In addition, a tunnel can provide quality of service features such as guaranteed bandwidth.

 **Note:** Steel-Belted Radius does not add tunnel functionality to your network. Steel-Belted Radius is able to support the authentication and accounting needs of any tunnels that you’ve already set up.

Administration and configuration of the tunnel happens at the remote site, since this is the side of the connection that requests remote access and opens the tunnel. An administrator at the remote site must configure the tunnel with various attributes: its destination IP address, what security protocols it supports, its password, and so on. These attributes are stored in a database to be retrieved when needed to set up a connection.

Storing tunnel attributes on a RADIUS server simplifies tunnel connections. At connection time, the tunnel is established by a network access device at the remote site. The NAD retrieves the tunnel configuration attributes from the RADIUS server and uses them to open the tunnel into the enterprise. After the tunnel is open, the user can be authenticated at the enterprise.

A RADIUS server is said to support tunnels if it has the ability to store and retrieve the configuration data that a NAD needs to open a tunnel. Steel-Belted Radius fully supports tunnels:

- Steel-Belted Radius can determine from the attributes in the incoming Access-Request whether the connection request involves a tunnel, and if so, which tunnel.
- Steel-Belted Radius can store and retrieve tunnel configuration data.
- Steel-Belted Radius can track the number of tunnels currently in use, compare to a maximum number, and refuse the connection if the number is exceeded.

Tunnel Authentication Sequence

1. Steel-Belted Radius receives an Access-Request message:
2. Steel-Belted Radius checks if the Access-Request contains a Called-Station-Id attribute. If it does, Steel-Belted Radius searches its database for a tunnel entry that contains the indicated telephone number in its Called-Station-Id list.

If a match between the Called-Station-Id and a tunnel entry can be found, Steel-Belted Radius constructs an Access-Accept message using the Attributes list in the matching tunnel entry. It then returns the Access-Accept to the client NAD.

 **Note:** If realms are in use, Steel-Belted Radius also searches for this number in its realm

configuration files. If a match is found, the Access-Request is routed to the realm, and the quest for a tunnel is abandoned. For this reason, it is important to ensure that DNIS numbers are unique across all tunnel entries and across all realm configuration files.

3. Steel-Belted Radius checks if the Access-Request contains a username in the form User<Delimiter>TunnelName or TunnelName<Delimiter>User. <Delimiter> is a single character that must match the server's tunnel delimiter character. The order of the realm name relative to the username must match the server's tunnel naming convention (prefix or suffix). Both of these values are determined per server (that is, all tunnels that use this server must follow the same conventions) by entering them in the Name Parsing tab of the Tunnels panel.
4. Steel-Belted Radius searches its database for a tunnel entry whose name matches the incoming TunnelName. If a match can be found, Steel-Belted Radius constructs an Access-Accept message using the Attributes list in the matching tunnel entry. It then returns the Access-Accept to the client NAD.
5. If Steel-Belted Radius was able to match the Access-Request with a tunnel entry, the NAD uses the attributes returned in the Access-Accept message to open a tunnel into the enterprise site. Authentication of the User-Name is attempted, usually at the enterprise site. If user authentication succeeds, the connection is complete. Otherwise, the user's connection request is denied.
6. If no matching tunnel entry was found in steps 1 or 2, Steel-Belted Radius concludes that a tunnel is not involved in making this connection. It then continues with its User-Name parsing sequence determine a destination for the authentication request.

The following is a wildcard example for IP Addresses:

NAS-IP-Address = 199.100.10.0

where NAS-IP-Address indicates any IP address on the 199.100.10.0 network.

Configuring Tunnel Support

To configure Steel-Belted Radius to support a tunnel, you must open the Tunnels panel (Configuring RADIUS Tunnels) in the SBR Administrator and add a tunnel entry.

A tunnel entry allows you to specify a list of connection Attributes such as the tunnel password, the IP address of the NAD at the enterprise site, encryption conventions to use, and so on. You can also enter the maximum number of tunnels that can be open at one time. You will need to coordinate with the administrator at the enterprise site to get some of this information.

Called Station Id

DNIS (Dialed Number Information Services) refers to a capability that many network access devices have to determine and use the telephone number that was dialed to make a connection request. The RADIUS standard supports DNIS by specifying the following attributes:

- Calling-Station-Id is the number from which the user originated the request.
- Called-Station-Id is the telephone number that was dialed to make the network connection.

When setting up a tunnel entry for the Steel-Belted Radius database, you can enter a telephone number or list of numbers in the Called Station Id list in the Tunnels panel. This list identifies **Called-Station-Id** attribute values that the server should expect to find in tunnel connection requests.

Dictionaries for Tunnel Support


The Tunnels panel allows you to create the Attributes list by selecting attributes from a drop-down list. The available selections include attributes from all standard and vendor-specific RADIUS dictionaries installed on the Steel-Belted Radius server.

When the server can accept a tunnel connection request, it consults the corresponding tunnel entry for the list of Attributes to return in the Access-Accept packet. Steel-Belted Radius always returns any standard RADIUS attributes that appear in the Attributes list. It also returns any vendor-specific attributes that are appropriate for the NAD that requested the tunnel connection. Vendor-specific attributes in the Attributes list that do not apply to the requesting NAD are ignored.

Concurrent Tunnel Connections

Steel-Belted Radius tracks the number of active connections for each tunnel. You can limit the number of concurrent connections that can be open through a specific tunnel. When a user requests a new connection through a tunnel, Steel-Belted Radius compares the number of active connections in a tunnel to the maximum number of connections: if a new connection would exceed the limit, Steel-Belted Radius rejects the additional connection.

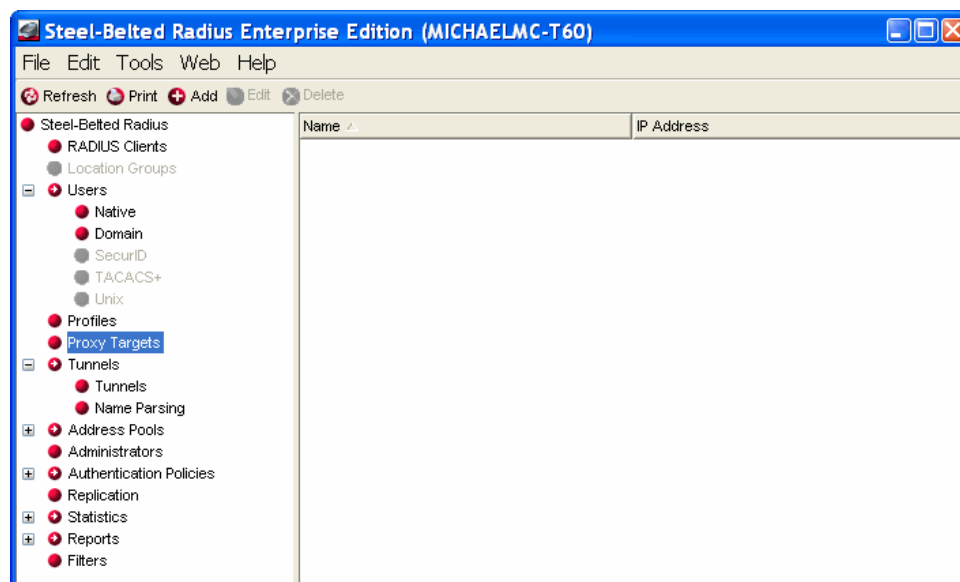
For concurrent connection limits to work, each NAD that can open a tunnel must be configured for RADIUS accounting and the same Steel-Belted Radius server must be specified for both authentication and accounting.

 **Note:** Concurrent tunnel connections cannot be tracked across multiple Steel-Belted Radius servers without additional software extensions. Contact Pulse Secure for more information.

Configuring RADIUS Tunnels

The Tunnels panel (Figure 70) lets you configure Steel-Belted Radius to support tunnels. When you add a tunnel entry, you are not creating a tunnel; you are enabling Steel-Belted Radius to support an existing tunnel's authentication and accounting needs and specifying how the server should parse tunnel names.

Figure 70: Tunnels Panel



Adding a Tunnel

To add a tunnel entry:

1. Choose **Tunnels > Tunnels** in the sidebar.

- Click the **Add** button in the Steel-Belted Radius toolbar.

The Add Tunnel dialog opens.

Figure 71: Add Tunnel Dialog

The Add Tunnel dialog box is shown. It includes fields for Name, Description, and a table for Attributes (with columns Attribute and Value). Below the table are Add, Edit, and Delete buttons. There is also a section for Called Station IDs with a text input and New, Edit, and Delete buttons. At the bottom, there is a checkbox for Maximum open tunnels and OK/Cancel buttons.

- Enter the name of the tunnel name in the **Name** field.

Tunnel names do not need to match the actual node name of a client tunnel server. The name you assign to a tunnel must not match the name assigned to a proxy target, realm, or tunnel in your Steel-Belted Radius configuration.

- Enter a description of the tunnel in the **Description** field.

Tunnel descriptions are used only for administrative purposes and do not affect tunnel connections. This field is typically used to identify the user or organization that uses the tunnel.

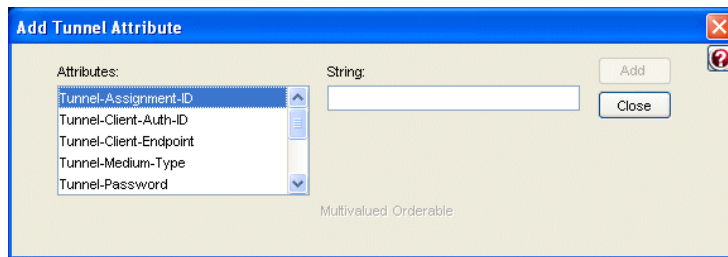
- Associate attributes and values with the tunnel you are setting up.

When a tunnel is used to make a connection, the attributes associated with the tunnel are filtered according to the make/model of the RADIUS client used to establish the connection.

To associate attributes and values with a tunnel:

- Click the **Add** button below the **Attributes** list.
The Add Tunnel Attribute dialog opens.

Figure 72: Add Tunnel Attribute Dialog



- b. Select the attribute you want to add from the **Attributes** list.
 - c. Specify the string or IP address you want to use for the attribute value.
 - d. Click **Add**.
 - e. When you finish adding attributes for the tunnel, click **Close**.
6. Optionally, specify one or more Called Station IDs for the tunnel.

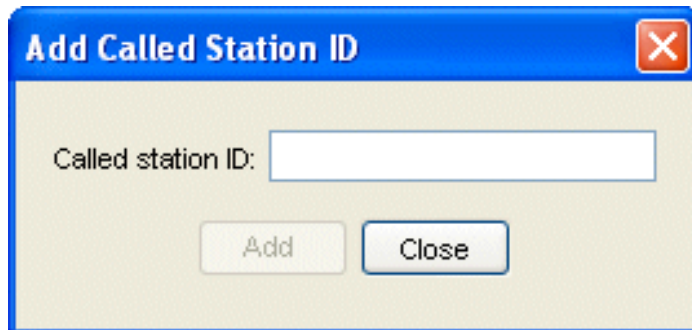
A Called Station ID is a telephone number that was dialed to make a network connection. The Called station ID list identifies the Called-Station-Id attribute values that the server expects to find in tunnel connection requests.

To add one or more Called Station ID numbers for a tunnel:

- a. Click the **New** button to the right of the Called Station ID list.

The Add Called Station ID dialog (Figure 73) opens.

Figure 73: Add Called Station ID Dialog



- b. Enter the number you want to use in the **Called station ID** field.
 - c. Click **Add**.

Repeat Steps a–c until you have added all called station IDs for the tunnel.

- d. When you are finished adding called station IDs, click **Close**.
7. If you want to limit the number of connections that can use the tunnel simultaneously, click the **Maximum open tunnels** check box and enter the **maximum number of tunnels** in the Maximum open tunnels field.

- Click **OK**.

Editing a Tunnel

To edit a tunnel entry:

- Choose **Tunnels > Tunnels** in the sidebar and select the tunnel you want to edit. Click **Edit**.
The Edit Tunnel dialog appears.

Figure 74: Edit Tunnel Dialog

The screenshot shows the 'Edit Tunnel' dialog box. It includes the following elements:

- Name:** RT124
- Description:** (empty text field)
- Attributes:** A table with columns 'Attribute' and 'Value'. To the right of the table are up and down arrow buttons. Below the table are 'Add...', 'Edit...', and 'Delete' buttons.
- Called Station IDs:** A list box containing '9785551258'. To the right are 'New...', 'Edit...', and 'Delete' buttons.
- Maximum open tunnels:** A checkbox that is currently unchecked.
- Buttons:** 'Save' and 'Cancel' buttons at the bottom.

- Modify the settings for the tunnel as appropriate.
- Refer to “Adding a Tunnel” for information on how to use the fields and controls on the Edit Tunnel dialog.
- When you are finished, click **Save**.

Deleting a Tunnel

To delete a tunnel entry from the Steel-Belted Radius database:

- Choose **Tunnels > Tunnels** in the sidebar.
- Select the tunnel you want to delete and click the **Delete** button on the Steel-Belted Radius toolbar (or right-click the entry and choose **Delete** from the context menu that appears).
- When the Confirm Delete dialog opens, click **Yes**.

Configuring Tunnel Name Parsing

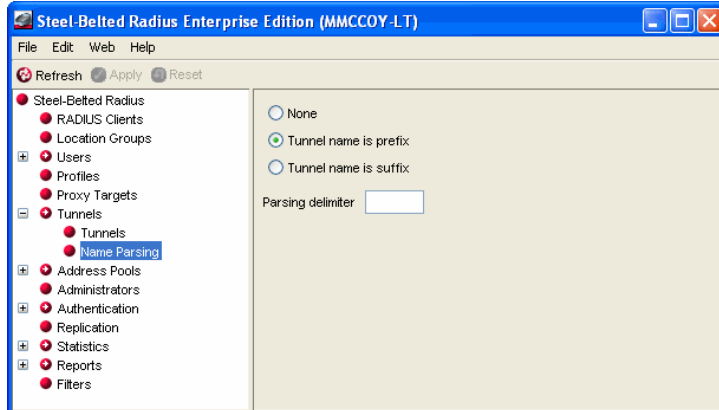
Tunnel name parsing lets Steel-Belted Radius determine whether the name string provided by a user includes a tunnel name by looking for the character configured as the delimiter for tunnel information. Tunnel name parsing options apply to all tunnels maintained by Steel-Belted Radius. You cannot set name parsing options for individual tunnels.

To configure tunnel name parsing:

- Choose **Tunnels > Name Parsing** in the sidebar.

The Name Parsing dialog appears.

Figure 75: Tunnel Panel: Name Parsing Tab



2. Click one of the following radio buttons:

- **None**—Tunnel name parsing is not supported. If you choose this option, the tunnel authentication sequence is bypassed for each Access-Request; the server uses the standard username/password authentication sequence only.
- **Tunnel name is prefix**—If the tunnel delimiter character is detected, the User-Name is assumed to be TunnelName<PrefixDelimiter>User.
- **Tunnel name is suffix**—If the tunnel delimiter character is detected, the User-Name is assumed to be User<SuffixDelimiter>TunnelName.

The option you choose applies to all tunnels defined on the server.

3. If you clicked **Tunnel name is prefix** or **Tunnel name is suffix**, use the Parsing delimiter field to specify the character used to separate the tunnel name and the username.

The default delimiter character for tunnel name parsing is @.

Note: Choose different delimiter characters and different prefix/suffix name parsing conventions for tunnels and for proxies or realms.


Chapter 14

Administering RADIUS Tunnels via WebGUI

This chapter describes how to set up and administer RADIUS tunnels via WebGUI.

About RADIUS Tunnels

A tunnel is a uniquely secure type of remote connection. A tunnel passes data between a remote site and an enterprise site, providing an additional layer of encrypted protocol “wrapper” around the data. A tunnel offers authentication and encryption features that help secure the connection against network vandals and eavesdroppers. In addition, a tunnel can provide quality of service features such as guaranteed bandwidth.

 **Note:** Steel-Belted Radius does not add tunnel functionality to your network. Steel-Belted Radius is able to support the authentication and accounting needs of any tunnels that you’ve already set up.

Administration and configuration of the tunnel happens at the remote site, since this is the side of the connection that requests remote access and opens the tunnel. An administrator at the remote site must configure the tunnel with various attributes: its destination IP address, what security protocols it supports, its password, and so on. These attributes are stored in a database to be retrieved when needed to set up a connection.

Storing tunnel attributes on a RADIUS server simplifies tunnel connections. At connection time, the tunnel is established by a network access device at the remote site. The NAD retrieves the tunnel configuration attributes from the RADIUS server and uses them to open the tunnel into the enterprise. After the tunnel is open, the user can be authenticated at the enterprise.


A RADIUS server is said to support tunnels if it has the ability to store and retrieve the configuration data that a NAD needs to open a tunnel. Steel-Belted Radius fully supports tunnels:

- Steel-Belted Radius can determine from the attributes in the incoming Access-Request whether the connection request involves a tunnel, and if so, which tunnel.
- Steel-Belted Radius can store and retrieve tunnel configuration data.
- Steel-Belted Radius can track the number of tunnels currently in use, compare to a maximum number, and refuse the connection if the number is exceeded.

Tunnel Authentication Sequence

1. Steel-Belted Radius receives an Access-Request message:
2. Steel-Belted Radius checks if the Access-Request contains a Called-Station-Id attribute. If it does, Steel-Belted Radius searches its database for a tunnel entry that contains the indicated telephone number in its Called-Station-Id list.

If a match between the Called-Station-Id and a tunnel entry can be found, Steel-Belted Radius constructs an Access-Accept message using the Attributes list in the matching tunnel entry. It then returns the Access-Accept to the client NAD.

 **Note:** If realms are in use, Steel-Belted Radius also searches for this number in its realm configuration files. If a match is found, the Access-Request is routed to the realm, and the quest for a tunnel is abandoned. For this reason, it is important to ensure that DNIS numbers are unique across

all tunnel entries and across all realm configuration files.

3. Steel-Belted Radius checks if the Access-Request contains a username in the form User<Delimiter>TunnelName or TunnelName<Delimiter>User. <Delimiter> is a single character that must match the server's tunnel delimiter character. The order of the realm name relative to the username must match the server's tunnel naming convention (prefix or suffix). Both of these values are determined per server (that is, all tunnels that use this server must follow the same conventions) by entering them in the Name Parsing tab of the Tunnels page.
4. Steel-Belted Radius searches its database for a tunnel entry whose name matches the incoming TunnelName. If a match can be found, Steel-Belted Radius constructs an Access-Accept message using the Attributes list in the matching tunnel entry. It then returns the Access-Accept to the client NAD.
5. If Steel-Belted Radius was able to match the Access-Request with a tunnel entry, the NAD uses the attributes returned in the Access-Accept message to open a tunnel into the enterprise site. Authentication of the User-Name is attempted, usually at the enterprise site. If user authentication succeeds, the connection is complete. Otherwise, the user's connection request is denied.
6. If no matching tunnel entry was found in steps 1 or 2, Steel-Belted Radius concludes that a tunnel is not involved in making this connection. It then continues with its User-Name parsing sequence determine a destination for the authentication request.

The following is a wildcard example for IP Addresses:

NAS-IP-Address = 199.100.10.0

where NAS-IP-Address indicates any IP address on the 199.100.10.0 network.

Configuring Tunnel Support

To configure Steel-Belted Radius to support a tunnel, you must open the Tunnels page (Configuring RADIUS Tunnels) in the SBR Administrator and add a tunnel entry.

A tunnel entry allows you to specify a list of connection Attributes such as the tunnel password, the IP address of the NAD at the enterprise site, encryption conventions to use, and so on. You can also enter the maximum number of tunnels that can be open at one time. You will need to coordinate with the administrator at the enterprise site to get some of this information.

Called Station Id

DNIS (Dialed Number Information Services) refers to a capability that many network access devices have to determine and use the telephone number that was dialed to make a connection request. The RADIUS standard supports DNIS by specifying the following attributes:

- Calling-Station-Id is the number from which the user originated the request.
- Called-Station-Id is the telephone number that was dialed to make the network connection.

When setting up a tunnel entry for the Steel-Belted Radius database, you can enter a telephone number or list of numbers in the Called Station Id list in the Tunnels page. This list identifies **Called-Station-Id** attribute values that the server should expect to find in tunnel connection requests.

Dictionaries for Tunnel Support

The Tunnels page allows you to create the Attributes list by selecting attributes from a drop-down list. The available selections include attributes from all standard and vendor-specific RADIUS dictionaries installed on the


Steel-Belted Radius server.

When the server can accept a tunnel connection request, it consults the corresponding tunnel entry for the list of Attributes to return in the Access-Accept packet. Steel-Belted Radius always returns any standard RADIUS attributes that appear in the Attributes list. It also returns any vendor-specific attributes that are appropriate for the NAD that requested the tunnel connection. Vendor-specific attributes in the Attributes list that do not apply to the requesting NAD are ignored.

Concurrent Tunnel Connections

Steel-Belted Radius tracks the number of active connections for each tunnel. You can limit the number of concurrent connections that can be open through a specific tunnel. When a user requests a new connection through a tunnel, Steel-Belted Radius compares the number of active connections in a tunnel to the maximum number of connections: if a new connection would exceed the limit, Steel-Belted Radius rejects the additional connection.

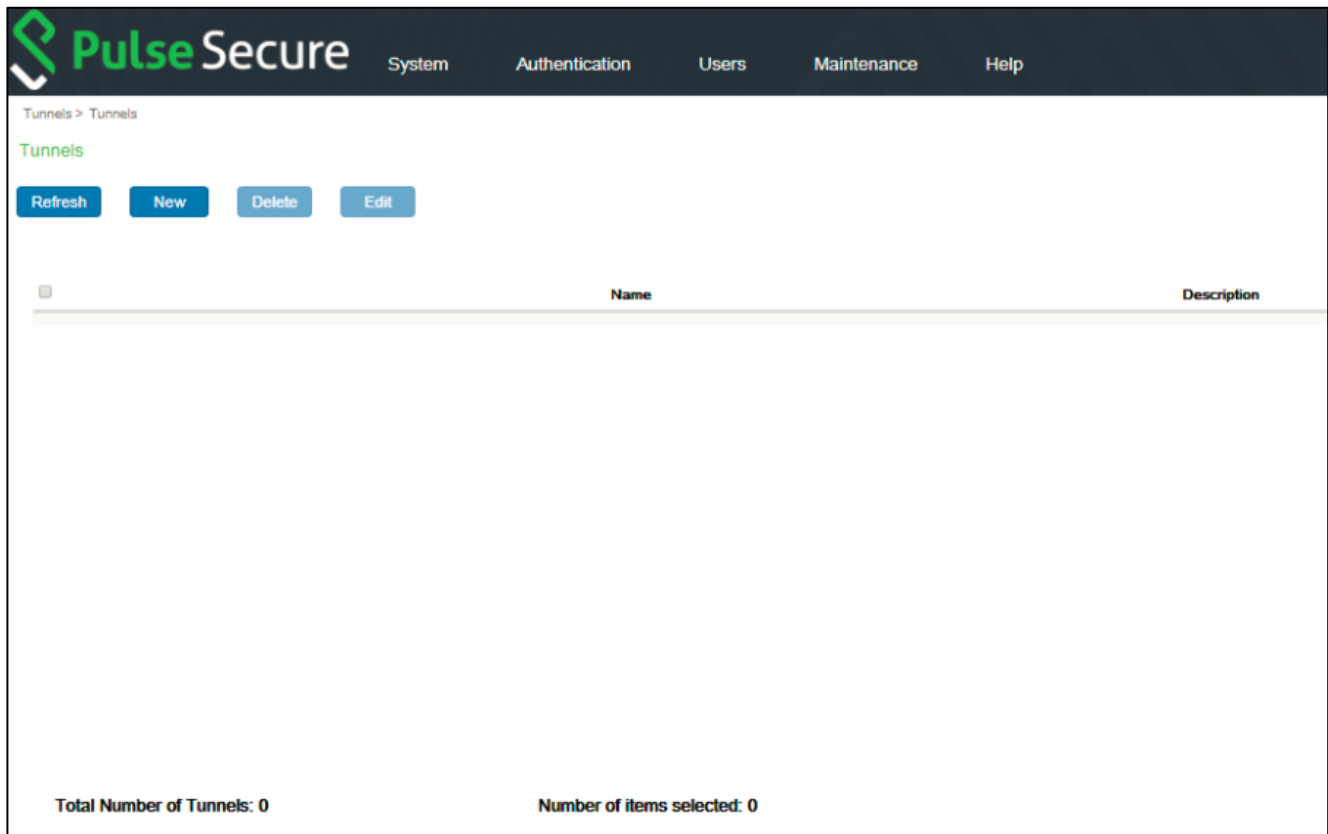
For concurrent connection limits to work, each NAD that can open a tunnel must be configured for RADIUS accounting and the same Steel-Belted Radius server must be specified for both authentication and accounting.

 **Note:** Concurrent tunnel connections cannot be tracked across multiple Steel-Belted Radius servers without additional software extensions. Contact Pulse Secure for more information.

Configuring RADIUS Tunnels

The Tunnels page [Figure 76: Tunnels Page](#) lets you configure Steel-Belted Radius to support tunnels. When you add a tunnel entry, you are not creating a tunnel; you are enabling Steel-Belted Radius to support an existing tunnel's authentication and accounting needs and specifying how the server should parse tunnel names.

Figure 76: Tunnels Page



Adding a Tunnel

To add a tunnel entry:

1. Choose **System > Tunnels > Tunnels** in the menubar.
2. Click the **New** button on the Tunnel page.

The Add Tunnel page appears.

Figure 77: Add Tunnel Page

3. Enter the name of the tunnel name in the **Name** field.

Tunnel names do not need to match the actual node name of a client tunnel server. The name you assign to a tunnel must not match the name assigned to a proxy target, realm, or tunnel in your Steel-Belted Radius configuration.

4. Enter a description of the tunnel in the **Description** field.

Tunnel descriptions are used only for administrative purposes and do not affect tunnel connections. This field is typically used to identify the user or organization that uses the tunnel.

5. Associate attributes and values with the tunnel you are setting up.

When a tunnel is used to make a connection, the attributes associated with the tunnel are filtered according to the make/model of the RADIUS client used to establish the connection.

To associate attributes and values with a tunnel:

- a. Click the **Add** button below the **Attributes** list.
The Add Tunnel Attribute page opens.

Figure 78: Add Tunnel Attribute Page

Add Tunnel List Attribute

Attributes:

- Tunnel-Assignment-ID
- Tunnel-Client-Auth-ID
- Tunnel-Client-Endpoint
- Tunnel-Medium-Type
- Tunnel-Password

String Value Integer IP Address

Hexadecimal Constant

String:

Multivalued Orderable

Add Close

- b. Select the attribute you want to add from the **Attributes** list.
 - c. Specify the string or IP address you want to use for the attribute value.
 - d. Click **Add**.
 - e. When you finish adding attributes for the tunnel, click **Close**.
6. Optionally, specify one or more Called Station IDs for the tunnel.

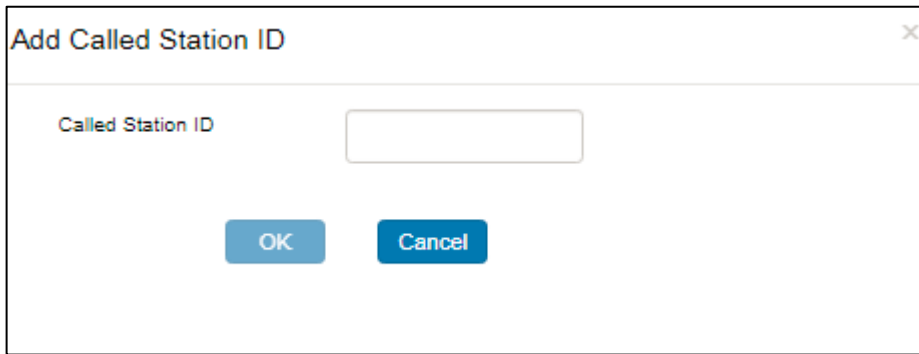
A Called Station ID is a telephone number that was dialed to make a network connection. The Called station ID list identifies the Called-Station-Id attribute values that the server expects to find in tunnel connection requests.

To add one or more Called Station ID numbers for a tunnel:

- a. Click the **New** button to the right of the Called Station ID list. The Add Called Station ID page

(Figure 79: Add Called Station ID Page) opens.

Figure 79: Add Called Station ID Page

A dialog box titled "Add Called Station ID" with a close button (X) in the top right corner. Inside the dialog, there is a label "Called Station ID" followed by a text input field. Below the input field are two buttons: "OK" and "Cancel".

- b. Enter the number you want to use in the **Called station ID** field.
 - c. Click **Add**.

Repeat Steps a–c until you have added all called station IDs for the tunnel.

 - d. When you are finished adding called station IDs, click **Close**.
7. If you want to limit the number of connections that can use the tunnel simultaneously, click the **Maximum open tunnels** check box and enter the **maximum number of tunnels** in the Maximum open tunnels field.
8. Click **OK**.

Editing a Tunnel

To edit a tunnel entry:

1. Choose **System > Tunnels > Tunnels** in the menubar and select the tunnel you want to edit. Click **Edit**.

The Edit Tunnel page appears.

Figure 80: Edit Tunnel Page

2. Modify the settings for the tunnel as appropriate.
3. Refer to “Adding a Tunnel” for information on how to use the fields and controls on the Edit Tunnel page.
4. When you are finished, click **Save**.

Deleting a Tunnel

To delete a tunnel entry from the Steel-Belted Radius database:

1. Choose **System > Tunnels > Tunnels** in the menubar.
2. Select the tunnel you want to delete and click the **Delete** button on the Tunnels Page.
3. When the Confirm Delete page opens, click **Yes**.

Configuring Tunnel Name Parsing

Tunnel name parsing lets Steel-Belted Radius determine whether the name string provided by a user includes a tunnel name by looking for the character configured as the delimiter for tunnel information. Tunnel name parsing options apply to all tunnels maintained by Steel-Belted Radius. You cannot set name parsing options for individual tunnels.

To configure tunnel name parsing:

1. Choose System > Tunnels > Name Parsing in the menubar.

The Name Parsing page appears.

Figure 81: Tunnel Page: Name Parsing Tab

2. Click one of the following radio buttons:

- **None**—Tunnel name parsing is not supported. If you choose this option, the tunnel authentication sequence is bypassed for each Access-Request; the server uses the standard username/password authentication sequence only.
- **Tunnel name is prefix**—If the tunnel delimiter character is detected, the User-Name is assumed to be TunnelName<PrefixDelimiter>User.
- **Tunnel name is suffix**—If the tunnel delimiter character is detected, the User-Name is assumed to be User<SuffixDelimiter>TunnelName.

The option you choose applies to all tunnels defined on the server.

3. If you clicked **Tunnel name is prefix** or **Tunnel name is suffix**, use the Parsing delimiter field to specify the character used to separate the tunnel name and the username.


The default delimiter character for tunnel name parsing is @.

Note: Choose different delimiter characters and different prefix/suffix name parsing conventions for tunnels and for proxies or realms.

Chapter 15

Administering Address Pools via Legacy SBR Administrator

This chapter describes how to set up IPv4 and IPX address pools via legacy SBR administrator. Steel-Belted Radius does not support IPv6 address pools.

 **Note:** Contact Pulse Secure Global Support Center If you need address pools larger than 65,535 (216) addresses.

Address Pool Files

The following files establish settings for IP and IPX address pools. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

Table 22: Address Pool Files

File Name	Function
dhcp.ini	Configures DHCP address pools so that IP addresses can be assigned from a backend DHCP server.
pool.dhc	Configures specific DHCP address pools, where pool is the name of an address pool listed in dhcp.ini.
radius.ini	Specifies (among other things) the suffixes used to set up NAD-specific IP pools.

Setting Up IP Address Pools

The IP Address Pool and IPX Address Pool Panels (Figure 82) allow you to set up one or more pools out of which unique IPv4 or IPX addresses are assigned as users require them. Each address pool consists of a list of one or more ranges of addresses.

Adding an IPv4 Address Pool

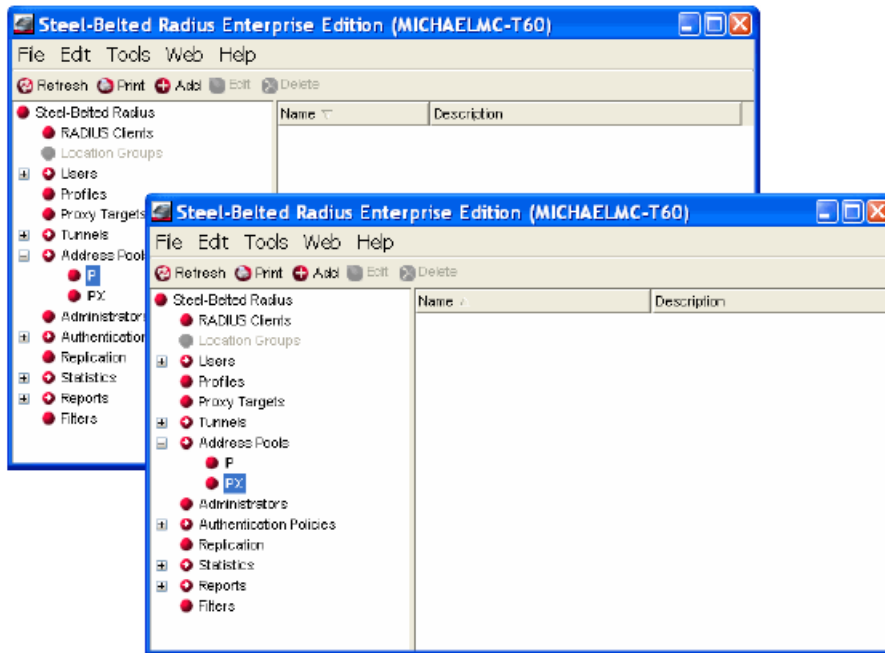
An IP address pool consists of one or more ranges of IPv4 addresses. You can add or delete ranges and set an optional description for each address pool.

To add an IP address pool:

1. Choose **Address Pools > IP** in the sidebar.

The IP Address Pools panel appears.

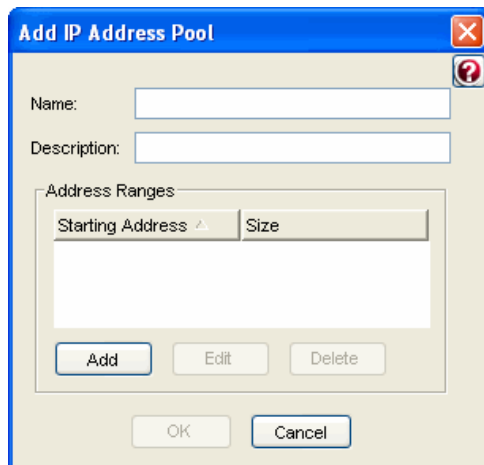
Figure 82: IP Address Pools Panel and IPX Address Pools Panel



- Click the **Add** button in the toolbar.

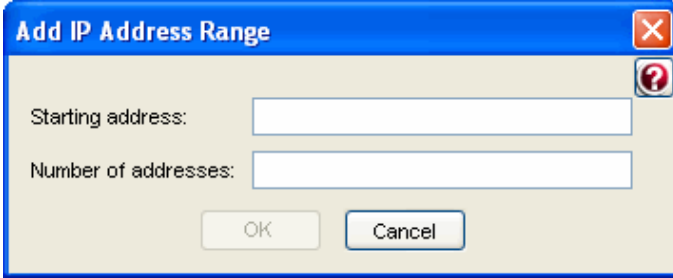
The Add IP Address Pool dialog appears.

Figure 83: Add IP Address Pool Dialog



- Enter the name of the IP address pool in the Name field.
- Optionally, enter a description of the address pool in the Description field.
- Identify the address range or ranges in the IP address pool.
 - Click the **Add** button below the Address Ranges list.
The Add IP Address Range dialog opens.

Figure 84: Add IP Address Range Dialog



The dialog box titled "Add IP Address Range" has a blue header bar with a close button (X) and a help button (?). It contains two text input fields: "Starting address:" and "Number of addresses:". Below these fields are two buttons: "OK" and "Cancel".

- b. Enter the first address in the **Starting address** field.
 - c. Enter the number of addresses in the address range in the **Number of addresses** field.
 - d. Click **Add**.
 - e. Repeat steps a–d for each address range in the IP address pool. When you are finished, click **Close**.
6. Click **OK**.

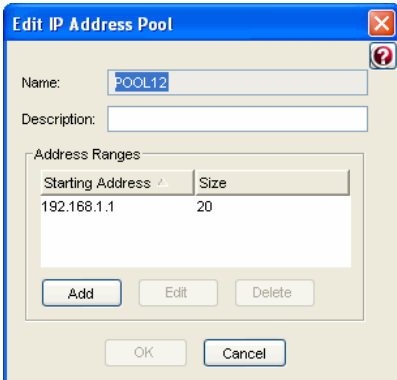
Editing an IP Address Pool

To edit an IP address pool:

1. Choose **Address Pools > IP** in the sidebar.
2. Select the entry you want to modify and click the **Edit** button (or right-click the entry and choose **Edit**).

The Edit IP Address Pool dialog appears.

Figure 85: Edit IP Address Pool Dialog



The dialog box titled "Edit IP Address Pool" has a blue header bar with a close button (X) and a help button (?). It contains a "Name:" field with the value "POOL12" and a "Description:" field. Below these is a table titled "Address Ranges" with two columns: "Starting Address" and "Size". The table contains one row with the values "192.168.1.1" and "20". Below the table are three buttons: "Add", "Edit", and "Delete". At the bottom of the dialog are "OK" and "Cancel" buttons.

Starting Address	Size
192.168.1.1	20

3. Modify the settings for the address pool as needed.
 - To add an address range to the address pool, click the **Add** button and specify the starting address and number of addresses in the range.
 - To modify an address range, select it and click the **Edit** button.
 - To delete an address range from the address pool, select it and click the **Delete** button.
4. When you are finished, click **Save**.

Removing an IP Address Pool

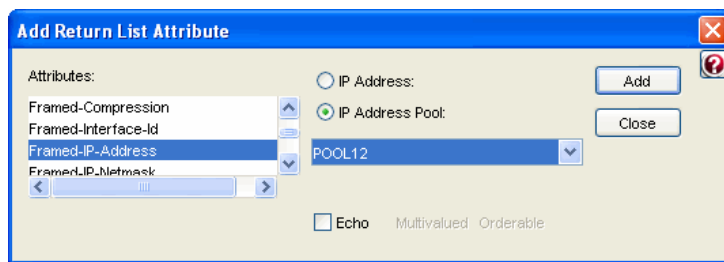
To delete an IP address pool:

1. Choose **Address Pools > IP** in the sidebar.
2. Select the entry you want to remove and click the **Delete** button (or right-click the entry and choose **Delete**).
3. When you are prompted to confirm the deletion, click **Yes**.

Specifying an IP Address Pool for User/Profile Records

The Framed-IP-Address return list attribute controls how the server assigns an IP address to a user making a connection. When you add or edit the Framed-IP-Address attribute in the Users or Profiles dialog, the Add Attribute dialog (Figure 86) allows you to choose an IP address pool instead of specifying an IP address.

Figure 86: Editing the Framed-IP-Address



Service-Level IP Address Pools

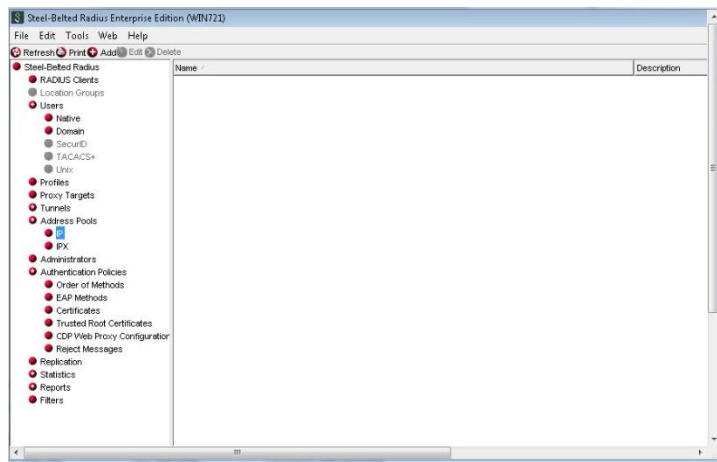
Steel-Belted Radius allows you to define a set of suffixes that define categories of IP address pools. For example, a pool category might correspond to the kinds of services available to users in that category. You might decide to define categories called Bronze, Silver, and Gold to identify different packet routing priorities.

To create a set of service-level address pools:

1. Define suffixes for the various service-level address pools in the [IPPoolSuffixes] section of radius.ini. For example:

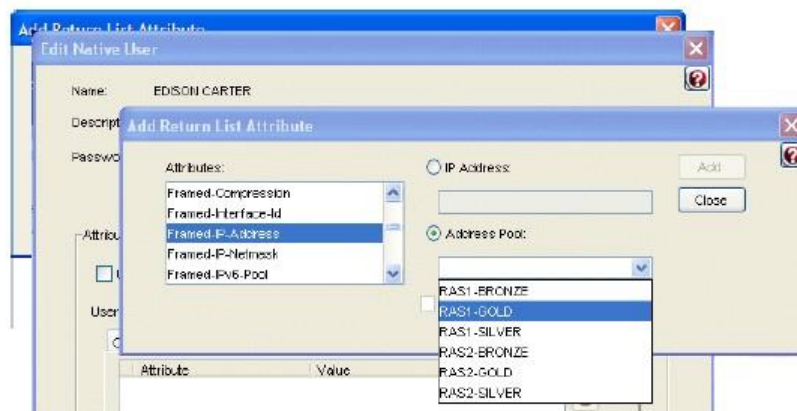
```
[IPPoolSuffixes]
-GOLD
-SILVER
-BRONZE
```
2. Define IP address pools using the suffixes configured in the [IPPoolSuffixes] section of radius.ini

Figure 87: Service Level Suffixes in the IP Address Pools Panel



3. Associate the new IP address pool with the appropriate NAD by use of **IP Address** Pool field on the RADIUS Clients panel.
4. Assign a user to a NAD-specific IP address pool and suffix in the Users panel or the Profiles panel.

Figure 88: Associating IP Address Pools with RADIUS Clients



If user EDISON CARTER, who has been assigned to <RAS>-GOLD, logs into RAS1, he receives an IP address from the RAS1-GOLD address pool. If he logs into RAS2, he receives an address from the RAS2-GOLD address pool. If, however, he logs into RAS3 but RAS3-GOLD has not been defined in the IP Pools dialog, he is not assigned an IP address.

Specifying IP Address Assignment from a DHCP Server

IP addresses can be assigned from a backend DHCP server, rather than from a standard IP address pool. DHCP address pools function like internal address pools—Framed-IP-Address can be allocated from any address pool, either internal or DHCP.

DHCP address pools are defined in the dhcp.ini file and initialization files with the extension .dhc.

In addition, each DHCP address pool must be enabled by adding a placeholder IP address pool in the SBR Administrator. This placeholder pool should have the same name as the DHCP pool, and should have an empty list of address ranges. The placeholder pool allows the DHCP pool to appear in lists presented by the SBR Administrator, so it can be selected into an attribute.

When an IP address must be assigned from a DHCP pool during an Access-Request, DHCP DISCOVER and

REQUEST messages are issued to trigger the allocation of an address. When an accounting Stop ends the session, DHCP RELEASE is issued to the server that allocated the address. Upon receipt of an accounting INTERIM request, a DHCP REQUEST message is issued to the server that allocated the address, attempting to extend the lease. If the server is specified as a broadcast address, DHCP failover occurs if the primary DHCP server goes down.

DHCP leases can be acquired, extended, and released by different servers. The server that acquires the lease adds all the information for extending and releasing the lease to the Class attribute.

Flexible configuration features allow RADIUS attributes to be mapped to DHCP options. Therefore, information from a RADIUS request can be provided to the DHCP server, and information returned from the DHCP server can be returned to the network access device.

During authentication, if an address is assigned from a pool, the pool name must refer to either a DHCP pool or an internal pool. If the pool name is not found, the request is rejected.

Address Allocation

During address allocation, a DISCOVER message is issued. If an OFFER is received from a DHCP server and the offered lease time meets the minimum lease time requirements, the server issues a REQUEST message. If an ACK message is received, the allocated address is returned in the Access-Accept.

In addition to the options required for normal DHCP operation, additional options in the DHCP DISCOVER and REQUEST messages are constructed based on the attributes in the RADIUS request and the literal values specified in the [Request] section for the pool. A Parameter Request List option is also constructed, listing all return options required for populating the RADIUS response, as specified in the [Reply] section for the pool.


If an address is assigned by means of DHCP, the DH= field is added to the Class attribute. This field includes:

- The unique client identifier for this lease.
- The address of the DHCP server.
- The lease time.

The unique client identifier for each user session is placed in the client hardware address field of the DHCP request as well as in the Client ID option. This information is used by the DHCP server to associate IP addresses with clients.


Address Renewal

If an INTERIM accounting message whose Class attribute includes both the IP= and the DH= fields is received, a REQUEST message is unicast to the DHCP server that allocated the address in an attempt to renew the lease. It requests the same lease time as was granted for the original request. If the server is specified as a broadcast address, DHCP failover occurs if the primary DHCP server goes down.

 **Note:** If a renewal request is rejected, the DHCP server does not inform the network access device that the user's IP address is not renewed and might become invalid.

Address Release

If an accounting Stop message whose Class attribute includes both the IP= and the DH= fields is received, a RELEASE message is unicast to the DHCP server that allocated the address.

 **Note:** The DHCP server does not reply to the RELEASE message.

An address to the DHCP server is also released when a session is deleted from its session database for reasons other than receiving an accounting Stop. For example, phantom session expiration or administrative deletion of a session result in the release of the temporary DHCP address.

DHCP Option Mapping

Options in a DHCP DISCOVER or REQUEST message can automatically be constructed based on attributes in the RADIUS request as well as pre-configured literal values. Also, options returned by the DHCP server in an OFFER message can be transmitted back to the network access device in RADIUS attributes.

The following applies to the mapping between RADIUS attributes and DHCP options:

- Both standard and vendor-specific DHCP options are supported. (Vendor-specific DHCP options must use standard encapsulation rules, as described in RFC 2132.)
- Format conversions between RADIUS attributes and DHCP options are performed. For example, a DHCP option containing an IP address is formatted into dotted notation when returned in a RADIUS string attribute.
- A single RADIUS request attribute can set more than one DHCP options in a request, and a single DHCP option can set more than one RADIUS response attribute.
- A single DHCP option containing multiple values can be mapped to multiple instances of a single RADIUS attribute.

For example, a RADIUS attribute called IP-Router could appear multiple times in an Access-Accept. DHCP's Router option returns a list of IP addresses of routers. This single DHCP option can be configured to return multiple instances of the RADIUS IP-Router attribute -- one for each router address in the list.

- A single DHCP option containing multiple values can be mapped to multiple RADIUS attributes. For example, two RADIUS attributes exist, Primary-DNS-Server and Secondary-DNS-Server. DHCP's DNS Server option returns a list of IP addresses of DNS servers. This single DHCP option can be configured to set the first DNS server address in Primary-DNS-Server and the second in Secondary-DNS-Server.
- Only attributes appropriate to the dictionary are returned.

Therefore, if network access devices from different vendors use different RADIUS attributes for the same information, each RADIUS attribute that might be required can be mapped to the same DHCP option. The correct attribute is returned to the network access device.

Using Multiple Servers

As the information required to renew or release a DHCP-assigned address is contained in the Class attribute, it is feasible to set up multiple servers, all utilizing a common DHCP server for address allocation. The network access device can issue requests to any of the servers, and addresses are assigned and released correctly even if different servers handle authentication and accounting requests for the same session.

This architecture requires that each server must be configured to be stateless—that is, the current sessions database must be turned off in the radius.ini file, as follows:

```
[CurrentSessions]
```

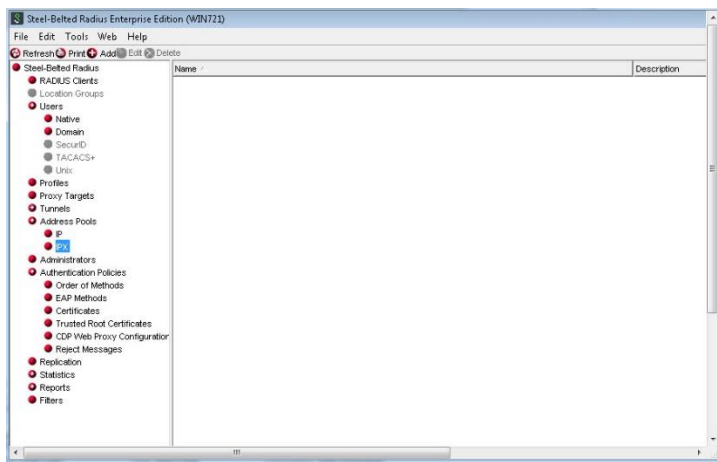
Enable = 0

Current sessions processing makes sense only when authentication and all accounting are directed to the same server. If current sessions processing is not disabled, the current sessions database is incorrect and always growing. For example, DHCP addresses are prematurely released when phantoms expire.

Setting Up IPX Address Pools

The IPX Pools dialog (Figure 89) allows you to set up one or more pools out of which unique IPX network numbers are assigned as users require them. Each pool consists of a list of one or more ranges of IPX network numbers.

Figure 89: Address Pools Panel: IPX Pools



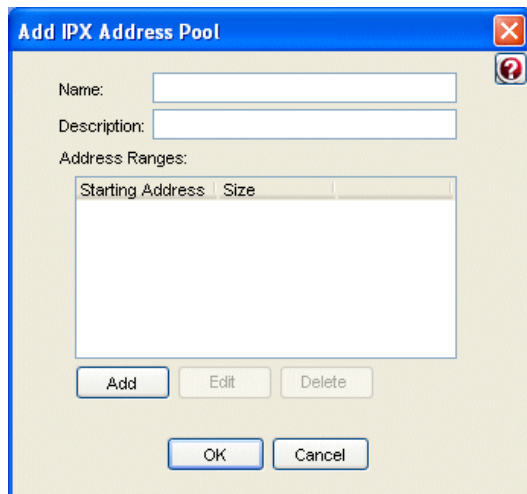
Adding an IPX Pool

An IPX pool consists of one or more ranges of IPX network numbers. You can add or delete ranges and set an optional description for each address pool.

To add an IPX address pool:

1. Choose Address Pools> IPX in the sidebar. The IPX Address Pools panel appears.
2. Click the Add button in the toolbar.

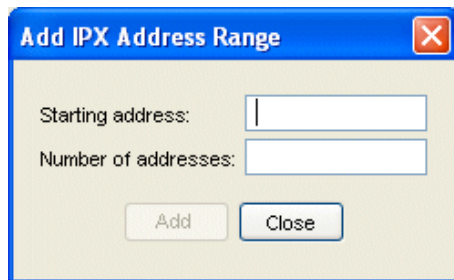
The Add IPX Address Pool dialog appears.

Figure 90: Add IPX Address Pool Dialog


The dialog box titled "Add IPX Address Pool" has a blue header bar with a close button (X) and a help button (?). It contains three text input fields: "Name:", "Description:", and "Address Ranges:". Below the "Address Ranges:" field is a table with two columns: "Starting Address" and "Size". At the bottom of the dialog are four buttons: "Add", "Edit", "Delete", and "OK", with a "Cancel" button below them.

3. Enter the name of the IPX address pool in the **Name** field.
4. Optionally, enter a description of the address pool in the Description field.
5. Identify the address ranges in the IP address pool.
6. Click the Add button below the Address Ranges list.

The Add IP Address Range dialog opens.

Figure 91: Add IP Address Range Dialog


The dialog box titled "Add IPX Address Range" has a blue header bar with a close button (X). It contains two text input fields: "Starting address:" and "Number of addresses:". At the bottom of the dialog are two buttons: "Add" and "Close".

- a. Enter the first address in the **Starting address** field.
 - b. Enter the number of IPX addresses in the address range in the **Number of addresses** field.
 - c. Click **Add**.
 - d. Repeat steps a–d for each address range in the IPX address pool. When you are finished, click **Close**.
7. Click **OK**.

Editing an IPX Address Pool

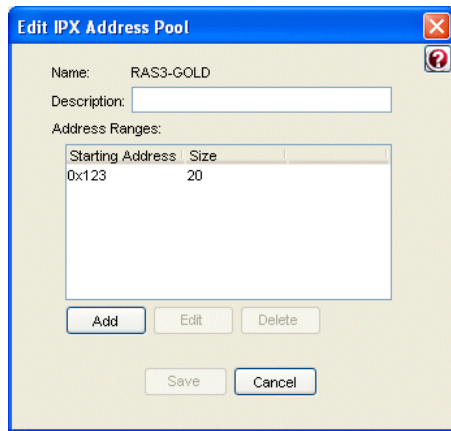
To edit an IPX address pool:

1. Choose **Address Pools > IPX** in the sidebar.
2. Select the entry you want to modify and click the **Edit** button (or right-click the entry and choose

Edit).

The Edit IPX Address Pool dialog appears.

Figure 92: Edit IPX Address Pool Dialog



3. Modify the settings for the address pool as needed.
 - To add an address range to the address pool, click the **Add** button and specify the starting address and number of addresses in the range.
 - To modify an address range, select it and click the **Edit** button.
 - To delete an address range from the address pool, select it and click the **Delete** button.
4. When you are finished, click **Save**.

Removing an IPX Address Pool

To delete an IPX address pool:

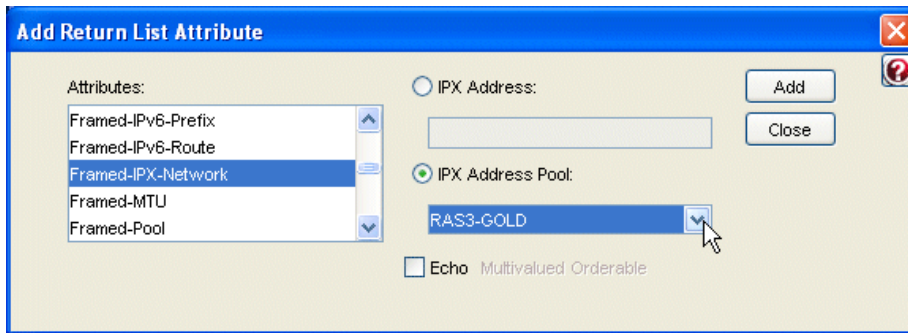
1. Click the **Address Pools** button to display the Address Pools panel.
2. Click the **IPX Address Pools** tab to display the list of IPX address pools that have been configured.
3. Select the entry you want to remove and click the **Delete** button (or right-click the entry and choose Delete).
4. When you are prompted to confirm the deletion, click **Yes**.

Specifying Pooled IPX Network Numbers in User/Profile Records

The Framed-IPX-Address return list attribute controls how Steel-Belted Radius assigns an IPX address to a user making a connection.

When you add or edit the Framed-IPX-Address attribute for a user or profile, the Framed-IPX-Address dialog appears. To select an IPX address assignment option, type an IPX address in the IPX address field or click the IPX Address Pool check box and select the name of the IPX address pool you want to use from the list.

Figure 93: Specifying an IPX Pool for the Framed-IPX-Address Attribute



Chapter 16

Administering Address Pools via WebGUI

This chapter describes how to set up IPv4 and IPX address pools via WebGUI. Steel-Belted Radius does not support IPv6 address pools.



Note: Contact Pulse Secure Global Support Center If you need address pools larger than 65,535 (2¹⁶) addresses.

Address Pool Files

The following files establish settings for IP and IPX address pools. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

Table 23: Address Pool Files

File Name	Function
dhcp.ini	Configures DHCP address pools so that IP addresses can be assigned from a backend DHCP server.
pool.dhc	Configures specific DHCP address pools, where pool is the name of an address pool listed in dhcp.ini.
radius.ini	Specifies (among other things) the suffixes used to set up NAD-specific IP pools.

Setting Up IP Address Pools

The IP Address Pool and IPX Address Pool pages (Figure 94: IP Address Pools Page and IPX Address Pools Page) allow you to set up one or more pools out of which unique IPv4 or IPX addresses are assigned as users require them. Each address pool consists of a list of one or more ranges of addresses.

Adding an IPv4 Address Pool

An IP address pool consists of one or more ranges of IPv4 addresses. You can add or delete ranges and set an optional description for each address pool.

To add an IP address pool:

1. Choose **System > Address Pools > IP** in the menubar. The IP Address Pools page appears.

Figure 94: IP Address Pools Page and IPX Address Pools Page

The screenshot shows the Pulse Secure web interface for the IP Address Pools page. The top navigation bar includes the Pulse Secure logo and links for System, Authentication, Users, Maintenance, and Help. The breadcrumb trail indicates the current location is Address Pools > IP. Below the breadcrumb, the word "IP" is displayed in green. There are four action buttons: Refresh, New, Delete, and Edit. A table with two columns, Name and Description, is shown below the buttons. The table is currently empty. At the bottom of the page, it states "Total Number of IP Pools: 0" and "Number of items selected: 0".

Address Pools > IP

IP

Refresh New Delete Edit

Name	Description
------	-------------

Total Number of IP Pools: 0 Number of items selected: 0

The screenshot shows the Pulse Secure web interface for the IPX Address Pools page. The top navigation bar includes the Pulse Secure logo and links for System, Authentication, Users, Maintenance, and Help. The breadcrumb trail indicates the current location is Address Pools > IPX. Below the breadcrumb, the word "IPX" is displayed in green. There are four action buttons: Refresh, New, Delete, and Edit. A table with two columns, Name and Description, is shown below the buttons. The table is currently empty. At the bottom of the page, it states "Total Number of IPX Pools: 0" and "Number of items selected: 0".

Address Pools > IPX

IPX

Refresh New Delete Edit

Name	Description
------	-------------

Total Number of IPX Pools: 0 Number of items selected: 0

2. Click the **Add** button on Add IP Pool Page.

The Add IP Address Pool dialog appears.

Figure 95: Add IP Address Pool Page

Pulse Secure System Authentication Users Maintenance Help

Address Pools > Add IP Address Pool

Add IP Address Pool

Name:

Description:

▼ Address Ranges

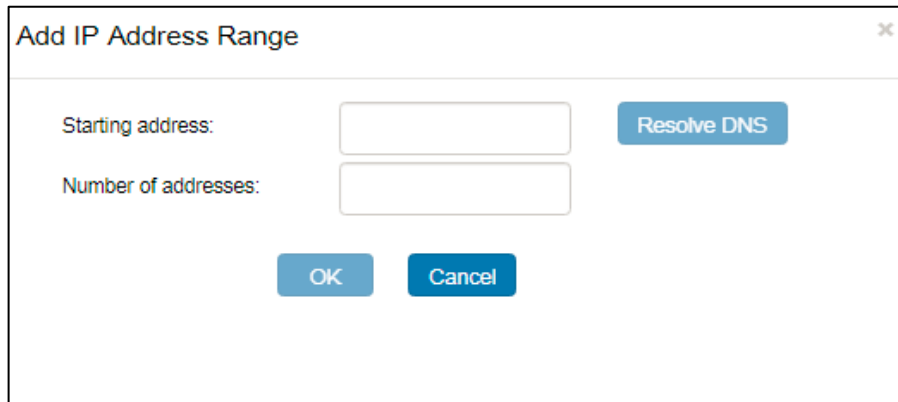
Starting Address	Size
------------------	------

Add Edit Delete

OK Cancel

3. Enter the name of the IP address pool in the Name field.
4. Optionally, enter a description of the address pool in the Description field.
5. Identify the address range or ranges in the IP address pool.
 - a. Click the **Add** button below the Address Ranges list.
The Add IP Address Range page opens.

Figure 96: Add IP Address Range Page

A dialog box titled "Add IP Address Range" with a close button (X) in the top right corner. It contains two input fields: "Starting address:" and "Number of addresses:". To the right of the "Starting address:" field is a blue button labeled "Resolve DNS". Below the input fields are two blue buttons: "OK" and "Cancel".

Add IP Address Range

Starting address: Resolve DNS

Number of addresses:

OK Cancel

- b. Enter the first address in the **Starting address** field.
 - c. Enter the number of addresses in the address range in the **Number of addresses** field.
 - d. Click **Add**.
 - e. Repeat steps a–d for each address range in the IP address pool. When you are finished, click **Close**.
6. Click **OK**.

Editing an IP Address Pool

To edit an IP address pool:

1. Choose **Address Pools > IP** in the menubar.
2. Select the entry you want to modify and click the **Edit** button.

The Edit IP Address Pool page appears.

Figure 97: Edit IP Address Pool Page

Address Pools > Edit IP Address Pool

Edit IP Address Pool

Name: IP POOL 1

Description: Pool Description

▼ Address Range

Starting Address	Size
10.1.1.1	100

Add Edit Delete

OK Cancel

3. Modify the settings for the address pool as needed.

- To add an address range to the address pool, click the **Add** button and specify the starting address and number of addresses in the range.
- To modify an address range, select it and click the **Edit** button.
- To delete an address range from the address pool, select it and click the **Delete** button.

4. When you are finished, click **Save**.

Removing an IP Address Pool

To delete an IP address pool:

1. Choose **System > Address Pools > IP** in the menubar.
2. Select the entry you want to remove and click the **Delete** button.
3. When you are prompted to confirm the deletion, click **Yes**.

Specifying an IP Address Pool for User/Profile Records

The Framed-IP-Address return list attribute controls how the server assigns an IP address to a user making a connection. When you add or edit the Framed-IP-Address attribute in the Users or Profiles dialog, the Add Attribute dialog (Figure 98: Editing the Framed-IP-Address) allows you to choose an IP address pool instead of specifying an IP address.

Figure 98: Editing the Framed-IP-Address

Add Check List Attribute

Attributes

- Framed-Compression
- Framed-IP-Address**
- Framed-IP-Netmask
- Framed-IPv6-Prefix
- Framed-Interface-Id

String IP Address IPv6 Address Value

Hexadecimal Integer **IP** IPv6-Prefix

IPv6-Interface

IP Address IP Address Pool

IP Address Pool:

IP POOL 1

☐ Default ☒ Multivalued ☐ Orderable

Add **Close**

Service-Level IP Address Pools

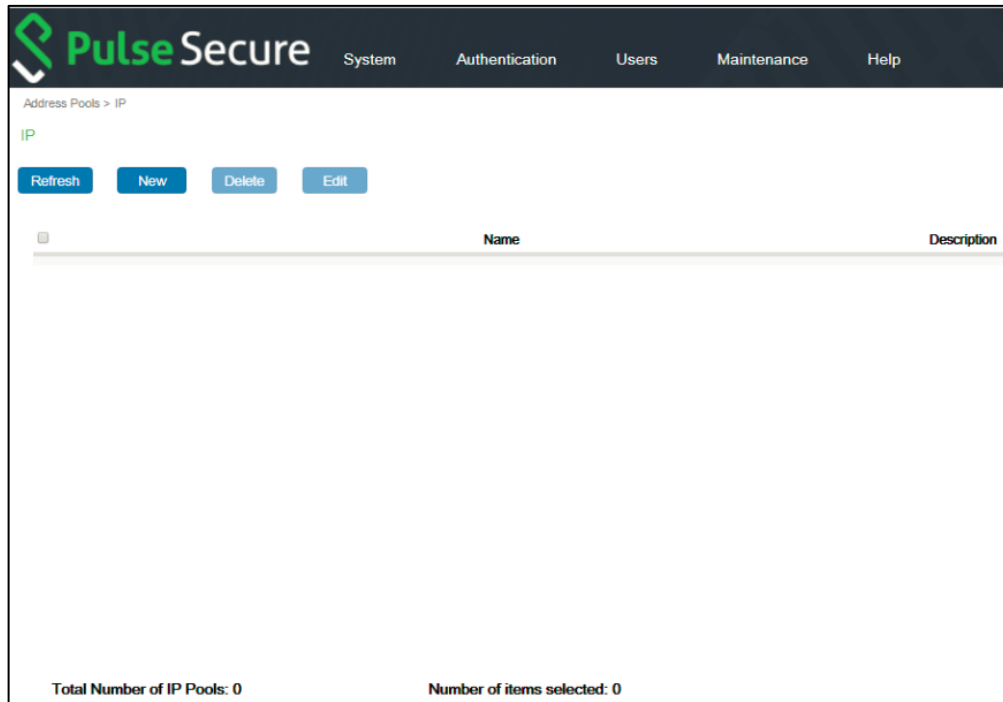
Steel-Belted Radius allows you to define a set of suffixes that define categories of IP address pools. For example, a pool category might correspond to the kinds of services available to users in that category. You might decide to define categories called Bronze, Silver, and Gold to identify different packet routing priorities.

To create a set of service-level address pools:

1. Define suffixes for the various service-level address pools in the [IPPoolSuffixes] section of radius.ini. For example:

```
[IPPoolSuffixes]
-GOLD
-SILVER
-BRONZE
```
2. Define IP address pools using the suffixes configured in the [IPPoolSuffixes] section of radius.ini

Figure 99: Service Level Suffixes in the IP Address Pools Page



3. Associate the new IP address pool with the appropriate NAD by use of **IP Address** Pool field on the RADIUS Clients page.
4. Assign a user to a NAD-specific IP address pool and suffix in the Users page or the Profiles page.

Figure 100: Associating IP Address Pools with RADIUS Clients

Add Return List Attribute

Attributes

- Framed-AppleTalk-Link
- Framed-AppleTalk-Network
- Framed-AppleTalk-Zone
- Framed-Compression
- Framed-IP-Address**

String IP Address IPv6 Address Value

Hexadecimal Integer **IP** IPX IPv6-Prefix

IPv6-Interface Date/time Echo Constant

IP Address IP Address Pool

IP Address Pool:

Pools

- RAS1-BRONZE
- RAS1-GOLD
- RAS1-SILVER
- pool associated with RAS client

☐ Echo ☐ Multivalued ☐ Orderable

Add **Close**

If user EDISON CARTER, who has been assigned to <RAS>-GOLD, logs into RAS1, he receives an IP address from the RAS1-GOLD address pool. If he logs into RAS2, he receives an address from the RAS2-GOLD address pool. If, however, he logs into RAS3 but RAS3-GOLD has not been defined in the IP Pools dialog, he is not assigned an IP address.

Specifying IP Address Assignment from a DHCP Server

IP addresses can be assigned from a backend DHCP server, rather than from a standard IP address pool. DHCP address pools function like internal address pools—Framed-IP-Address can be allocated from any address pool, either internal or DHCP.

DHCP address pools are defined in the dhcp.ini file and initialization files with the extension .dhc.

In addition, each DHCP address pool must be enabled by adding a placeholder IP address pool in the SBR Administrator. This placeholder pool should have the same name as the DHCP pool, and should have an empty list of address ranges. The placeholder pool allows the DHCP pool to appear in lists presented by the SBR Administrator, so it can be selected into an attribute.

When an IP address must be assigned from a DHCP pool during an Access-Request, DHCP DISCOVER and REQUEST messages are issued to trigger the allocation of an address. When an accounting Stop ends the session, DHCP RELEASE is issued to the server that allocated the address. Upon receipt of an accounting INTERIM request, a DHCP REQUEST message is issued to the server that allocated the address, attempting to extend the lease. If the server is specified as a broadcast address, DHCP failover occurs if the primary DHCP

server go down.

DHCP leases can be acquired, extended, and released by different servers. The server that acquires the lease adds all the information for extending and releasing the lease to the Class attribute.

Flexible configuration features allow RADIUS attributes to be mapped to DHCP options. Therefore, information from a RADIUS request can be provided to the DHCP server, and information returned from the DHCP server can be returned to the network access device.

During authentication, if an address is assigned from a pool, the pool name must refer to either a DHCP pool or an internal pool. If the pool name is not found, the request is rejected.

Address Allocation

During address allocation, a DISCOVER message is issued. If an OFFER is received from a DHCP server and the offered lease time meets the minimum lease time requirements, the server issues a REQUEST message. If an ACK message is received, the allocated address is returned in the Access-Accept.

In addition to the options required for normal DHCP operation, additional options in the DHCP DISCOVER and REQUEST messages are constructed based on the attributes in the RADIUS request and the literal values specified in the [Request] section for the pool. A Parameter Request List option is also constructed, listing all return options required for populating the RADIUS response, as specified in the [Reply] section for the pool.


If an address is assigned by means of DHCP, the DH= field is added to the Class attribute. This field includes:

- The unique client identifier for this lease.
- The address of the DHCP server.
- The lease time.

The unique client identifier for each user session is placed in the client hardware address field of the DHCP request as well as in the Client ID option. This information is used by the DHCP server to associate IP addresses with clients.


Address Renewal

If an INTERIM accounting message whose Class attribute includes both the IP= and the DH= fields is received, a REQUEST message is unicast to the DHCP server that allocated the address in an attempt to renew the lease. It requests the same lease time as was granted for the original request. If the server is specified as a broadcast address, DHCP failover occurs if the primary DHCP server go down.

 **Note:** If a renewal request is rejected, the DHCP server does not inform the network access device that the user's IP address is not renewed and might become invalid.

Address Release

If an accounting Stop message whose Class attribute includes both the IP= and the DH= fields is received, a RELEASE message is unicast to the DHCP server that allocated the address.

 **Note:** The DHCP server does not reply to the RELEASE message.

An address to the DHCP server is also released when a session is deleted from its session database for reasons other than receiving an accounting Stop. For example, phantom session expiration or administrative deletion of

a session result in the release of the temporary DHCP address.

DHCP Option Mapping

Options in a DHCP DISCOVER or REQUEST message can automatically be constructed based on attributes in the RADIUS request as well as pre-configured literal values. Also, options returned by the DHCP server in an OFFER message can be transmitted back to the network access device in RADIUS attributes.

The following applies to the mapping between RADIUS attributes and DHCP options:

- Both standard and vendor-specific DHCP options are supported. (Vendor-specific DHCP options must use standard encapsulation rules, as described in RFC 2132.)
- Format conversions between RADIUS attributes and DHCP options are performed. For example, a DHCP option containing an IP address is formatted into dotted notation when returned in a RADIUS string attribute.
- A single RADIUS request attribute can set more than one DHCP options in a request, and a single DHCP option can set more than one RADIUS response attribute.
- A single DHCP option containing multiple values can be mapped to multiple instances of a single RADIUS attribute.

For example, a RADIUS attribute called IP-Router could appear multiple times in an Access-Accept. DHCP's Router option returns a list of IP addresses of routers. This single DHCP option can be configured to return multiple instances of the RADIUS IP-Router attribute -- one for each router address in the list.

- A single DHCP option containing multiple values can be mapped to multiple RADIUS attributes. For example, two RADIUS attributes exist, Primary-DNS-Server and Secondary-DNS-Server. DHCP's DNS Server option returns a list of IP addresses of DNS servers. This single DHCP option can be configured to set the first DNS server address in Primary-DNS-Server and the second in Secondary-DNS-Server.
- Only attributes appropriate to the dictionary are returned.

Therefore, if network access devices from different vendors use different RADIUS attributes for the same information, each RADIUS attribute that might be required can be mapped to the same DHCP option. The correct attribute is returned to the network access device.

Using Multiple Servers

As the information required to renew or release a DHCP-assigned address is contained in the Class attribute, it is feasible to set up multiple servers, all utilizing a common DHCP server for address allocation. The network access device can issue requests to any of the servers, and addresses are assigned and released correctly even if different servers handle authentication and accounting requests for the same session.

This architecture requires that each server must be configured to be stateless—that is, the current sessions database must be turned off in the radius.ini file, as follows:

```
[CurrentSessions]
```

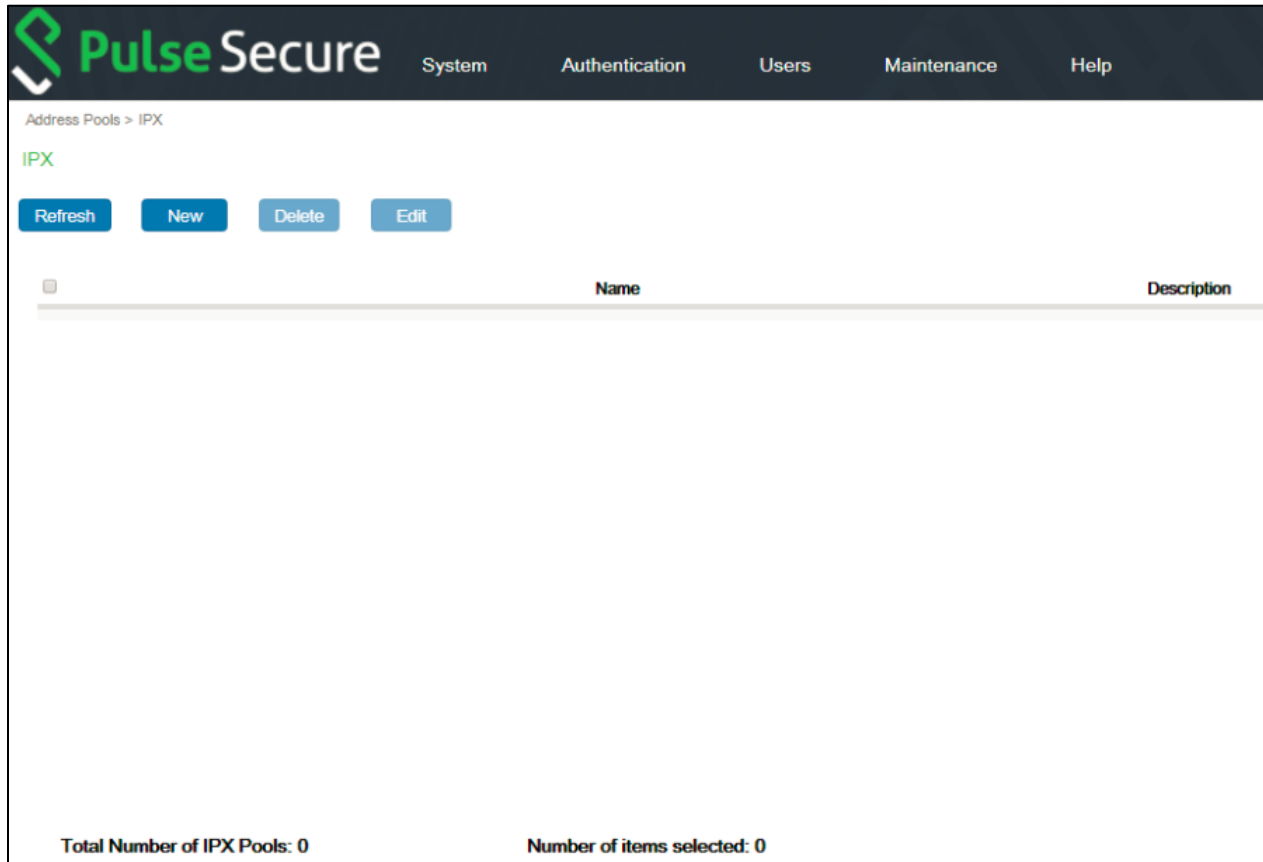
```
Enable = 0
```

Current sessions processing makes sense only when authentication and all accounting are directed to the same server. If current sessions processing is not disabled, the current sessions database is incorrect and always growing. For example, DHCP addresses are prematurely released when phantoms expire.

Setting Up IPX Address Pools

The IPX Pools page (Figure 101: Address Pools Page: IPX Pools) allows you to set up one or more pools out of which unique IPX network numbers are assigned as users require them. Each pool consists of a list of one or more ranges of IPX network numbers.

Figure 101: Address Pools Page: IPX Pools



Adding an IPX Pool

An IPX pool consists of one or more ranges of IPX network numbers. You can add or delete ranges and set an optional description for each address pool.

To add an IPX address pool:

1. Choose System > Address Pools > IPX in the menubar. The IPX Address Pools page appears.
2. Click the **New** button on Add IPX Address Pool Page.

The Add IPX Address Pool page appears.

Figure 102: Add IPX Address Pool Page

Pulse Secure System Authentication Users Maintenance Help

Address Pools > Add IPX Address Pool

Add IPX Address Pool

Name:

Description:

▼ Address Ranges

Starting Address	Size
------------------	------

Add Edit Delete OK Cancel

3. Enter the name of the IPX address pool in the **Name** field.
4. Optionally, enter a description of the address pool in the **Description** field.
5. Identify the address ranges in the IP address pool.
 - a. Click the **Add** button below the Address Ranges list.

The Add IP Address Range page opens.

Figure 103: Add IP Address Range Page

Add IPX Address Range

Starting Address:

Number of addresses:

OK Cancel

- b. Enter the first address in the **Starting address** field.
 - c. Enter the number of IPX addresses in the address range in the **Number of addresses** field.
 - d. Click **Add**.
 - e. Repeat steps a–d for each address range in the IPX address pool. When you are finished, click **Close**.
6. Click **OK**.

Editing an IPX Address Pool

To edit an IPX address pool:

1. Choose **System > Address Pools > IPX** in the menubar.
2. Select the entry you want to modify and click the **Edit** button

The Edit IPX Address Pool page appears.

Figure 104: Edit IPX Address Pool Page

The screenshot displays the 'Edit IPX Address Pool' interface in Pulse Secure. The top navigation bar includes 'System', 'Authentication', 'Users', 'Maintenance', and 'Help'. The breadcrumb trail shows 'Address Pools > Edit IPX Address Pool'. The main form contains two input fields: 'Name' with the value 'IPX POOL' and 'Description' with the value 'POOL 1 Description'. Below these is a section titled 'Address Ranges' with a dropdown arrow. Under this section is a table with two columns: 'Starting Address' and 'Size'. The table contains one data row with the values '00001234' and '123'. At the bottom of the page are five buttons: 'Add', 'Edit', 'Delete', 'OK', and 'Cancel'.

Starting Address	Size
00001234	123

3. Modify the settings for the address pool as needed.
 - To add an address range to the address pool, click the **Add** button and specify the starting address and number of addresses in the range.
 - To modify an address range, select it and click the **Edit** button.

- To delete an address range from the address pool, select it and click the **Delete** button.
4. When you are finished, click **Save**.

Removing an IPX Address Pool

To delete an IPX address pool:

1. Choose the **System > Address Pools > IPX** tab to display the list of IPX address pools that have been configured.
2. Select the entry you want to remove and click the **Delete** button.
3. When you are prompted to confirm the deletion, click **Yes**.

Specifying Pooled IPX Network Numbers in User/Profile Records

The Framed-IPX-Address return list attribute controls how Steel-Belted Radius assigns an IPX address to a user making a connection.

When you add or edit the Framed-IPX-Address attribute for a user or profile, the Framed-IPX-Address page appears. To select an IPX address assignment option, type an IPX address in the IPX address field or click the IPX Address Pool check box and select the name of the IPX address pool you want to use from the list.

Figure 105: Specifying an IPX Pool for the Framed-IPX-Address Attribute

The screenshot shows the 'Add Return List Attribute' dialog box. At the top, the title is 'Add Return List Attribute'. Below the title, there is a section labeled 'Attributes' with a list box containing the following items: Framed-Compression, Framed-IP-Address, Framed-IP-Netmask, Framed-IPX-Network (which is highlighted), and Framed-IPX-Routing. Below the list box, there are several tabs: String, IP Address, IPv6 Address, Value, Hexadecimal, Integer, IP, IPX (which is selected), and IPv6-Prefix. Below these tabs, there are more tabs: IPv6-Interface, Date/time, Echo, and Constant. Below these tabs, there are two input fields: 'IPX Address' and 'IPX Address Pool'. The 'IPX Address Pool' field is currently empty. Below these fields, there is a dropdown menu labeled 'IPX Address Pool:' with 'IPX POOL' selected. At the bottom of the dialog, there are three checkboxes: 'Echo' (which is checked), 'Multivalued', and 'Orderable'. At the very bottom, there are two buttons: 'Add' and 'Close'.

Chapter 17

Setting Up Administrator Accounts via Legacy SBR Administrator

This chapter describes how to set up Steel-Belted Radius administrators via legacy SBR administrator and specify what permissions an administrator holds.

Administrator Files

The following files establish settings for administrative permissions. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

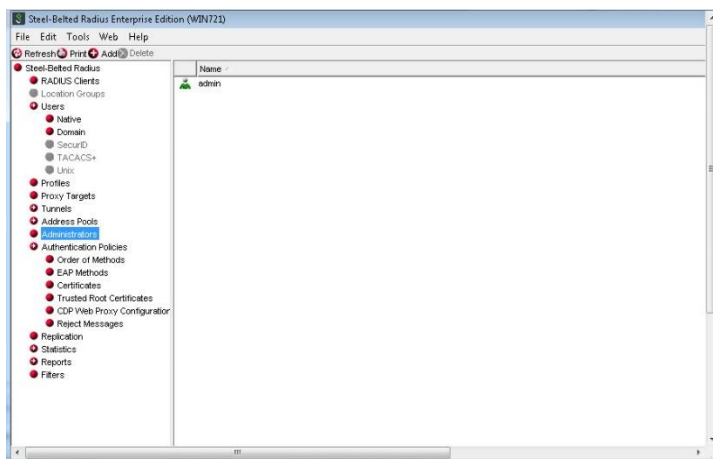
Table 24: Administrator Files

File Name	Function
access.ini	Maps operating system user or group account levels to administrative permissions.
admin.ini	Maps administrative access levels to sets of access rights.

Administrators Panel

The Administrators panel lets you grant and revoke the right to use the SBR Administrator to configure a Steel-Belted Radius server. Each time you log into a Steel-Belted Radius server, SBR Administrator prompts you to authenticate yourself by entering an account name and password.

Figure 106: Administrators Panel



When the Steel-Belted Radius software is installed, any user who is a member of the group Administrators on a Steel-Belted Radius server implicitly has the right to use the SBR Administrator at its default (full) level of access. The Administrators panel lets you modify these default permissions.

The Administrators panel lists the users and groups who have been explicitly granted the right to run the SBR Administrator. Local users or groups are shown with their normal name. Remote users or groups are shown with the name of the domain, followed by a backslash and then the name of the domain user or group.

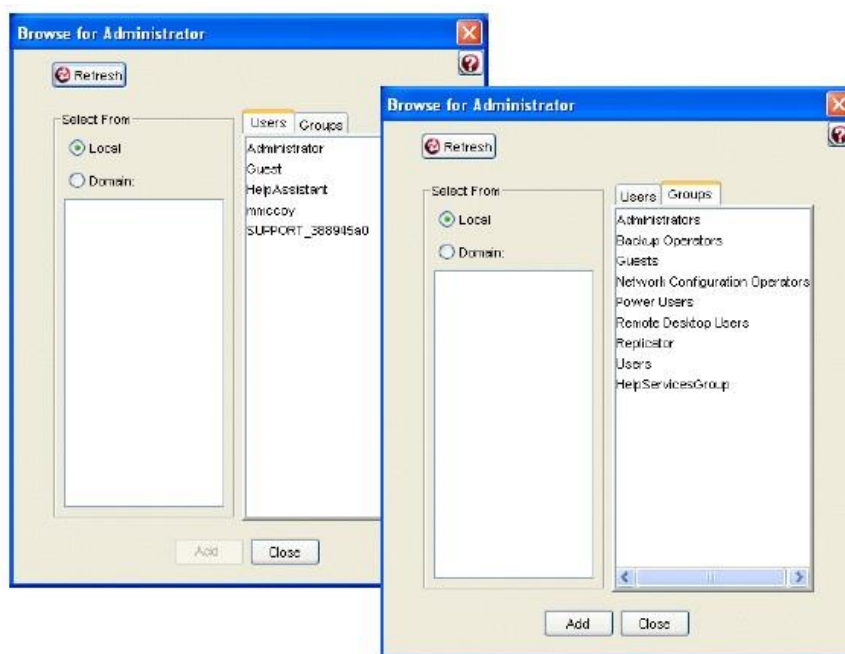
If you want to control administrative access at a finer level of detail, Steel-Belted Radius allows you to designate other Windows user and/or group accounts as administrative accounts. You can also assign various levels of administrative privilege to these accounts. Refer to “access.ini File” and “admin.ini File” in the Steel-Belted Radius Reference Guide for more information.

Adding a Local Administrator

To add a local administrator to the Steel-Belted Radius database:

1. Choose **Administrators** in the sidebar.
The Administrators panel appears.
2. Click the **Add** button to open the Browse for Administrator dialog.

Figure 107: Browse for Administrator Dialogs



3. Click the **Local** radio button to specify you are adding a local user.
4. Identify the local users or groups you want to add.
 - If you want to add a local user, click the **Users** tab and select the name of a user.
 - If you want to add a local group, click the **Groups** tab and select the name of a user group.
5. Click **Add**.
6. Continue adding local users and groups until you are done, then click **Close**.

Adding a Remote Administrator

Note: Browsing within a domain with large number of users or groups to select an administrator or group name can adversely affect Steel-Belted Radius performance.

To grant access to a remote administrator within a domain:

1. Choose Administrators in the sidebar.

The Administrators panel appears.

2. Click the **Add** button to open the Browse for Administrator dialog Figure 107).
3. Click the **Domain** radio button to specify you are adding a remote (domain) user.
4. When the list of domains appears, select the domain within which you would like to grant access.
5. Identify the remote users or groups within that domain who you want to add.
 - If you want to add a remote user, click the **Users** tab and select the name of a user.
 - If you want to add a remote group, click the **Groups** tab and select the name of a user group.
6. Click **Add**.
7. Continue adding domain users and groups until you are done, then click **Close**.


Deleting an Administrator

To revoke rights for a Steel-Belted Radius administrator:

1. Choose **Administrators** in the sidebar.

The Administrators panel appears.

2. Select the user or group whose administration rights you want to revoke.
3. Click the **Delete** button on the SBR Administrator toolbar (or right-click the entry and choose **Delete**).
4. When you are prompted to confirm the deletion, click **Yes**.

 **Note:** Be careful not to revoke your own rights. If you do so, you will no longer have access to Steel- Belted Radius administrative functions.

Chapter 18

Setting Up Administrator Accounts via WebGUI

This chapter describes how to set up Steel-Belted Radius administrators via WebGUI and specify what permissions an administrator holds.

Administrator Files

The following files establish settings for administrative permissions. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

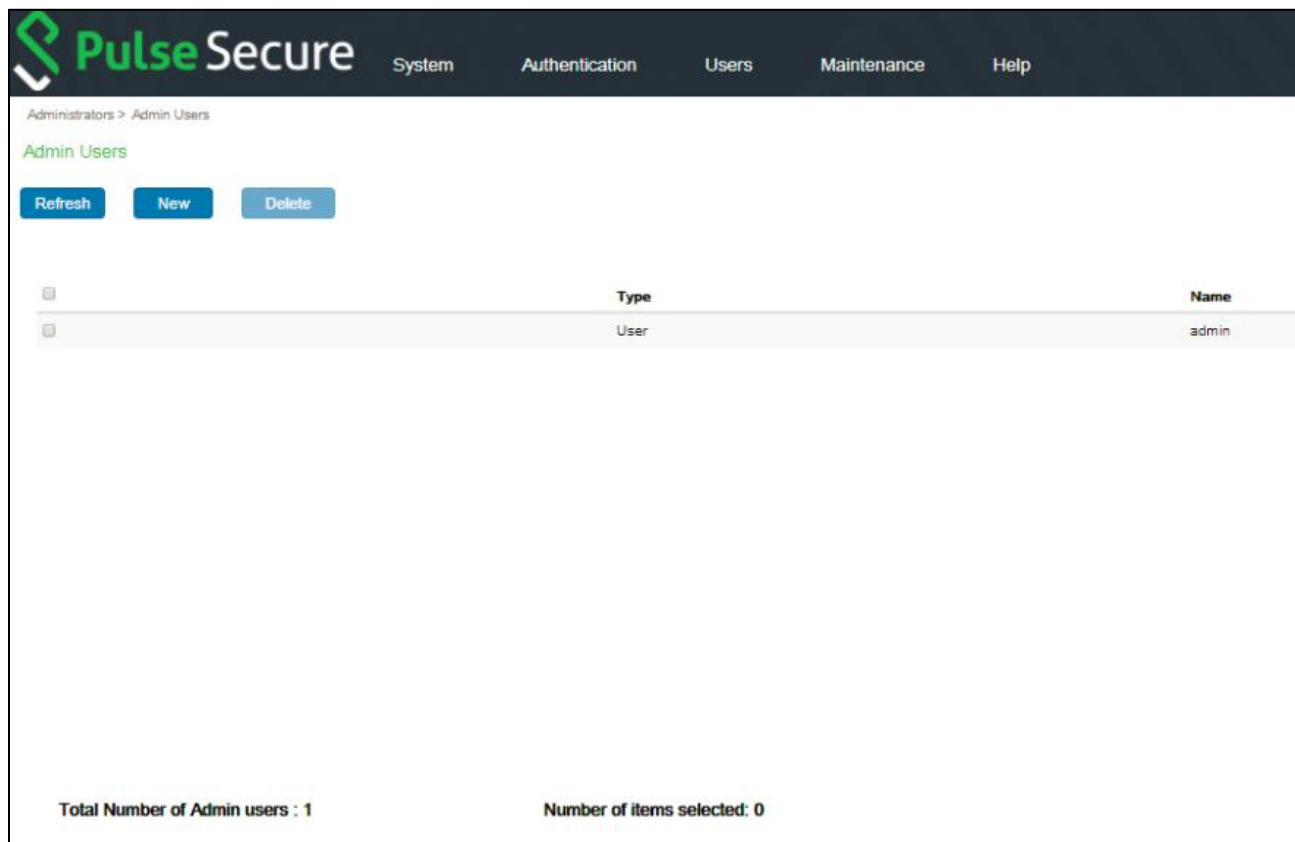
Table 25: Administrator Files

File Name	Function
access.ini	Maps operating system user or group account levels to administrative permissions.
admin.ini	Maps administrative access levels to sets of access rights.

Administrators Page

The Administrators page lets you grant and revoke the right to use the SBR Administrator to configure a Steel-Belted Radius server. Each time you log into a Steel-Belted Radius server, SBR Administrator prompts you to authenticate yourself by entering an account name and password.

Figure 108: Administrators Page



When the Steel-Belted Radius software is installed, any user who is a member of the group Administrators on a Steel-Belted Radius server implicitly has the right to use the SBR Administrator at its default (full) level of access. The Administrators page lets you modify these default permissions.

The Administrators page lists the users and groups who have been explicitly granted the right to run the SBR Administrator. Local users or groups are shown with their normal name. Remote users or groups are shown with the name of the domain, followed by a backslash and then the name of the domain user or group.

If you want to control administrative access at a finer level of detail, Steel-Belted Radius allows you to designate other Windows user and/or group accounts as administrative accounts. You can also assign various levels of administrative privilege to these accounts. Refer to “access.ini File” and “admin.ini File” in the Steel-Belted Radius Reference Guide for more information.

Adding a Local Administrator

To add a local administrator to the Steel-Belted Radius database:

1. Choose **Users > Administrator > Admin Users**. The Administrators page appears.
2. Click the **New** button to open the Browse for Administrator page.

Figure 109: Browse for Administrator Pages

The screenshot shows the 'Browse for Administrator' dialog box in the Pulse Secure interface. The dialog has a dark header bar with the Pulse Secure logo and navigation links: System, Authentication, Users, Maintenance, and Help. Below the header, the breadcrumb 'Administrators > Browse for Administrator' is visible. The main title 'Browse for Administrator' is in green. A blue 'Refresh' button is located below the title. The 'Name:' field is a text input box. Below it, the 'Select From' section has two radio buttons: 'Local' (selected) and 'Domain'. A green 'Attributes:' label is followed by a scrollable list box. At the bottom, there are two tabs: 'Users' (selected) and 'Groups'. The 'Users' tab displays a list of usernames: admin, Administrator, dtumuluri, Guest, ramesh, Test1, Test2, Test3, Test4, and Test5. At the very bottom are 'OK' and 'Cancel' buttons.

Pulse Secure System Authentication Users Maintenance Help

Administrators > Browse for Administrator

Browse for Administrator

Refresh

Name:

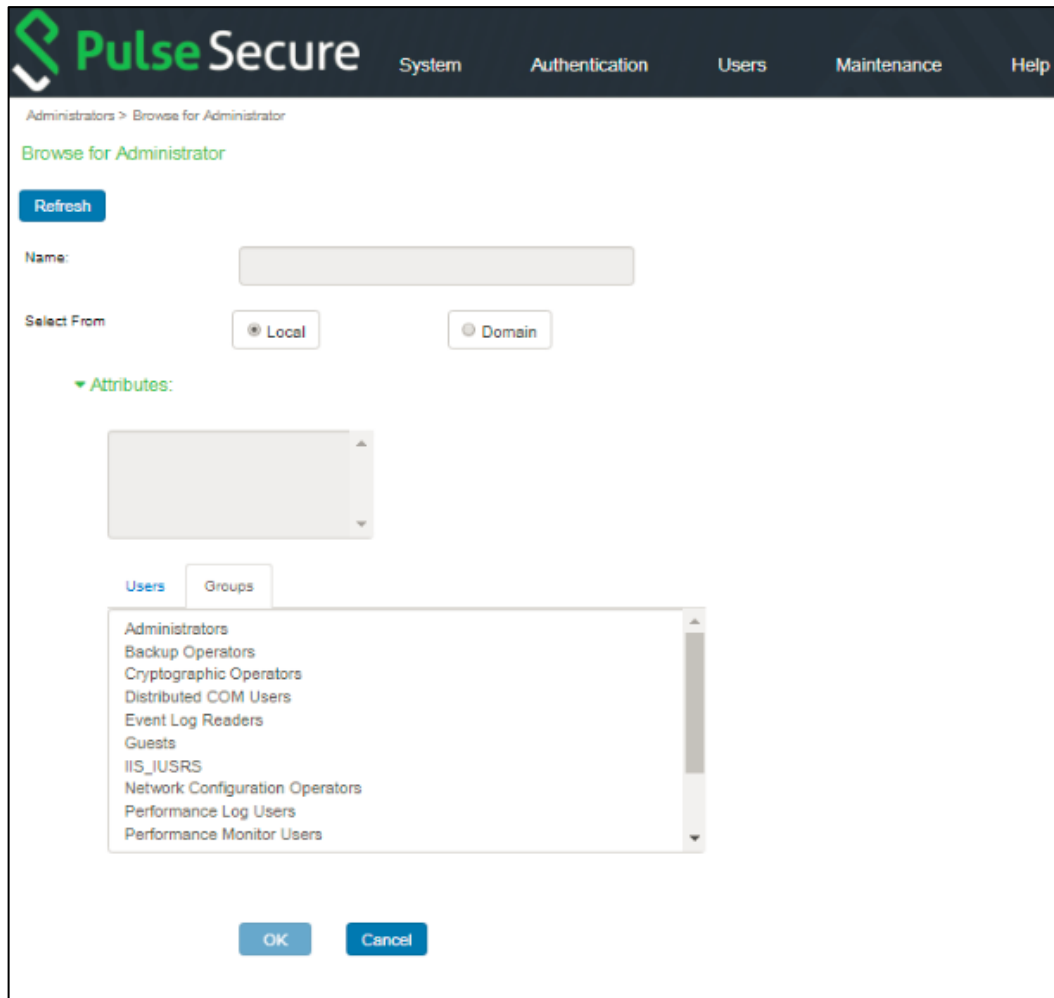
Select From ☒ Local ☐ Domain

Attributes:

Users Groups


admin
Administrator
dtumuluri
Guest
ramesh
Test1
Test2
Test3
Test4
Test5

OK Cancel



3. Click the **Local** radio button to specify you are adding a local user.
4. Identify the local users or groups you want to add.
 - If you want to add a local user, click the **Users** tab and select the name of a user.
 - If you want to add a local group, click the **Groups** tab and select the name of a user group.
5. Click **Add**.
6. Continue adding local users and groups until you are done, then click **Close**.

Adding a Remote Administrator

 **Note:** Browsing within a domain with large number of users or groups to select an administrator or group name can adversely affect Steel-Belted Radius performance.

To grant access to a remote administrator within a domain:

1. Choose **Users > Administrators > Admin Users** in the menubar.
The Administrators page appears.
2. Click the **New** button to open the Browse for Administrator pages (Figure 109: Browse for

Administrator Pages).


3. Click the **Domain** radio button to specify you are adding a remote (domain) user.
4. When the list of domains appears, select the domain within which you would like to grant access.
5. Identify the remote users or groups within that domain who you want to add.
 - If you want to add a remote user, click the **Users** tab and select the name of a user.
 - If you want to add a remote group, click the **Groups** tab and select the name of a user group.
6. Click **Add**.
7. Continue adding domain users and groups until you are done, then click **Close**.

Deleting an Administrator

To revoke rights for a Steel-Belted Radius administrator:

1. Choose **Users > Administrators > Admin Users** in the menubar.


The Administrators page appears.
2. Select the user or group whose administration rights you want to revoke.
3. Click the **Delete** button on the SBR Administrator toolbar
4. When you are prompted to confirm the deletion, click **Yes**.

 **Note:** Be careful not to revoke your own rights. If you do so, you will no longer have access to Steel-Belted Radius administrative functions.

Chapter 19

Setting Up Filters via Legacy SBR Administrator

This chapter describes how to set up and use filters in Steel-Belted Radius via legacy SBR Administrator.

 **Note:** If you are running the Global Enterprise Edition (GEE) of Steel-Belted Radius, you can use a separately licensed add-on module to use Javascript to select and create filters. For more information, refer to the Steel-Belted Radius Scripting Guide.

Overview

A filter is a collection of rules for adding, modifying, or removing attributes or attribute values in RADIUS requests and responses. You define filters and their rules by means of the Add Filter dialog (described in [Adding a Filter](#)). You enable filters by referring to them by name when using the SBR Administrator or when editing certain .ini file sections.

A filter consists of one or more rules, which are processed in sequential order.


- Add rules specify that an attribute-value pair (AVP) is added to a RADIUS packet during processing. The AVP is added after all other rules are processed. An attribute is added to a packet only if it is legal to do so.

Some attributes can appear only once in a RADIUS packet; others can appear multiple times. If an attribute that is the subject of an Add rule is already present in the packet (after processing Allow and Exclude rules) and the attribute can only appear once, the Add rule is not processed and the second instance of the attribute is not added.

- Allow rules specify whether an attribute (or AVP) is allowed in a RADIUS packet.
 - If an Allow rule specifies an attribute name and an attribute value, then only attributes of the specified type and value are allowed in the RADIUS packet.
 - If an Allow rule specifies an attribute name without an attribute value, then all attributes of the specified type, regardless of value, are allowed in the RADIUS packet.
 - If an Allow rule does not specify an attribute name, then all attributes, regardless of value, are allowed in the RADIUS packet.
- Exclude rules specify an attribute (or AVP) is excluded from a RADIUS packet.
 - If an Exclude rule specifies an attribute name and an attribute value, then only attributes of the specified type and value are excluded from the RADIUS packet.
 - If an Exclude rule specifies an attribute name without an attribute value, then all attributes of the specified type, regardless of value, are excluded from the RADIUS packet.
 - If an Exclude rule does not specify an attribute name, then all attributes, regardless of value, are excluded from the RADIUS packet.
- Replace rules specify the conditions whereby one attribute (or attribute value) is replaced with another.

- If a Replace rule specifies that one named attribute of a specified value (attr1 v1) should be replaced with a different attribute of a specified value (attr2 v2) , then any occurrence of the first AVP is replaced with the second AVP. Result: attr2 v2.
- If a Replace rule specifies that a named attribute without a specified value (attr1) should be replaced with a different attribute of a specified value (attr2 v2) , then any occurrence of the first attribute (regardless of value) is replaced with the second AVP. Result: attr2 v2.
- If a Replace rule specifies that one named attribute of a specified value (attr1 v1) should be replaced with a different attribute without a specified value (attr2), then any occurrence of the first attribute is replaced with the second attribute, which retains the value of the original attribute. Result: attr2 v1.
- If a Replace rule specifies that one named attribute (without a specified value) should be replaced with a different attribute without a specified value, then any occurrence of the first attribute is replaced with the second attribute, which retains the value of the original attribute. Result: attr2 v1.
- Script rules specify when to run attribute filter scripts. For information on attribute filter scripts, refer to the Steel-Belted Radius Scripting Guide.

The Steel-Belted Radius dictionary file radius.dct provides string aliases for certain integer values defined in the RADIUS standard. You can use these strings in attribute filter rules.

 **Note:** Filter rules provide you with tremendous flexibility. However, Steel-Belted Radius does not prevent you from creating an invalid RADIUS packet. Some attributes are not appropriate for certain types of requests. For example, adding a pooled Framed-Ip-Address attribute to an accounting request could cause a loss of available IP addresses.

Order of Filter Rules

The order of rules within a filter is important. General default rules that take no parameters, such as Allow (allow all attributes unless otherwise specified) or Exclude (exclude all attributes unless otherwise specified) must appear as the first rule in the filter. Later rules supersede earlier rules; the last applicable rule “wins.” Add and Replace rules are applied after the Allow and Exclude rules.

More specific rules with more parameters (Add attribute value) act as exceptions to less specific rules with fewer parameters (Allow attribute, EXCLUDE). For example, you might want to allow a certain attribute and exclude one or more specific values for that attribute. Or you might exclude all attributes, allow specific attributes, and add specific attribute/value pairs.

 **Note:** Script rules are not subject to rule ordering.

You can use two basic approaches to designing a filter:

- Start the rule list with a default Exclude rule (no parameters) and add Allow rules for any attributes or attribute/value pairs that you want to insert into the packet. Add and Replace rules might be used.
- Start the rule list with a default Allow rule (no parameters) and add Exclude rules for any attributes or attribute/value pairs that you want to remove from the packet. Add and Replace rules might be used.

The default action for Steel-Belted Radius is Exclude. If a filter does not contain any rules, the filter removes all attributes from a packet when the filter is applied.

Values in Filter Rules

The value of an attribute is interpreted based on the type of the attribute in its attribute dictionary. **Table 26** lists the meaning of each attribute type.

Table 26: Filter Rule Values

Attribute Type	Function																						
hexadecimal	A hexadecimal value is specified as a string. Special characters might be included using escape codes.																						
int1, int4, integer	1- or 4-byte unsigned decimal number (integer is equivalent to int4).																						
	<p>Note: The Steel-Belted Radius dictionary file radius.dct provides string aliases for certain integer values defined in the RADIUS standard. You can use these strings in attribute filter rules.</p>																						
ipaddr, ipaddr-pool	An IP address in dotted notation; for example: EXCLUDE NAS-IP-Address 127.0.0.1																						
ipxaddr-pool	A sequence of hex digits; for example: ALLOW Framed-IPX-Network 0042A36B																						
string	<p>String attribute (includes null terminator). A string is specified as text. The text can be enclosed in double-quotes ("). The text is interpreted as a regular expression. Backslash (\) is the escape character. Escape codes are interpreted as follows:</p> <table> <tr> <th>Code</th><th>Meaning</th></tr> <tr> <td>\a</td><td>7</td></tr> <tr> <td>\b</td><td>8</td></tr> <tr> <td>\f</td><td>12</td></tr> <tr> <td>\n</td><td>10</td></tr> <tr> <td>\r</td><td>13</td></tr> <tr> <td>\t</td><td>9</td></tr> <tr> <td>\v</td><td>11</td></tr> <tr> <td>\nnn</td><td>nnn is a decimal value between 0 and 255</td></tr> <tr> <td>\xnn</td><td>nn is a hexadecimal value between 00 and FF</td></tr> <tr> <td>\c</td><td>c is a single character, interpreted literally</td></tr> </table> <p>Literal backslashes (\) within a string and double-quotes (") within quoted strings should be prefixed with an escape character. For example: ADD Reply-Message Session limit is one hour ADD Reply-Message "Session limit is one hour" ADD Reply-Message "Your user name is \"George\""</p>	Code	Meaning	\a	7	\b	8	\f	12	\n	10	\r	13	\t	9	\v	11	\nnn	nnn is a decimal value between 0 and 255	\xnn	nn is a hexadecimal value between 00 and FF	\c	c is a single character, interpreted literally
Code	Meaning																						
\a	7																						
\b	8																						
\f	12																						
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\r	13																						
\t	9																						
\v	11																						
\nnn	nnn is a decimal value between 0 and 255																						
\xnn	nn is a hexadecimal value between 00 and FF																						
\c	c is a single character, interpreted literally																						
time	<p>A time value is specified with a string indicating date and time: yyyy/mm/dd hh:mm:ss The date portion is mandatory; the time portion can be specified to whatever degree of precision is required, or can be omitted entirely. For example: 2006/4/3 14:00:00 and 2006/4/3 14 both refer to April 3, 2006 at 2:00 p.m. For example: ADD Ascend-PW-Expiration 2006/4/3</p>																						

Referencing Attribute Filters

Steel-Belted Radius attribute filtering provides flexibility in packet processing. You reference filters by name in SBR Administrator dialogs, in various .ini and .aut configuration files, and in the FilterOut and FilterIn sections of your .pro and .dir files. You can use the same filter for all packets in all realms. You can apply filtering to some realms, and not others. To disable filtering for a realm, omit filtering parameters from the *.pro or *.dir files and from the EAP-PEAP/EAP-TTLS configurations. Filtering is often used only for packets that are routed “out” to realms (the FilterOut parameter).

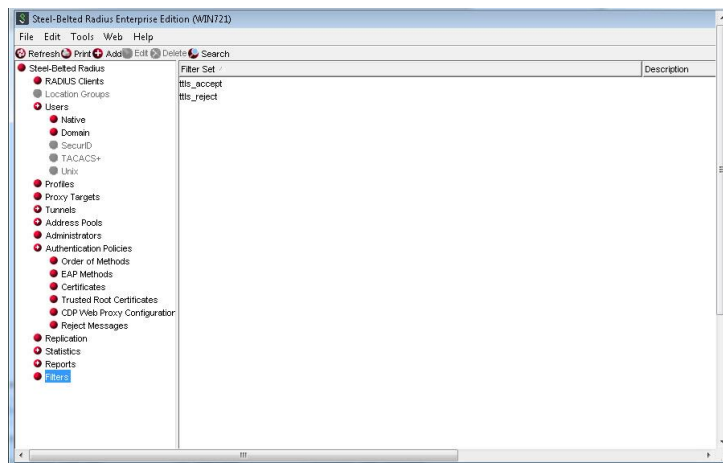
To reference filtering rules in proxy or directed realm configurations, you must use the FilterOut and FilterIn parameters in the [Auth] and [Acct] sections of a realm configuration file. For more information, refer to the Steel-Belted Radius Reference Guide.

Note: Do not allocate IP addresses from Steel-Belted Radius IP address pools in accounting filters. These addresses will be allocated but never released.

Filters Panel

You can use the Filters panel (Figure 110) to display the filters configured for Steel-Belted Radius. To open the Filters panel, click Filters in the SBR Administrator sidebar.

Figure 110: Filters Panel

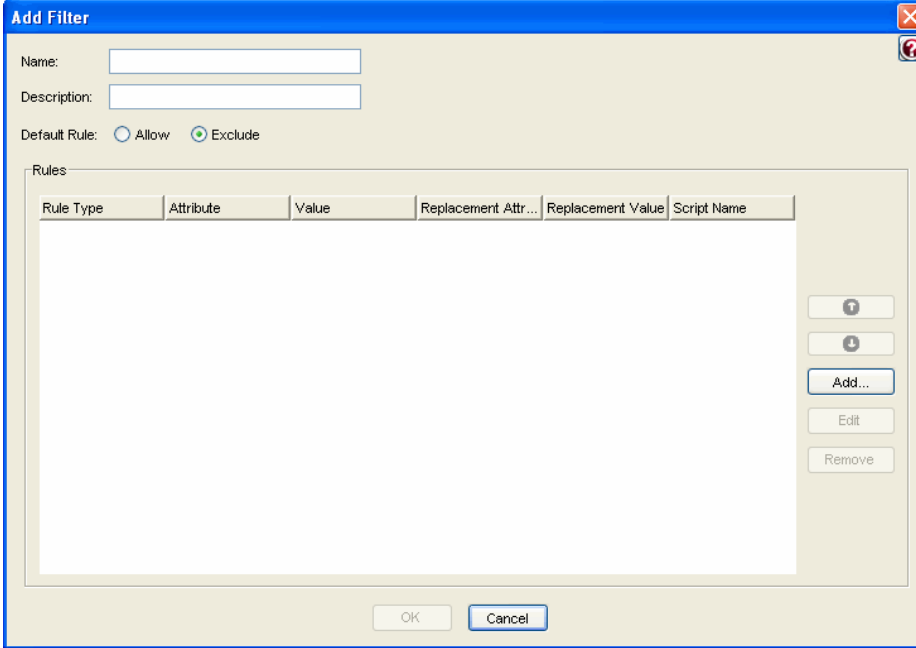


Adding a Filter

To add a filter:

1. Click **Filters** in the SBR Administrator sidebar to display the Filter panel.
2. Click **Add** in the toolbar to display the Add Filter dialog (Figure 111).

Figure 111: Add Filter Dialog

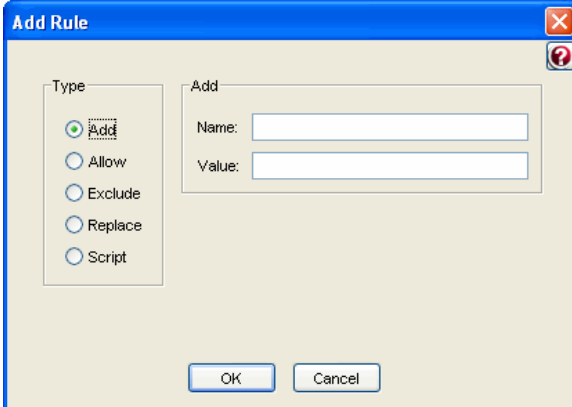


The **Add Filter** dialog box contains the following elements:

- Name:** A text input field.
- Description:** A text input field.
- Default Rule:** Two radio buttons, **Allow** and **Exclude**. The **Exclude** button is selected.
- Rules:** A table with the following columns: Rule Type, Attribute, Value, Replacement Attr..., Replacement Value, and Script Name. The table is currently empty.
- Buttons:** On the right side of the Rules table, there are buttons for **Add...**, **Edit**, and **Remove**. At the bottom of the dialog are **OK** and **Cancel** buttons.

3. Enter the name of the filter in the **Name** field.
4. Optionally, enter a description of the filter in the **Description** field.
You can enter as many as 4095 characters for a filter description.
5. Use the **Default Rule** radio buttons to specify whether attributes should be allowed or excluded if no other rule applies to a RADIUS packet.
6. Click the **Add** button to display the Add Rule dialog.

Figure 112: Add Rule Dialog



The **Add Rule** dialog box contains the following elements:

- Type:** A group box containing five radio buttons: **Add** (selected), **Allow**, **Exclude**, **Replace**, and **Script**.
- Add:** A sub-dialog box with two text input fields: **Name:** and **Value:**.
- Buttons:** **OK** and **Cancel** buttons at the bottom.

7. Select the type of rule you want to add to the filter.
Options are Add, Allow, Exclude, Replace, and Script. The fields in the Add Rule dialog depend on the option you select.
8. Specify the attribute name and value settings you want to use for the rule.

 **Note:** GEE: If you edit the filters for a Steel-Belted Radius server, you can apply your configuration

changes without stopping the server:

- Linux: Issue the HUP signal to the Steel-Belted Radius process: `kill -HUP ProcessID`
- Windows: Run the `radhup.exe` program from the command shell. (`radhup.exe` is located in the server directory that you specified at installation time, usually `C:\Radius\Service.`)

Searching the Filter List

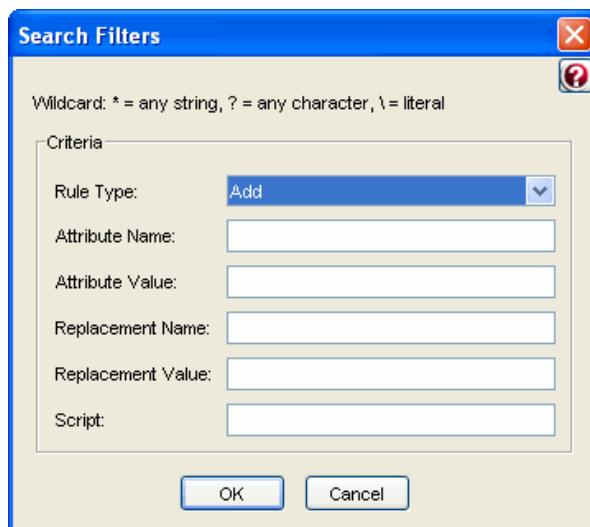
You can search your list of filters to identify those of a specific type or that use a specific rule. To search your filter list:

1. Open the Filters panel.
2. Click the **Search** toolbar button.
3. When the Search Filters dialog (Figure 113) appears, enter one or more search criteria in the fields provided.

You can use the question mark (?) wildcard to represent one character in a string. You can use the asterisk (*) wildcard to represent any number of characters. For example, entering the search string `MS-MPPE-*` would identify any filter that looks for the `MS-MPPE-Recv-Key` or `MS-MPPE-Send-Key` attribute.

4. Click **OK**.

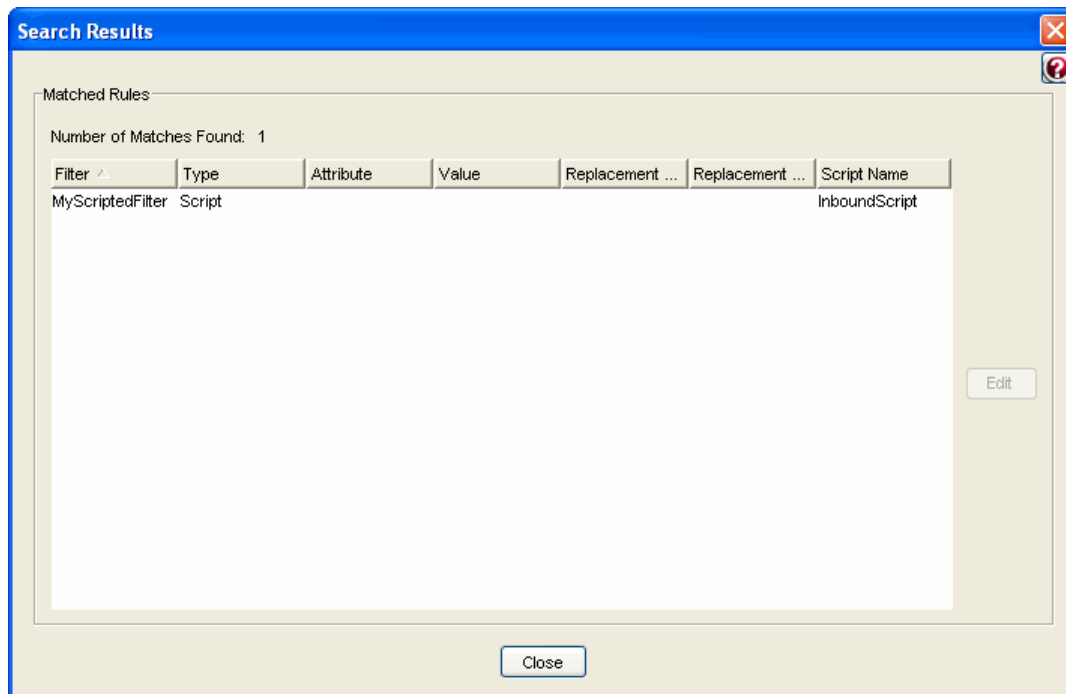
Figure 113: Search Filters Dialog



The Search Results dialog (.

Figure 114) displays the list of filters that satisfy your search criteria.


Figure 114: Search Results Dialog



Chapter 20

Setting Up Filters via WebGUI

This chapter describes how to set up and use filters in Steel-Belted Radius via WebGUI.

 **Note:** If you are running the Global Enterprise Edition (GEE) of Steel-Belted Radius, you can use a separately licensed add-on module to use Javascript to select and create filters. For more information, refer to the Steel-Belted Radius Scripting Guide.

Overview

A filter is a collection of rules for adding, modifying, or removing attributes or attribute values in RADIUS requests and responses. You define filters and their rules by means of the Add Filter page (described in [Adding a Filter](#)). You enable filters by referring to them by name when using the SBR Administrator or when editing certain .ini file sections.

A filter consists of one or more rules, which are processed in sequential order.


- Add rules specify that an attribute-value pair (AVP) is added to a RADIUS packet during processing. The AVP is added after all other rules are processed. An attribute is added to a packet only if it is legal to do so.

Some attributes can appear only once in a RADIUS packet; others can appear multiple times. If an attribute that is the subject of an Add rule is already present in the packet (after processing Allow and Exclude rules) and the attribute can only appear once, the Add rule is not processed and the second instance of the attribute is not added.
- Allow rules specify whether an attribute (or AVP) is allowed in a RADIUS packet.
 - If an Allow rule specifies an attribute name and an attribute value, then only attributes of the specified type and value are allowed in the RADIUS packet.
 - If an Allow rule specifies an attribute name without an attribute value, then all attributes of the specified type, regardless of value, are allowed in the RADIUS packet.
 - If an Allow rule does not specify an attribute name, then all attributes, regardless of value, are allowed in the RADIUS packet.
- Exclude rules specify an attribute (or AVP) is excluded from a RADIUS packet.
 - If an Exclude rule specifies an attribute name and an attribute value, then only attributes of the specified type and value are excluded from the RADIUS packet.
 - If an Exclude rule specifies an attribute name without an attribute value, then all attributes of the specified type, regardless of value, are excluded from the RADIUS packet.
 - If an Exclude rule does not specify an attribute name, then all attributes, regardless of value, are excluded from the RADIUS packet.
- Replace rules specify the conditions whereby one attribute (or attribute value) is replaced with another.
 - If a Replace rule specifies that one named attribute of a specified value (attr1 v1) should be

replaced with a different attribute of a specified value (attr2 v2) , then any occurrence of the first AVP is replaced with the second AVP. Result: attr2 v2.

- If a Replace rule specifies that a named attribute without a specified value (attr1) should be replaced with a different attribute of a specified value (attr2 v2) , then any occurrence of the first attribute (regardless of value) is replaced with the second AVP. Result: attr2 v2.
- If a Replace rule specifies that one named attribute of a specified value (attr1 v1) should be replaced with a different attribute without a specified value (attr2), then any occurrence of the first attribute is replaced with the second attribute, which retains the value of the original attribute. Result: attr2 v1.
- If a Replace rule specifies that one named attribute (without a specified value) should be replaced with a different attribute without a specified value, then any occurrence of the first attribute is replaced with the second attribute, which retains the value of the original attribute. Result: attr2 v1.
- Script rules specify when to run attribute filter scripts. For information on attribute filter scripts, refer to the Steel-Belted Radius Scripting Guide.

The Steel-Belted Radius dictionary file radius.dct provides string aliases for certain integer values defined in the RADIUS standard. You can use these strings in attribute filter rules.

 **Note:** Filter rules provide you with tremendous flexibility. However, Steel-Belted Radius does not prevent you from creating an invalid RADIUS packet. Some attributes are not appropriate for certain types of requests. For example, adding a pooled Framed-Ip-Address attribute to an accounting request could cause a loss of available IP addresses.

Order of Filter Rules

The order of rules within a filter is important. General default rules that take no parameters, such as Allow (allow all attributes unless otherwise specified) or Exclude (exclude all attributes unless otherwise specified) must appear as the first rule in the filter. Later rules supersede earlier rules; the last applicable rule “wins.” Add and Replace rules are applied after the Allow and Exclude rules.

More specific rules with more parameters (Add attribute value) act as exceptions to less specific rules with fewer parameters (Allow attribute, EXCLUDE). For example, you might want to allow a certain attribute and exclude one or more specific values for that attribute. Or you might exclude all attributes, allow specific attributes, and add specific attribute/value pairs.

 **Note:** Script rules are not subject to rule ordering.

You can use two basic approaches to designing a filter:

- Start the rule list with a default Exclude rule (no parameters) and add Allow rules for any attributes or attribute/value pairs that you want to insert into the packet. Add and Replace rules might be used.
- Start the rule list with a default Allow rule (no parameters) and add Exclude rules for any attributes or attribute/value pairs that you want to remove from the packet. Add and Replace rules might be used.

The default action for Steel-Belted Radius is Exclude. If a filter does not contain any rules, the filter removes all attributes from a packet when the filter is applied.

Values in Filter Rules

The value of an attribute is interpreted based on the type of the attribute in its attribute dictionary. **Table 26** lists the meaning of each attribute type.


Table 27: Filter Rule Values

Attribute Type	Function																						
hexadecimal	A hexadecimal value is specified as a string. Special characters might be included using escape codes.																						
int1, int4, integer	1- or 4-byte unsigned decimal number (integer is equivalent to int4).																						
<p>Note: The Steel-Belted Radius dictionary file radius.dct provides string aliases for certain integer values defined in the RADIUS standard. You can use these strings in attribute filter rules.</p>																							
ipaddr, ipaddr-pool	An IP address in dotted notation; for example: EXCLUDE NAS-IP-Address 127.0.0.1																						
ipxaddr-pool	A sequence of hex digits; for example: ALLOW Framed-IPX-Network 0042A36B																						
string	String attribute (includes null terminator). A string is specified as text. The text can be enclosed in double-quotes (""). The text is interpreted as a regular expression. Backslash (\) is the escape character. Escape codes are interpreted as follows: <table> <tr> <th>Code</th><th>Meaning</th></tr> <tr> <td>\a</td><td>7</td></tr> <tr> <td>\b</td><td>8</td></tr> <tr> <td>\f</td><td>12</td></tr> <tr> <td>\n</td><td>10</td></tr> <tr> <td>\r</td><td>13</td></tr> <tr> <td>\t</td><td>9</td></tr> <tr> <td>\v</td><td>11</td></tr> <tr> <td>\nnn</td><td>nnn is a decimal value between 0 and 255</td></tr> <tr> <td>\xnn</td><td>nn is a hexadecimal value between 00 and FF</td></tr> <tr> <td>\c</td><td>c is a single character, interpreted literally</td></tr> </table> <p>Literal backslashes (\) within a string and double-quotes (") within quoted strings should be prefixed with an escape character. For example: ADD Reply-Message Session limit is one hour ADD Reply-Message "Session limit is one hour" ADD Reply-Message "Your user name is \"George\""</p>	Code	Meaning	\a	7	\b	8	\f	12	\n	10	\r	13	\t	9	\v	11	\nnn	nnn is a decimal value between 0 and 255	\xnn	nn is a hexadecimal value between 00 and FF	\c	c is a single character, interpreted literally
Code	Meaning																						
\a	7																						
\b	8																						
\f	12																						
\n	10																						
\r	13																						
\t	9																						
\v	11																						
\nnn	nnn is a decimal value between 0 and 255																						
\xnn	nn is a hexadecimal value between 00 and FF																						
\c	c is a single character, interpreted literally																						
time	A time value is specified with a string indicating date and time: yyy/mm/dd hh:mm:ss The date portion is mandatory; the time portion can be specified to whatever degree of precision is required, or can be omitted entirely. For example: 2006/4/3 14:00:00 and 2006/4/3 14 both refer to April 3, 2006 at 2:00 p.m. For example: ADD Ascend-PW-Expiration 2006/4/3																						

Referencing Attribute Filters

Steel-Belted Radius attribute filtering provides flexibility in packet processing. You reference filters by name in SBR Administrator pages, in various .ini and .aut configuration files, and in the FilterOut and FilterIn sections of your .pro and .dir files. You can use the same filter for all packets in all realms. You can apply filtering to some realms, and not others. To disable filtering for a realm, omit filtering parameters from the *.pro or *.dir files and from the EAP-PEAP/EAP-TTLS configurations. Filtering is often used only for packets that are routed “out” to realms (the FilterOut parameter).

To reference filtering rules in proxy or directed realm configurations, you must use the FilterOut and FilterIn parameters in the [Auth] and [Acct] sections of a realm configuration file. For more information, refer to the Steel-Belted Radius Reference Guide.

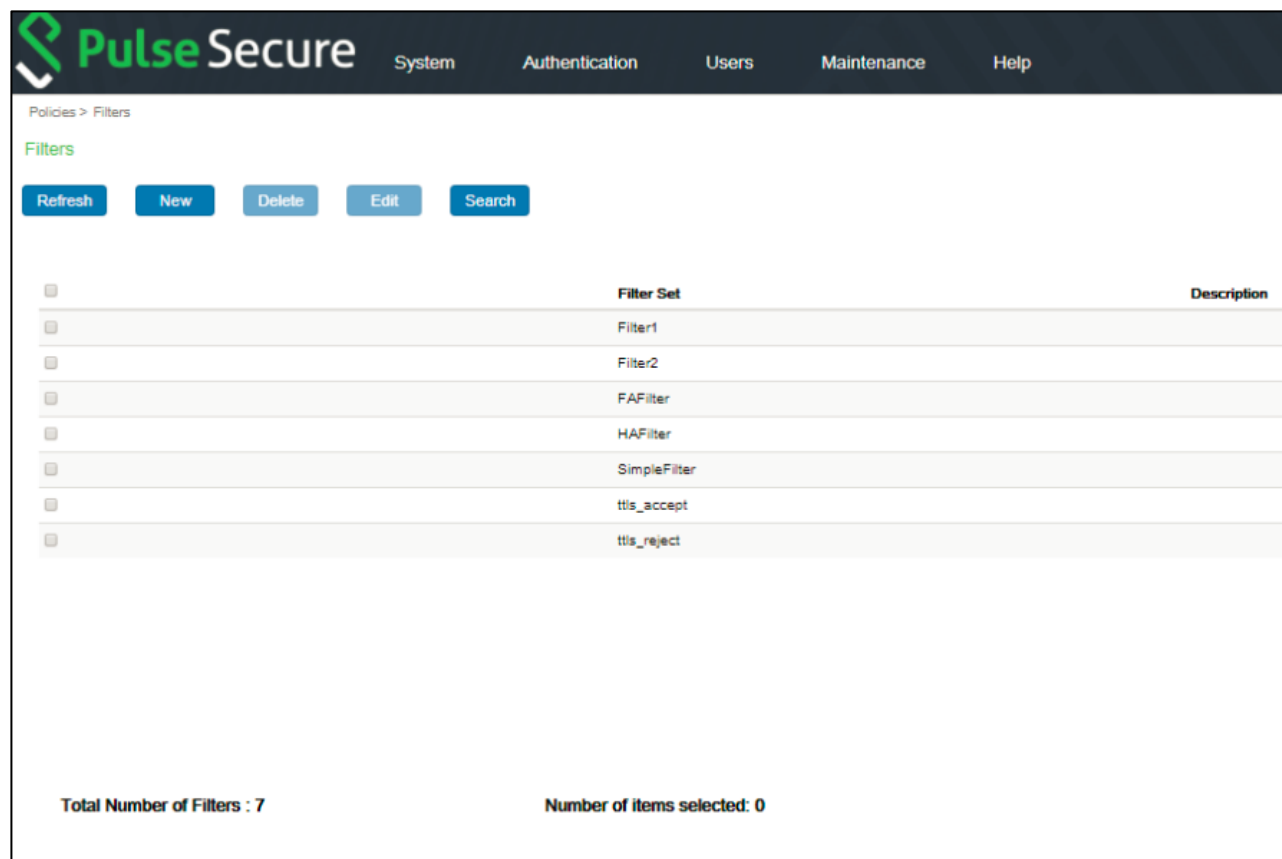
 **Note:** Do not allocate IP addresses from Steel-Belted Radius IP address pools in accounting filters. These addresses will be allocated but never released.

Filters Page

You can use the Filters page (Figure 115: Filters Page) to display the filters configured for Steel-Belted Radius.

To open the Filters page, click the **System > Policies > Filters** to view the Filters.

Figure 115: Filters Page



The screenshot displays the Pulse Secure web interface for the Filters page. The breadcrumb trail is 'Policies > Filters'. Below the title, there are buttons for 'Refresh', 'New', 'Delete', 'Edit', and 'Search'. A table lists the configured filters:

	Filter Set	Description
<input type="checkbox"/>	Filter1	
<input type="checkbox"/>	Filter2	
<input type="checkbox"/>	FAFilter	
<input type="checkbox"/>	HAFilter	
<input type="checkbox"/>	SimpleFilter	
<input type="checkbox"/>	ttls_accept	
<input type="checkbox"/>	ttls_reject	

At the bottom of the page, it indicates 'Total Number of Filters : 7' and 'Number of items selected: 0'.

Adding a Filter

To add a filter:

1. Click **System > Policies > Filters** in the SBR Administrator menubar to display the Filter page.
2. Click **New** on the Add Filter page. Add Filter page appears.

Figure 116: Add Filter Page


3. Enter the name of the filter in the **Name** field.
4. Optionally, enter a description of the filter in the **Description** field.
You can enter as many as 4095 characters for a filter description.
5. Use the **Default Rule** radio buttons to specify whether attributes should be allowed or excluded if no other rule applies to a RADIUS packet.
6. Click the **Add** button to display the Add Rule page.

Figure 117: Add Rule Page

7. Select the type of rule you want to add to the filter.

Options are Add, Allow, Exclude, Replace, and Script. The fields in the Add Rule page depend on the option you select.

8. Specify the attribute name and value settings you want to use for the rule.

 **Note: GEE:** If you edit the filters for a Steel-Belted Radius server, you can apply your configuration changes without stopping the server:

- Linux: Issue the HUP signal to the Steel-Belted Radius process: `kill -HUP ProcessID`
- Windows: Run the `radhup.exe` program from the command shell. (`radhup.exe` is located in the server directory that you specified at installation time, usually `C:\Radius\Service`.)

Searching the Filter List

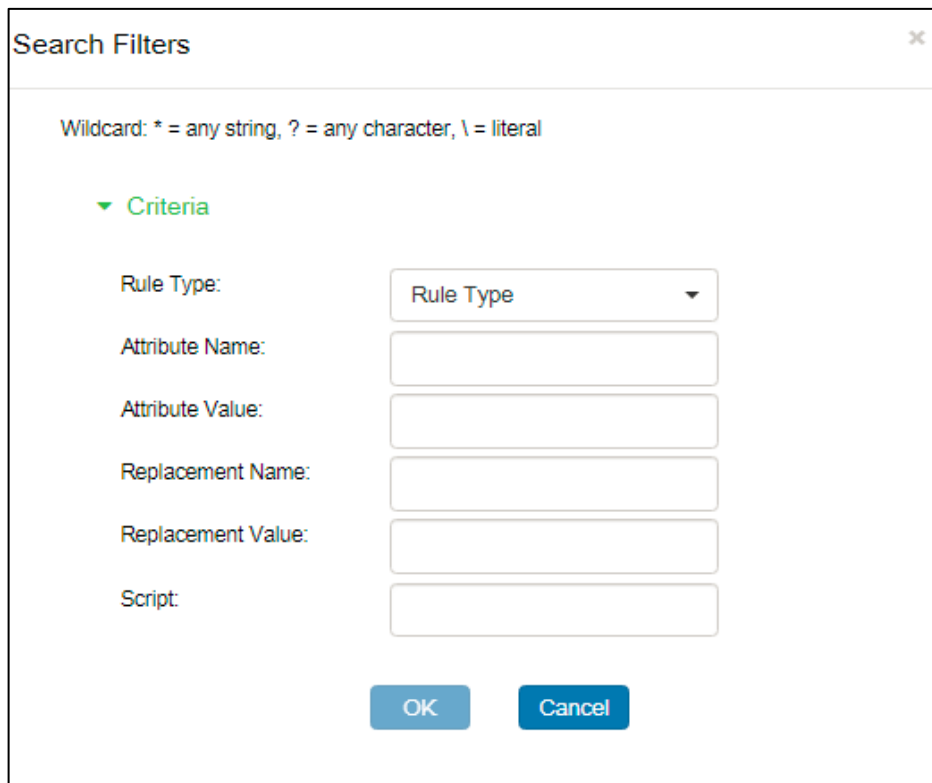
You can search your list of filters to identify those of a specific type or that use a specific rule. To search your filter list:

1. Open the Filters page.
2. Click the Search button to go to search Filters Page.
3. On click of Search button, Search Filters Modal window (**Figure 118: Search Filters Modal Window**) appears, enter one or more search criteria in the fields provided.

You can use the question mark (?) wildcard to represent one character in a string. You can use the asterisk (*) wildcard to represent any number of characters. For example, entering the search string `MS-MPPE-*` would identify any filter that looks for the `MS-MPPE-Recv-Key` or `MS-MPPE-Send-Key` attribute.

4. Click **OK**.

Figure 118: Search Filters Modal Window



The image shows a modal window titled "Search Filters" with a close button (X) in the top right corner. Below the title bar, there is a text instruction: "Wildcard: * = any string, ? = any character, \ = literal". Underneath this, a green downward arrow icon is followed by the word "Criteria". Below "Criteria", there are six labels on the left, each corresponding to a form field on the right: "Rule Type:" (a dropdown menu showing "Rule Type"), "Attribute Name:" (a text input field), "Attribute Value:" (a text input field), "Replacement Name:" (a text input field), "Replacement Value:" (a text input field), and "Script:" (a text input field). At the bottom of the modal, there are two buttons: "OK" and "Cancel".

The Search Results page (Figure 119: Search Results Page) displays the list of filters that satisfy your search criteria.

Figure 119: Search Results Page

Pulse Secure

System Authentication Users Maintenance Help

Policies > Search Filters

Search Filters

Search

Click on Search button to get filters search options.

▼ Search Results

Number of Matches Found: 5

Filter	Type	Attribute	Value	Replacement Attribute	Replacement Value	Script Name
ttls_accept	Exclude	Class				
ttls_accept	Exclude	EAP-Message				
ttls_accept	Exclude	MS-MPPE-Recv-Key				
ttls_accept	Exclude	MS-MPPE-Send-Key				
ttls_reject	Exclude	EAP-Message				

Edit

Close

Chapter 21

Setting Up EAP Authentication Policies via Legacy SBR Administrator

This chapter presents an overview of concepts relating to the Extensible Authentication Protocol (EAP) and describes how to configure Steel-Belted Radius to use EAP authentication methods and plug-ins via SBR Administrator.

About the Extensible Authentication Protocol

Steel-Belted Radius supports the Extensible Authentication Protocol (EAP), a standard for communication between network access devices and servers that provides for the future extensibility of authentication protocols.

EAP allows specialized knowledge about authentication protocols to be taken out of a NAD so that it acts solely as a conduit between authentication server and client. This means that new types of authentication can be supported by adding the appropriate functionality to server and client, without any changes to PPP or network access devices. When the authentication process is complete, the RADIUS server simply informs the NAD of the result.

Steel-Belted Radius supports several EAP authentication mechanisms, such as TTLS, TLS, PEAP, LEAP, MD5-Challenge, and Generic Token. Support for EAP has been designed to anticipate other authentication types as they become available.

TLS v1.2 (latest version) protocol provides improved flexibility and enhanced security. It supports modern encryption algorithms like SHA-256, AES cipher suites to communicate with RADIUS clients and avoid any weak cipher suite negotiations. OpenSSL 1.0.2d is used to support TLS v1.2 and address various security vulnerabilities.

The [EapSettings] section of radius.ini initialization file contains two parameters: AllowTLSFallback and MinimumProtocolVersion.

- Parameter AllowTLSFallback enables fallback to support SSL/TLS protocol versions
- Parameter MinimumProtocolVersion specifies the protocol version (TLSv10/TLSv11/TLSv12) to be used for EAP



Note: AllowTLSFallback option in radius.ini is applicable only for certificate based EAP plugins. The TLS fallback is a unique feature, aimed to provide backward compatibility to deprecated EAP client.

When AllowTLSFallback option is enabled in radius.ini, SBR EAP component will be initialized with protocol independent SSL structure. Depending on EAP client's hello message, SBR will either negotiate in TLS v1.2 or it can degrade itself till SSL v3 compliant server. This option is very specific to EAP plugins only.


For technical details about EAP, see RFC 2284, "PPP Extensible Authentication Protocol (EAP)," and RFC 2869, "RADIUS Extensions."

Handling EAP Requests

The flow of RADIUS packets in an EAP scenario is quite different from the transactions using standard user credentials (for example, PAP or CHAP). Standard user credentials involve the transmission of a RADIUS request from the NAD to Steel-Belted Radius and a response (either an Accept or Reject) from the server back to the NAD.

With EAP, the first packet sent from the NAD to Steel-Belted Radius contains an EAP-Message attribute containing an EAP Identity Response. This is a signal sent by the system being authenticated that it wants to be authenticated by means of EAP. It is now up to Steel-Belted Radius to select the EAP protocol with which it is to authenticate the end-user.

The contents of the User-Name attribute is the only guideline available to Steel-Belted Radius in selecting the appropriate EAP protocol. Should Steel-Belted Radius select an EAP protocol that is not supported by the client, the client has the opportunity to send an EAP-NAK and to request a specific alternate protocol.

 **Note:** Given this general flow, a RADIUS request with EAP credentials must incur a minimum of two network round-trips between the RAS (or Access Point) and the Steel-Belted Radius before reaching a successful conclusion.

Automatic EAP Helpers

Automatic EAP helpers serve as intermediaries between EAP and traditional authentication methods. These helper modules can be configured (using an associated .eap file) to work with existing authentication methods to shield the authentication methods from the particulars of the selected EAP protocol.

Table 28 indicates whether each EAP type is implemented as an EAP helper or stand-alone module in Steel-Belted Radius.

Table 28: EAP Implementations

EAP-Type	Implemented As
EAP-TTLS	Standalone Authentication Method Module
EAP-TLS	Standalone Authentication Method Module
EAP-TLS	Automatic EAP helper
LEAP	Automatic EAP helper for MS-CHAP-v1
EAP Generic-Token	Standalone Authentication Method Module (SecurID)
EAP MD5-Challenge	Automatic EAP helper for CHAP
EAP MS-CHAP-v2	Automatic EAP helper for MS-CHAP-v2 (needed for PEAP)

Whether an automatic EAP helper can be used in conjunction with a specific authentication method depends on what types of credentials the authentication method supports.

The automatic EAP helper that implements EAP MD5-Challenge generates CHAP credentials, while the helper that implements LEAP generates MS-CHAP-v1 credentials. As such, EAP MD5-Challenge can be used only with

authentication methods that support CHAP, and LEAP can be used only with authentication methods that support MS-CHAP-v1.

Table 29 summarizes the support for MS-CHAP-v1 and CHAP in the Steel-Belted Radius authentication methods.

Table 29: MS-CHAP-v1 and CHAP Support

Authentication Method	MS-CHAP-V1	CHAP
LDAP	Yes for BindName (password must be stored in the clear or encrypted using enc-md5 in LDAP server), No for Bind	Yes for BindName (password must be stored in the clear or encrypted using enc-md5 in LDAP server), No for Bind
Local	Yes	Yes
Proxy RADIUS	Yes	Yes
SecurID	No	No
SQL	Yes if password is in clear or encrypted using enc-md5 in SQL database	Yes if password is in clear or encrypted using enc- md5 in SQL database
TACACS+	No	Yes
UNIX User	No	No
UNIX Group	No	No
Windows Domain User	Yes (server must be running under SYSTEM account)	No
Windows Domain Group	Yes (server must be running under SYSTEM account)	No

Authentication Request Routing


The order in which authentication methods and automatic EAP helpers are called to handle an authentication request depends on two factors:

- The ordered list of enabled authentication methods (viewable in the Authentication Policies panel in SBR Administrator). See [“Activating EAP Methods”](#) for information on using the Authentication Policies panel.
- The EAP-related configuration for each of the enabled authentication methods in the eap.ini file, which you configure from the Authentication Policies panel.

When Steel-Belted Radius receives an authentication request that does not contain EAP credentials, it passes the request to each enabled authentication method until one of the methods claims the request. The EAP settings in the eap.ini file come into play only when a request with EAP credentials is received. An authentication request contains EAP credentials if it includes one or more EAP-Message attributes and contains no other form of user credentials (for example, User-Password).

EAP-Only Setting

When an authentication method's EAP-Only setting is 1, Steel-Belted Radius prevents the authentication method from being called for any request that does not contain EAP credentials. Under this setting, the authentication method is also bypassed if an authentication request specifically requests an EAP protocol that is not listed in the authentication method's EAP-Type list in the eap.ini file.

 **Note:** The PEAP authentication method plug-in converts the inner EAP/Generic Token credentials to PAP for security reasons. If you are using SecurID with PEAP, you should set the EAP-Only setting to 0.

First-Handle-Via-Auto-EAP Setting

If your configuration involves clients using more than one EAP protocol, Steel-Belted Radius must select an initial EAP protocol with which to proceed when receiving an authentication request with EAP credentials.

Selecting the incorrect EAP protocol is not fatal; the client simply sends an EAP NAK in response to the server's selected protocol and suggests an alternate one. After one additional network round-trip, the correct EAP protocol becomes active.

Depending on the capabilities of the authentication methods being used, you might be able to cut out this additional network round-trip that affects a portion of your EAP-based authentication requests.

If an authentication method can check for the existence of a user and can retrieve the user's password information with only the information available in the authentication request (for example, the username), it is said to be prefetch-capable. A prefetch-capable authentication method could be consulted first to see if a user exists in its database before committing to a specific EAP protocol.

If your authentication method is prefetch-capable, you would set First-Handle-Via-Auto-EAP to 0, indicating that the authentication method should have the first chance to handle the request. You would also set First-Handle-Via-Auto-EAP to 0 if the authentication method is capable of handling EAP credentials all on its own (clearly, it would not expect an automatic helper EAP method to do work on its behalf in this case).

By configuring the authentication method to be called first, Steel-Belted Radius can delay selection of an EAP protocol until it has ascertained whether the user exists in a particular authentication method's database. This is a useful technique when you plan to use more than one EAP protocol, but you do not know which one the client will want. Even in this scenario, automatic EAP helpers can still end up performing the EAP protocol processing; they will take over after the authentication method has retrieved a user's password information, rather than before.

The goal of an automatic EAP helper is to generate credentials against which traditional authentication methods (ones that do not understand EAP) can operate. Once an automatic EAP helper has generated these credentials, the authentication method that triggered the use of the helper is checked first for a password/credential match. Should this match not be present, the same traditional credentials are passed to all remaining enabled authentication methods in the master list (in the order in which they appear in the list).

Table 30: Authentication Method Prefetch Capability

Authentication Method	Prefetch Capable?
LDAP	Yes, if using BindName (rather than the Bind option)
Native User	Yes

Authentication Method	Prefetch Capable?
SQL	Yes, if password does not need to be used as an input parameter in the SQL statement
UNIX User	No
Windows Domain	No

Note: If you enable the lockout facility in Steel-Belted Radius and you use a tunneled authentication method (TTLS or PEAP) with a prefetch-capable method (native user, SQL, or LDAP) and an enabled EAP protocol (MS-CHAPv2, MD5-Challenge, LEAP, TLS), then you must enable First Handle via Auto- EAP in that prefetch-capable method to prevent the outer username (anonymous) from being added to the lockout list.

Otherwise, when Steel-Belted Radius receives an authentication request that uses an unconfigured EAP method, Steel-Belted Radius will reject the user (because the EAP method is not configured) and add the outer username (anonymous) to its lockout list. This will result in all users with an outer authentication name of anonymous being rejected until the lockout period expires.

EAP-NAK Notifications

If you are supporting only one type of client or only one EAP protocol, Steel-Belted Radius selects that EAP protocol for all EAP-based authentication requests it receives. If you are planning to support multiple EAP protocols and do not intend to maintain databases that track the appropriate EAP protocol on a user-by-user basis, Steel-Belted Radius automatically selects the appropriate EAP protocol for you.

When multiple EAP protocols are in play, you should configure each authentication method you plan to use with all the EAP protocols that can be used with it. In this configuration, when Steel-Belted Radius receives an authentication request containing EAP information, it chooses the first EAP protocol listed for the first authentication method that claims the request. Should the client require a different EAP protocol, it sends back an EAP-NAK that specifies the EAP protocol it would prefer to use.

After receiving an EAP-NAK, Steel-Belted Radius performs a scan of the authentication methods to find the first authentication method that has the requested EAP protocol listed (the authentication method might support this EAP protocol directly or with the help of an automatic EAP helper).

If the requested EAP protocol does not appear in any of the authentication methods' lists of supported EAP protocols, Steel-Belted Radius rejects the authentication request.

Reauthenticating Connections

Most Access Points understand only a limited number of attributes that can be included in a RADIUS response to signal that the user has been accepted. The Session-Timeout attribute is of particular significance in a WLAN realm as it instructs the Access Point how long to allow the user to remain connected to a WLAN before having to re-authenticate to Steel-Belted Radius.

You can configure your choice of Session-Timeout settings using standard Steel-Belted Radius reply-list items on a user-by-user basis. If you are using EAP-TLS or EAP-TTLS to authenticate users, you can also have these modules automatically generate Session-Timeout attributes based on policies set in their configuration files. This level of control is necessary for EAP-TLS and EAP-TTLS as these modules also support session resumption, a quicker method of re-authenticating users. The value in the Session-Timeout attribute might need to be

dynamically calculated in these cases.

Note: Not all Access Points support the Session-Timeout attribute. You should check your Access Points' specifications to determine whether this configuration must be performed in a fixed manner on the Access Point or if the Access Point should defer to the server.

Certificates

A certificate is an electronic data structure used to identify an individual, a server, a company, or some other entity, and to associate that identity with a public key and an associated private key. Like a passport, a certificate provides generally recognized proof of an entity's identity. Certificates bind public key values to entities, so that remote users of an entity's public key can be certain the associated private key is owned by the correct person or system. Certificates help prevent the use of fake public keys for impersonation. Only the public key certified by the certificate will work with the corresponding private key possessed by the entity identified by the certificate. The most widely accepted format for certificates is defined by the ITU-T X.509 international standard, which is described in RFC 3280, "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile."

Certificate authorities (CAs) are entities that validate identities and issue certificates. An organization that wants to serve as its own CA can issue its own certificates, or an organization can purchase certificates from a trusted third-party CA. The methods used to validate an identity vary depending on the policies of a given CA. In general, before issuing a certificate, a CA must verify the identity of the entity and must digitally sign the certificate to ensure it cannot be modified. This ensures that a certificate issued by a CA binds a particular public key to the name of the entity the certificate identifies (such as the name of an employee).

In addition to a public key, a certificate includes the name of the entity it identifies, an expiration date, the name and URI of the CA that issued the certificate, a serial number, and the digital signature of the issuing CA, which creates a mathematical relationship between the signing CA certificate's public key and the public key of the certificate it signs. The CA's digital signature allows the certificate to function as a "letter of introduction" for users who know and trust the CA but don't know the entity identified by the certificate.

Because a certificate's expiration date is part of its signed contents, remote entities can verify that a certificate is valid and current.

Common types of certificates include the following:

- Certificate Authority certificates can sign other certificates.
- Server certificates are used on a server to enable a software client to verify the validity of the connection to a machine ("Am I really connecting to www.pulsesecure.net?) and to create an encrypted channel between a client and a server.
- Client certificates are used to allow a server to verify a client's identity (certificate based authentication) and to allow a user to digitally sign or encrypt data. Client certificates, which is digitally signed by a trusted certificate authority, is stronger proof of a client's identity than username/password credentials alone.

Certificate Chains

A certificate chain is a sequence of certificates, where each certificate in the chain is signed by the certificate above it in the chain. At the top of the chain is a self-signed certificate. Each CA in the chain vouches for the identity in the entity to which it issues a signed digital certificate. Certificate chains establish a chain of trust; if you trust the CA at the top of the chain, this implies you can trust the signed certificates below it in the chain.

Certificate Revocation Lists

Under normal circumstances, a certificate remains valid until it reaches its expiration date. However, a certificate might become invalid before it expires. For example, if an employee whose identity is bound to a certificate terminates employment or if an enterprise suspects the confidentiality of the private key associated with a certificate's public key has been compromised, the certificate might be declared invalid and revoked before its expiration date.

When a CA revokes a certificate, it must let other entities know the certificate is no longer valid and should not be accepted. A certificate revocation list (CRL) is a signed data structure that identifies the serial numbers of certificates that have been issued and subsequently revoked by the CA. When a remote entity is asked to use a certificate to verify a remote user's identity, it can download a current copy of the applicable CRL from a CRL distribution point (CDP) and confirm that the certificate's serial number is not present. If a CRL has expired, the entity must connect to the CDP to download a new revocation list.

CRLs can be issued by a CA periodically (hourly, daily, or weekly) or as needed. When a certificate is revoked, its serial number is listed in the CRL, and that serial number remains in the CRL at least one period after the certificate's expiration date. CRLs, like certificates, can be distributed by untrusted servers and untrusted communications.

Under some circumstances, latency (the time between when a certificate is revoked and when the certificate's serial number appears on the CRL of the issuing CA) might be a concern. For example, if a revocation is reported today, that revocation will not be reliably notified to certificate-using systems until all currently issued CRLs are updated, which might take hours, days, or even weeks. Online revocation checking can reduce the latency between a revocation report and the distribution of the information to relying parties.

If CRL checking is enabled, Steel-Belted Radius uses the URI information contained in a client certificate to connect to the certificate's CDP. Steel-Belted Radius then uses HTTP, LDAP, or a network file system to retrieve the appropriate CRLs. Steel-Belted Radius stores these retrieved CRLs in the CRLCache directory under the radiusdir server directory.

When a client certificate is presented during EAP-TLS or EAP-TTLS authentication, Steel-Belted Radius can evaluate the client's certificate chain against its set of stored CRLs to verify none of the certificates in the chain have been revoked.

You can configure the following settings for CRL checking:

- Static CDPs—A static CDP is a CDP whose address (URI) is specified in the [Static_CDPs] section of a TLS or TTLS initialization file.
- CRL expiration—The CRL checking feature can be configured to operate in strict or lax mode.
 - In strict mode, a cached CRL that has expired will be immediately discarded; if Steel-Belted Radius cannot acquire a new CRL in the allotted time during a CRL check on a chain, the user is rejected.
 - In lax mode, you can configure Steel-Belted Radius to accept an expired CRL for a period past its expiration. Note that Steel-Belted Radius attempts to obtain a current CRL whether it is running in strict or lax mode.
- Missing CDP attribute—When a CRL check is performed on a certificate chain, Steel-Belted Radius reads the contents of the CDP attribute for each certificate past the root certificate and uses the CDP information to retrieve the appropriate CRL. If a non-root certificate in the chain does not contain a CDP attribute, no CRL checking will be performed for that certificate. You can configure EAP-TLS to reject the user if it encounters a non-root certificate that is missing a CDP attribute.

- Incomplete LDAP CDP—Some CAs can create certificates that contain an LDAP-style CDP (`//ldap:\...`) that does not specify the identity of the LDAP server to be queried. You can designate a default LDAP server that will be used when such CDPs are encountered. If you do not designate a default LDAP server and an LDAP-style CDP is encountered, the CRL retrieval will fail.
- HTTP proxies for CRL checking—Network security policy may prevent Steel-Belted Radius from making a direct HTTP connection to a CDP. In such cases, you can configure Steel-Belted Radius to download CRLs through an HTTP proxy server on its local network. Optionally, you can specify the hosts or domains that do not require an HTTP proxy.
- CRL cache flushing—You can flush the CRL caches used for EAP-TLS and EAP-TTLS authentication at any time.

EAP-TLS

The EAP-TLS (Transport Layer Security) protocol requires that both user and authentication server have certificates for mutual authentication. While the mechanism is very strong, it requires that the corporation that deploys it maintain a certificate infrastructure for all of its users.

EAP-TLS can be deployed as an authentication method or as an automatic EAP helper.

- When EAP-TLS is deployed as an authentication method, EAP-TLS appears in the Authentication Policies panel in SBR Administrator after it is deployed as an authentication method. You can use the Authentication Policies panel to enable the EAP-TLS method and specify its sequence relative to other authentication methods Steel-Belted Radius uses.

When EAP-TLS is deployed as an authentication method, you can configure it to perform certificate revocation list (CRL) checking. When CRL checking is enabled, EAP-TLS confirms that the client's certificate chain traces back to one of the trusted root certificates installed at initialization and checks the serial number of each certificate in the chain against the contents of CRLs to verify that none of the certificates in the chain have been revoked.

You can configure the `tlsauth.aut` file to call a fixed profile when TLS-EAP is used. This profile specifies the attributes that are sent back in response to a successful authentication.

You cannot use secondary authorization when EAP-TLS is deployed as an authentication method.

- When EAP-TLS is deployed as an automatic EAP helper, you must list TLS in the EAP-Type list of an authentication method. When EAP-TLS is triggered, the `tlsauth` authentication goes through the TLS handshake required by the EAP-TLS specification. Assuming the user provides a certificate that the server can verify against a list of trusted root certificates, the EAP-TLS part of the exchange concludes successfully.

You might not want to grant access to your network to every user with a trusted certificate. By enabling the optional secondary authorization feature of the `tlsauth` plugin, you can have Steel-Belted Radius authorize users with valid certificates on a case-by-case basis. Secondary authorization also allows you to include user-specific attributes in an Access-Accept response; these attributes can be used to communicate options that are to be active for a user's connection to the NAD. Without secondary authorization, the only attributes returned on an Access-Accept are those generated by the `tlsauth` plug-in itself (termination-action and session-limit).

If you enable the TLS authentication method, secondary authorizations must be performed by local authentication methods (they cannot be proxied). The authentication method you select for secondary authorizations must be able to authenticate users in a single pass; it cannot challenge the

authorization request and request additional information. The username employed during secondary authorization is derived from a field in the user's certificate. Since a user's certificate does not include a password, you must configure `tlsauth` to make the secondary authorization request with no password or with a fixed password.

If you configure secondary authorization with no password, your selected authentication method must be capable of handling requests that do not include passwords; the only authentication methods that support this style of authentication and ship with Steel-Belted Radius are Native User, LDAP and SQL. If you configure secondary authorization with a fixed password, you can use any authentication method that supports PAP authentication. In this configuration all user records must have the same fixed password.

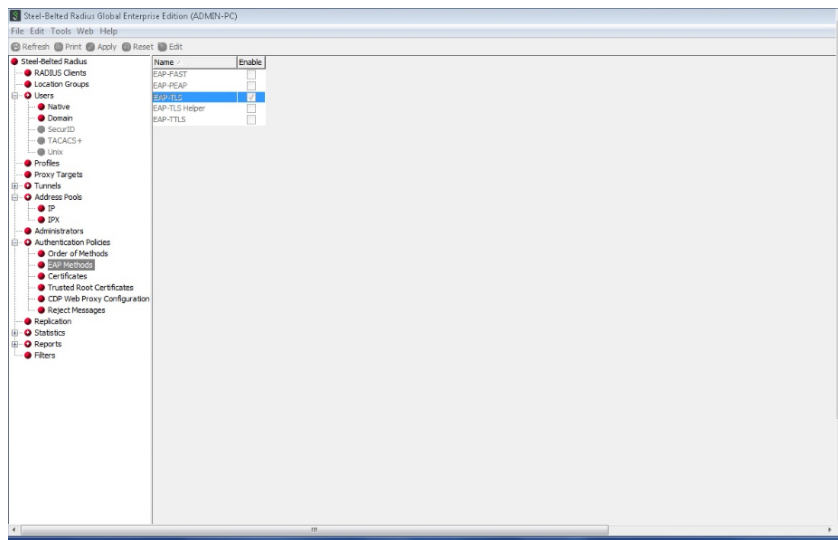
Configuring EAP-TLS as an Authentication Method

Note: You must configure the server certificate for the Steel-Belted Radius server before you use the EAP-TLS authentication method. For information on configuring your server certificate, see [“Configuring Server Certificates”](#).

To configure EAP-TLS as an authentication method:

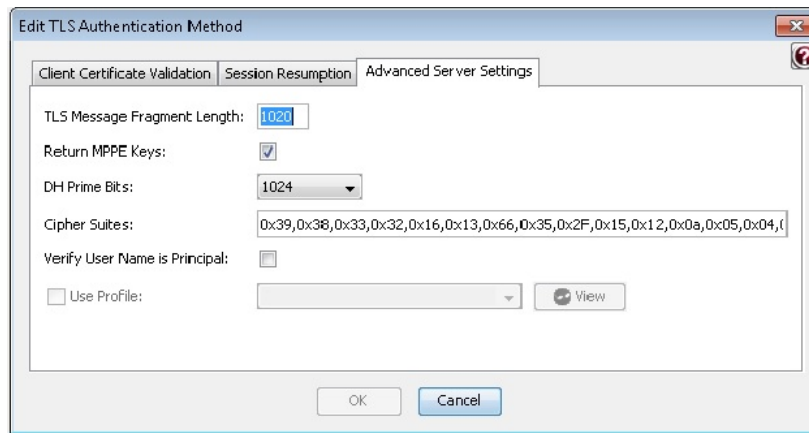
1. Select Authentication Policies > EAP Methods to open the EAP Methods panel.

Figure 120: EAP Methods Panel



2. Click the **Enable** check box for the EAP-TLS authentication method.
3. Select the **EAP-TLS** entry and click the **Edit** button on the toolbar (or double-click the **EAP-TLS** entry).

The Edit TLS Authentication Method dialog opens.

Figure 121: Edit TLS Authentication Method dialog

4. Use the tabs in the Edit TLS Authentication Method dialog to configure the following settings:

- Client certificate validation
- Session resumption
- Advanced server settings

Each configuration task is described separately below.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the EAP-TLS protocol:

1. Click the **Client Certificate Validation** tab in the Edit TLS Authentication Method dialog.
2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. Enter the number of seconds that EAP-TLS will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

4. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

EAP-TLS always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), EAP-TLS does not accept a CRL that has expired.
 - If you enter a value greater than 0 (lax expiration mode), EAP-TLS considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.
5. Click the Allow Missing CDP Attribute check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, EAP-TLS will not know how to retrieve a CRL and will not be able to perform

a revocation check on the certificate.

If you click the Allow Missing CDP Attribute check box, EAP-TLS allows such certificates and skips CRL checking for them.

If you clear the Allow Missing CDP Attribute check box, EAP-TLS does not accept a CRL with a missing CDP attribute.

6. If you want to specify a CRL cache timeout period, click the CRL Cache Timeout Period check box and enter the number of hours in the timeout period in the hours field.
 - If you do not enable this setting, the CRL will be refreshed whenever it expires.
 - If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
 - If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

7. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the Default LDAP Server Name field.


CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

8. If your enterprise uses Active Directory and you want client certificates published to user accounts, click the Verify that Client Certificates are published to user accounts check box.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the EAP-TLS protocol:

1. Click the **Session Resumption** tab in the Edit TLS Authentication Method dialog.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the Termination Action field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the Resumption Limit field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and might not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-TLS protocol:

1. Click the Advanced Server Settings tab in the Edit TLS Authentication Method dialog.
2. Enter the maximum length of the TLS message that might be generated during each iteration of the TLS exchange, in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round trips required to conclude the TLS exchange. A value of 1400 might result in 6 round-trips, while a value of 500 might result in 15 round trips.

Some Access Points might have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enable the **Return MPPE Keys** check box to specify whether the TLS authentication method includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

4. Use the **DH Prime Bits** list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

- Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

- Optionally, enable the **Verify User Name is Principal** check box if you want Steel-Belted Radius to verify that the contents of the RADIUS User-Name attribute match the Principal Name of the certificate used to authenticate the user.

Certificates issued by Microsoft's Windows 2000 Certificate Server typically include a Subject Alternative Name/Other Name attribute, where Principal Name set to something like **user@certtest.acme.com**.

The Windows XP client that supports EAP-TLS in conjunction with 802.1X extracts this attribute value from the client's certificate and uses it to respond to the Access Point's EAP Identity Request. The Access Point, in turn, packages up this value as the RADIUS User-Name attribute in requests it sends to a RADIUS server.

You should clear (disable) the check box if the certificates used do not include a Principal Name or if the client being used does not report the contents of Principal Name as the user's identity in response to an EAP Identity Request.

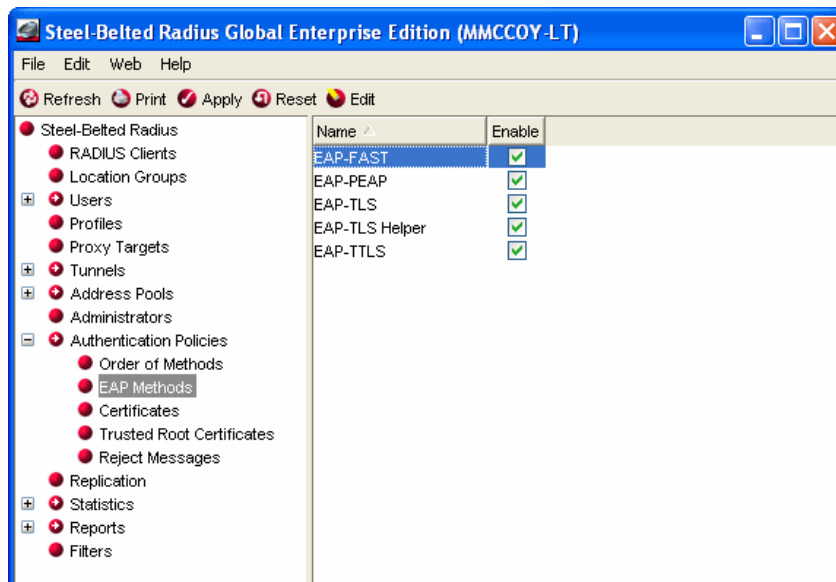
Configuring EAP-TLS as an Automatic EAP Helper

Note: You must configure the server certificate for the Steel-Belted Radius server before you use the TLS EAP helper. For information on configuring your server certificate, see "[Configuring Server Certificates](#)".

To configure EAP-TLS as an EAP helper:

- Select Authentication Policies > EAP Methods to open the EAP Methods panel (Figure 122).

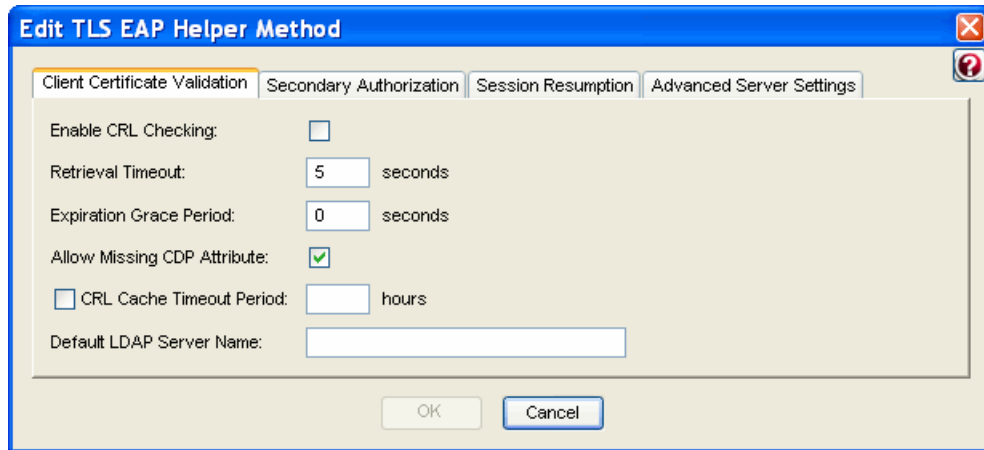
Figure 122: EAP Methods Panel



2. Click the Enable check box for the EAP-TLS Helper method.
3. Select the EAP-TLS Helper entry and click the Edit button on the toolbar (or double-click the EAP-TLS Helper entry).

The Edit TLS EAP Helper Method dialog opens.

Figure 123: Edit TLS EAP Helper Method dialog



4. Use the tabs in the Edit TLS EAP Helper Method dialog to configure the following settings:
 - Client certificate validation
 - Secondary authorization
 - Session resumption
 - Advanced server settings

Each configuration task is described separately below.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Client Certificate Validation** tab in the Edit TLS EAP Helper Method dialog.
2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. Enter the number of seconds that the TLS EAP helper will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

4. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

The TLS EAP helper always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), the TLS EAP helper does not accept a CRL that has expired.
 - If you enter a value greater than 0 (lax expiration mode), the TLS EAP helper considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.
5. Click the **Allow Missing CDP Attribute** check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, the TLS EAP helper will not know how to retrieve a CRL and will not be able to perform a revocation check on the certificate.

If you click the **Allow Missing CDP Attribute** check box, the TLS EAP helper allows such certificates and skips CRL checking for them.

If you clear the **Allow Missing CDP Attribute** check box, the TLS EAP helper does not accept a CRL with a missing CDP attribute.

6. If you want to specify a CRL cache timeout period, click the **CRL Cache Timeout Period** check box and enter the number of hours in the timeout period in the **hours** field.
 - If you do not enable this setting, the CRL will be refreshed whenever it expires.
 - If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
 - If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

7. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the **Default LDAP Server Name** field.

CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

Configuring Secondary Authentication

Secondary authorization settings let you specify whether secondary authorization is performed and, if it is, what information is used in the secondary authorization request.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Secondary Authorization** tab in the Edit TLS EAP Helper Method dialog.
2. Click the **Enable Secondary Authorization** check box to enable secondary authorization checking.

If secondary authorization is disabled, the EAP-TLS plug-in accepts the user upon proof of ownership of a private key that matches a valid certificate.

If secondary authorization is enabled, a secondary authorization check against a traditional

authentication method such as an SQL plug-in is performed.

3. Specify whether you want user names to be converted to Subject CN names or principal names.

After the EAP-TLS module has concluded its processing, it might still defer to a traditional authentication method (core or plug-in) for final authorization. To do so, it must provide a user name and password to the traditional authentication method.

- If you click the **Subject CN** option button, the EAP-TLS module parses the Subject attribute of the client's certificate for the least significant 'CN=' and takes the value of this attribute (for example, 'George Washington') as the user name being passed to the traditional authentication method.
 - If you click the **Principal Name** option button, the EAP-TLS module uses the principal name (Subject Alternate Name or Other Name) from the client certificate (for example, joe@acme.com) as the user name being passed to the traditional authentication method.
4. If you plan to use secondary authorization against an authentication method (for example, LDAP) that cannot be configured to ignore the lack of user credentials, specify a fixed password that the plug-in uses on all secondary authorization checks in the **Fixed Password** field.

By default, the secondary authorization check includes a user name but no other user credentials, because no password or similar credential for the client is available at the conclusion of the TLS handshake. Some authentication methods (Native User, LDAP, and SQL) can be configured to not require user credentials.

5. If you want the EAP-TLS plug-in to add four attributes to the request before the secondary authorization check is performed, click the Include Certificate Info check box.

When the Include Certificate Info check box is clicked, Steel-Belted Radius adds the following attributes to the request:

- The Funk-Peer-Cert-Subject attribute contains the value of the Subject attribute in the client certificate.
- The Funk-Peer-Cert-Principal attribute contains the value of the principal name (Subject Alternate Name or Other Name) attribute of the client certificate.
- The Funk-Peer-Cert-Issuer attribute contains the value of the Issuer attribute in the client certificate.
- The Funk-Peer-Cert-Hash attribute contains a hexadecimal ASCII representation of the SHA1 hash of the client certificate.

These attributes are ignored if the authentication method that performs the authentication check does not use them.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Session Resumption** tab in the Edit TLS EAP Helper Method dialog.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the Termination Action field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the TLS EAP helper protocol:

1. Click the **Advanced Server Settings** tab in the Edit TLS EAP Helper Method dialog.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter the maximum number of seconds you want to allow for the EAP authentication sequence in the **Max Transaction Time** field.

If the EAP authentication sequence takes longer than the number of seconds specified in this field, Steel-Belted Radius terminates the user authentication.

4. Enable the **Return MPPE Keys** check box to specify whether the TLS EAP helper includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the **DH Prime Bits** list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

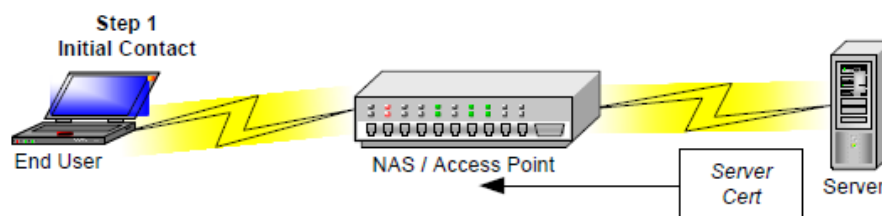
Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

EAP-TTLS

EAP-TTLS (Tunneled Transport Layer Security) is designed to provide authentication that is as strong as EAP-TLS, but it does not require that each user be issued a certificate. Instead, only the authentication servers are issued certificates. User authentication is performed by password; but the password credentials are transported in a securely encrypted "tunnel" established based upon the server certificates.

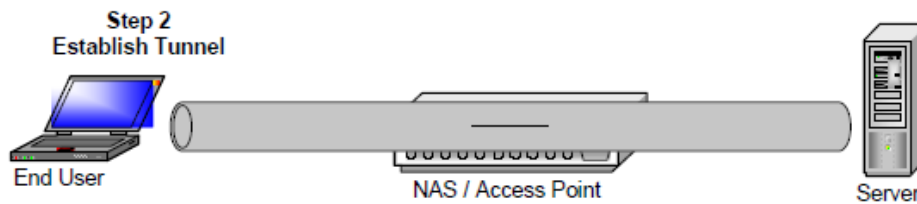
1. After the authentication server determines that the user has made an authentication request, it sends its certificate to the user's system.

Figure 124: Server Certificate Sent to RAS



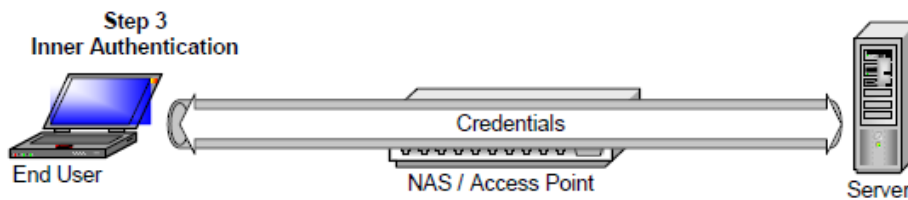
2. The authentication server's certificate is used to establish a tunnel between the user and the server.

Figure 125: Tunnel Established



- Once the tunnel is established, credentials can be exchanged safely between the server and the user since tunnels encrypt all data in a secure fashion. This stage is called *inner authentication*.

Figure 126: Inner Authentication



With EAP-TTLS, it is not necessary to create a new infrastructure of user certificates. User authentication is performed against the same security database that is already in use on the corporate LAN; for example, Windows Domain Controllers, SQL or LDAP databases, or token systems.

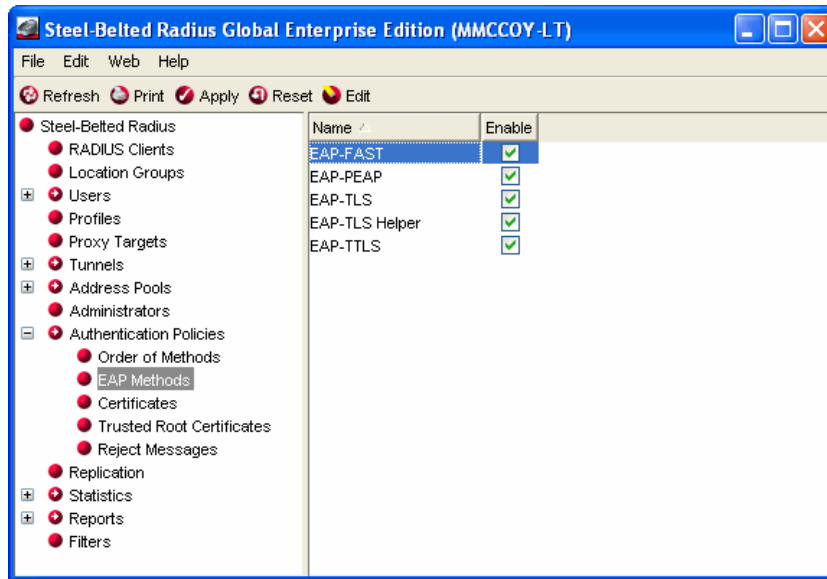
The routing of the inner authentication request can be handled either by means of standard Steel-Belted Radius authentication request routing or by means of a directed realm. If your EAP-TTLS tunnel ends at a dedicated server and all the inner authentication requests are to be performed by other servers, you should use standard request routing so the proxy realm target can be determined in a standard fashion (that is, the decoration of the username revealed by inner authentication). If your EAP-TTLS tunnel and inner authentication are handled by the same server, you can use a directed realm to specify which authentication method(s) handle the inner authentication.

Configuring EAP-TTLS

To configure EAP-TTLS as an authentication method:

- Select **Authentication Policies > EAP Methods** to open the EAP Methods panel.

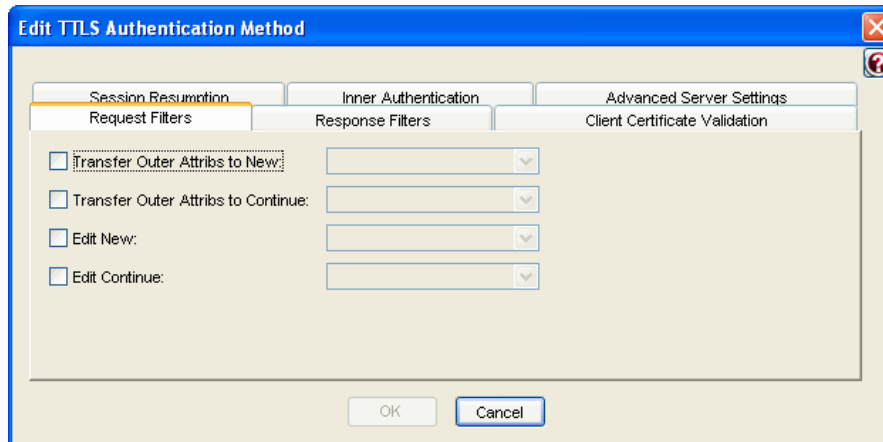
Figure 127: EAP Methods Panel



2. Click the **Enable** check box for the EAP-TTLS method.
3. Select the EAP-TTLS entry and click the **Edit** button on the toolbar (or double-click the EAP-TTLS entry).

The Edit TTLS Authentication Method dialog opens.

Figure 128: Edit TTLS Authentication Method dialog



Use the tabs in the Edit TTLS Authentication Method dialog to configure the following settings:

- Request filters
- Response filters
- Client certificate validation
- Session resumption
- Inner authentication
- Advanced server settings

Each configuration task is described separately below.

Configuring Request Filters

Request filters affect the attributes of inner authentication requests. By default, Steel-Belted Radius does not use request filters.

To configure request filtering for the EAP-TTLS protocol:

1. Click the **Request Filters** tab in the Edit TTLS Authentication method dialog.
2. Optionally, click the **Transfer Outer Attribs to New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests).

- If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

- If this filter is not specified, no attributes from the outer request are transferred to the inner request.

3. Optionally, click the **Transfer Outer Attribs to Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

4. Optionally, click the **Edit New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 2) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

5. Optionally, click the **Edit Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than a new inner authentication request). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 3) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

Configuring Response Filters

Response filters affect the attributes in the final response (Access-Accept or Access-Reject) returned to the originating NAD. By default, Steel-Belted Radius does not use response filters.

To configure response filtering for the EAP-TTLS protocol:

1. Click the **Response Filters** tab in the Edit TTLS Authentication method dialog.
2. Optionally, click the **Transfer Inner Attrs to Accept** check box and select the filter you want to use from the dropdown list.

This filter affects only an outer Access-Accept response that is sent back to a network access device.

- If this filter is specified, the filter is applied to the inner authentication response and all resulting attributes are transferred to the outer authentication response.
- If this filter is not specified, no inner authentication response attributes are transferred to the outer authentication response.

3. Optionally, click the **Transfer Inner Attrs to Reject** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the EAP-TTLS protocol:

1. Click the **Client Certificate Validation** tab in the Edit TTLS Authentication Method dialog.
2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. If you want to require that the client must provide a certificate as part of the TTLS exchange, click the **Require Client Certificate** check box.
4. Enter the number of seconds that EAP-TTLS will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

5. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

EAP-TTLS always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), EAP-TTLS does not accept a CRL that has expired.
 - If you enter a value greater than 0 (lax expiration mode), EAP-TTLS considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.
6. Click the **Allow Missing CDP Attribute** check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, EAP-TTLS will not know how to retrieve a CRL and will not be able to perform a revocation check on the certificate.

- If you click the **Allow Missing CDP Attribute** check box, EAP-TTLS allows such certificates and skips CRL checking for them.
 - If you clear the **Allow Missing CDP Attribute** check box, EAP-TTLS does not accept a CRL with a missing CDP attribute.
7. If you want to specify a CRL cache timeout period, click the **CRL Cache Timeout** Period check box and enter the number of hours in the timeout period in the **hours** field.
- If you do not enable this setting, the CRL will be refreshed whenever it expires.
 - If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
 - If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

8. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the Default LDAP Server Name field.

CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the EAP-TTLS protocol:

1. Click the Session Resumption tab in the Edit TTLS Authentication Method dialog.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.
 - If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.
 - If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and

computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the **Termination Action** field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Inner Authentication Settings

The inner authentication settings let you specify the way in which the inner authentication step is to operate.

To configure inner authentication settings for the EAP-TTLS protocol:

1. Click the **Inner Authentication** tab in the Edit TTLS Authentication Method dialog.
2. If you want requests to be routed based on the methods listed in the directed realm, enter the name of a directed realm in the **Directed Realm** field.

Omitting this setting causes the inner authentication request to be handled like any other request received from a network access device.

3. If you want requests to be processed by means of a realm selection script, enter the name of a script in the **Realm Selection Script** field.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-TTLS protocol:

1. Click the Advanced Server Settings tab in the Edit TTLS Authentication Method dialog.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the

size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter the maximum number of seconds you want to allow for the EAP authentication sequence in the **Max Transaction Time** field.

If the EAP authentication sequence takes longer than the number of seconds specified in this field, Steel-Belted Radius terminates the user authentication.

4. Enable the **Return MPPE Keys** check box to specify whether the TTLS authentication method includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the DH Prime Bits list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the Cipher Suites field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

EAP-PEAP

The EAP-PEAP (Protected EAP) protocol is similar to EAP-TTLS. Unlike EAP-TTLS, which can tunnel any kind of authentication request (such as PAP or CHAP) and extended attributes, PEAP can tunnel only other EAP protocols inside its connection.

EAP-PEAP works in two phases:

- In Phase 1, the client authenticates the server and uses a TLS handshake to create an encrypted tunnel.
- In Phase 2, the server authenticates the user or machine credentials using an EAP authentication protocol. The EAP authentication is protected by the encrypted tunnel created in Phase 1. The authentication type negotiated during Phase 2 can be any valid EAP type, such as GTC (Generic Token Card) or MS-CHAPv2.

Microsoft's implementation of PEAP and Cisco's implementation of PEAP supports different methods of client authentication through the TLS tunnel.

- The Microsoft PEAP implementation requires MS-CHAP-V2 for client authentication.
- The Cisco PEAP implementation supports client authentication by EAP-Generic Token, which Cisco uses both for authenticating token cards and for authenticating users against Windows domain/

Active Directory accounts.

The Cisco PEAP implementation supports the ability to hide username identities until the TLS encrypted tunnel is established and authentication phase is complete. The Microsoft PEAP implementation sends the username in clear text in Phase 1 of PEAP authentication.

Steel-Belted Radius supports both Microsoft PEAP and Cisco PEAP.

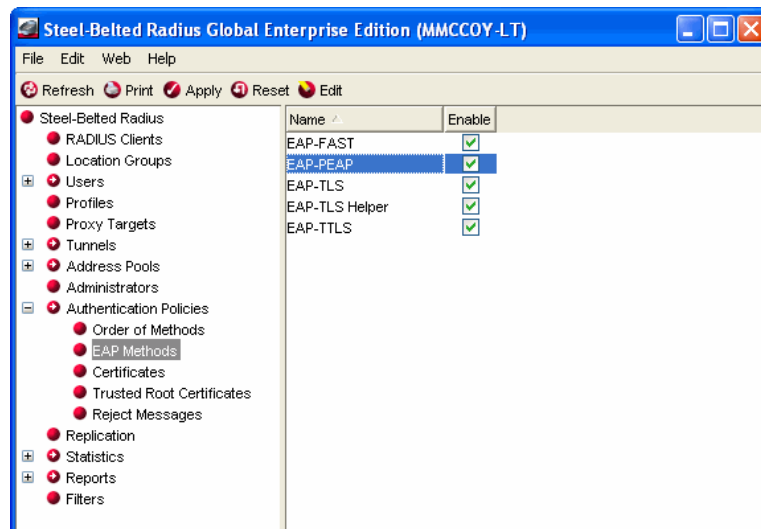
Configuring EAP-PEAP

Note: You must configure the server certificate for the Steel-Belted Radius server before you use the EAP-PEAP authentication method. For information on configuring your server certificate, see [“Configuring Server Certificates”](#).

To configure EAP-PEAP on a Steel-Belted Radius server:

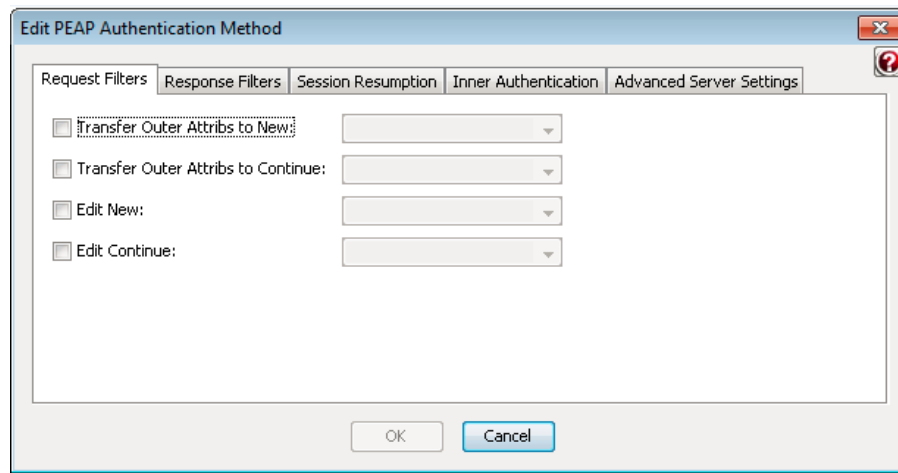
1. Select **Authentication Policies > EAP Methods** to open the EAP Methods panel.

Figure 129: EAP Methods Panel



2. Click the **Enable** check box for the EAP-PEAP authentication method.
3. Select the EAP-PEAP entry and click the **Edit** button on the toolbar (or double-click the EAP-PEAP entry).
The Edit PEAP Authentication Method dialog opens.

Figure 130: Edit PEAP Authentication Method dialog



4. Use the tabs in the Edit PEAP Authentication Method dialog to configure the following settings:

- Request filters
- Response filters
- Session resumption
- Inner authentication
- Advanced server settings

Each configuration task is described separately below.

Configuring Request Filters

Request filters affect the attributes of inner authentication requests. By default, Steel-Belted Radius does not use request filters.

Note: You must configure filters using the Filters panel before you can associate them with the EAP- PEAP authentication method. For information on configuring filters, see “[Setting Up Filters](#)”.

To configure request filtering for the EAP-PEAP protocol:

1. Click the **Request Filters** tab in the Edit PEAP Authentication method dialog.
2. Optionally, click the **Transfer Outer Attribs to New check** box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests).

- If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.
- If this filter is not specified, no attributes from the outer request are transferred to the inner request.

3. Optionally, click the **Transfer Outer Attrs to Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

4. Optionally, click the **Edit New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 2) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

5. Optionally, click the **Edit Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than a new inner authentication request). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 3) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

Configuring Response Filters

Response filters affect the attributes in the final response (Access-Accept or Access-Reject) returned to the originating NAD. By default, Steel-Belted Radius does not use response filters.

To configure response filtering for the EAP-PEAP protocol:

1. Click the **Response Filters** tab in the Edit PEAP Authentication method dialog.
2. Optionally, click the **Transfer Inner Attrs to Accept** check box and select the filter you want to use from the dropdown list.

This filter affects only an outer Access-Accept response that is sent back to a network access device.

- If this filter is specified, the filter is applied to the inner authentication response and all resulting attributes are transferred to the outer authentication response.
 - If this filter is not specified, no inner authentication response attributes are transferred to the outer authentication response.

3. Optionally, click the **Transfer Inner Attrs to Reject** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to re-authenticate after the session timer has expired.

To configure session resumption for the EAP-PEAP protocol:

1. Click the **Session Resumption** tab in the Edit PEAP Authentication method dialog.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the **Termination Action** field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Inner Authentication Settings

Inner authentication settings let you specify the manner in which the inner authentication step operates. To configure inner authentication settings for the EAP-PEAP protocol:

1. Click the **Inner Authentication** tab in the Edit PEAP Authentication method dialog.
2. Optionally, enter the name of a directed realm in the **Directed Realm** field.

Specifying the name of a directed realm causes the request to be routed based on the methods listed in the directed realm. Omitting this setting causes the inner authentication request to be handled like any other request received from a network access device.

3. Optionally, enter the name of a realm selection script in the **Realm Selection Script** field.

You must license the Steel-Belted Radius scripting module to use realm selection scripts. For information on the Steel-Belted Radius scripting module, refer to the Steel-Belted Radius Scripting Guide.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-PEAP protocol:

1. Click the Advanced Server Settings tab in the Edit PEAP Authentication method dialog.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter xxx in the **Max Transaction** Time field.
4. Enable the **Return MPPE Keys** check box to specify whether the EAP-PEAP module includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the DH Prime Bits list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

7. Enter the minimum version of the PEAP protocol that the server should negotiate in the **PEAP Minimum Version** field.

If you enter 0, the server negotiates version 0, which is compatible with Microsoft's initial PEAP implementation (shipped in Microsoft XP Service Pack 1).

If you enter 1, the server negotiates version 1, which is compatible with Cisco's initial PEAP implementation (shipped in Cisco ACU).

Note: The value entered in this setting must be less than or equal to the value entered for the PEAP Maximum Version field.

8. Enter the maximum version of the PEAP protocol that the server should negotiate in the PEAP Maximum Version field.

If you enter 0, the server negotiates version 0, which is compatible with Microsoft's initial PEAP implementation (shipped in Microsoft XP Service Pack 1).

If you enter 1, the server negotiates version 1, which is compatible with Cisco's initial PEAP implementation (shipped in Cisco ACU).

Note: The value entered in this setting must be equal to or greater than the value entered for the **PEAP Minimum Version** field.

Configuring Server Certificates

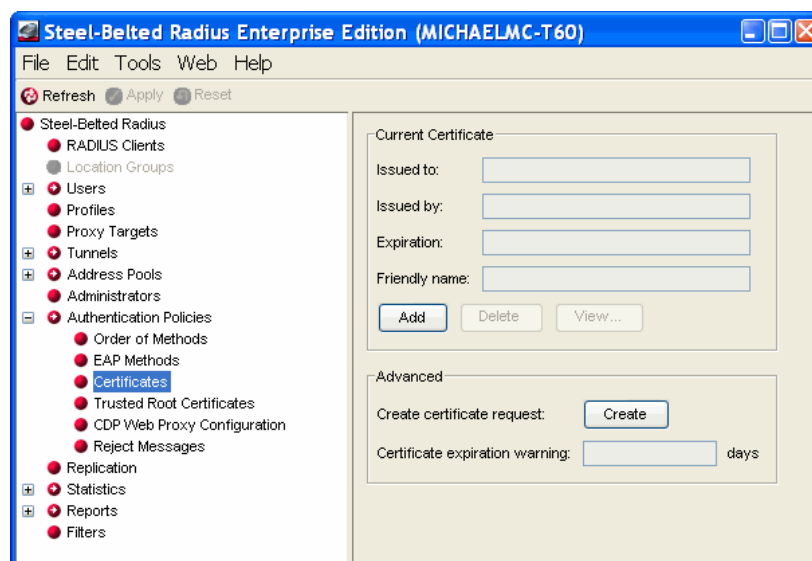
You must install cert if

Adding a Server Certificate

To add a certificate to the Steel-Belted Radius server:

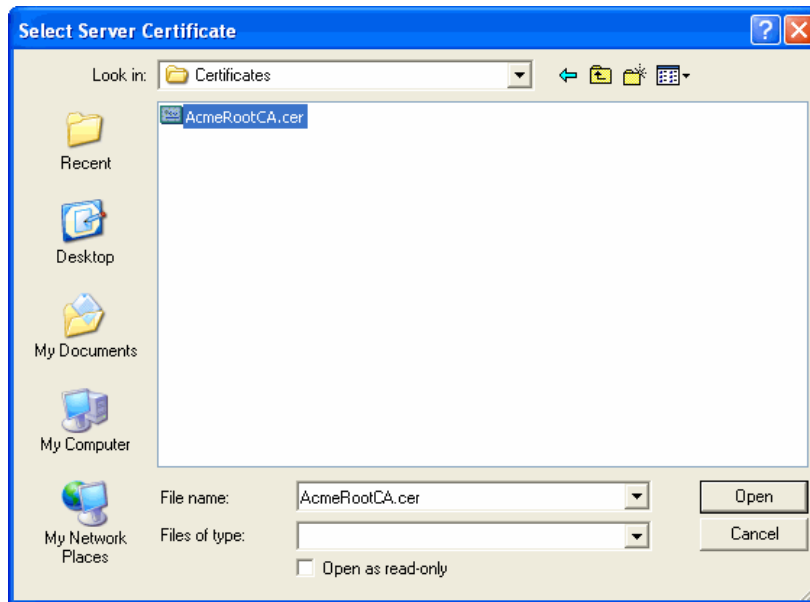
1. Select **Authentication Policies > Certificates** to open the Certificates panel (Figure 131).

Figure 131: Certificates Panel



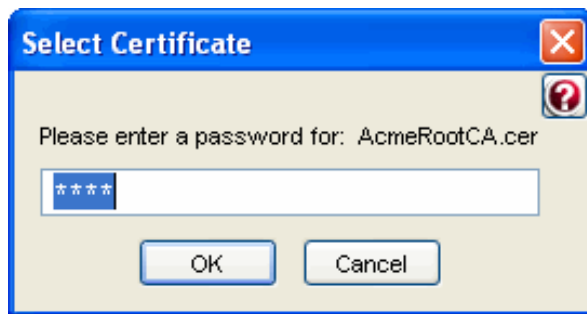
2. Click the **Add** button.
3. When the Select Server Certificate dialog opens, navigate to the location of your server certificate, select the certificate you want to use, and click **Open**.

Figure 132: Select Server Certificate Dialog



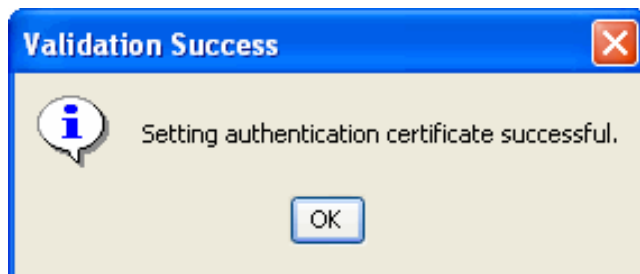
4. When the Select Certificate dialog (Figure 133) opens, enter the password for the certificate you selected and click **OK**.

Figure 133: Select Certificate Dialog



5. When the Validation Success dialog appears, click **OK**.

Figure 134: Validation Success Dialog



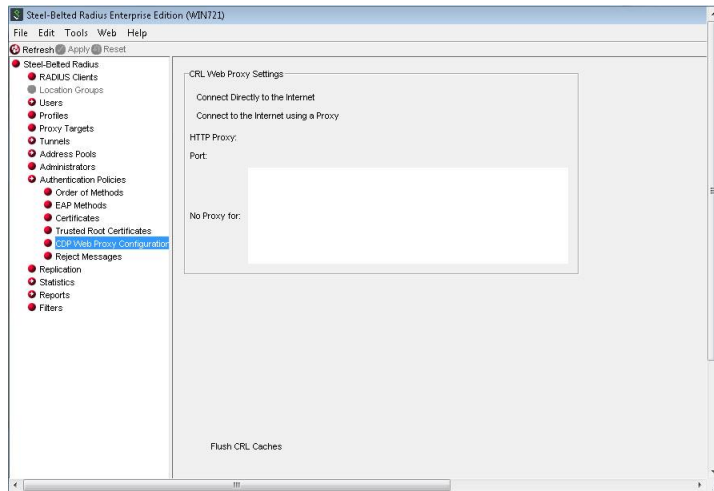
Configuring a CDP Web Proxy

Your network security policies may prohibit Steel-Belted Radius from making a direct HTTP connection to a CRL distribution points (CDP). You can configure an HTTP proxy server to relay requests from Steel-Belted Radius for updated certificate revocation lists to an external CDP.

To configure a CDP web proxy server:

1. Select **Authentication Policies > CDP Web Proxy Configuration** to open the CDP Web Proxy.

Figure 135: CDP Web Proxy Configuration Panel



2. Specify whether you want Steel-Belted Radius to use a proxy to connect to an external CDP.
 - If you click **Connect Directly to the Internet**, Steel-Belted Radius can connect to an external CDP without going through an HTTP proxy. If you select this option, you can skip the rest of this procedure.
 - If you click **Connect to the Internet Using a Proxy**, Steel-Belted Radius must go through an HTTP proxy to connect to a CDP.
3. Enter the name or IP address of the HTTP proxy in the **HTTP Proxy** field.
4. Enter the port number to use for the HTTP proxy in the **Port** field.
5. Optionally, identify the hosts for which no HTTP proxy is required in the **No Proxy For** field. If a CDP host matches an entry in this field, Steel-Belted Radius bypasses the HTTP proxy and attempts to open a connect to the host directly.


You can enter the names or IP addresses of hosts or the names of domains, separating each entry with a comma or semi-colon. Steel-Belted Radius compares IP addresses and host names using an exact string match. For example, if you enter `cdp.pulsesecure.net` in the exclusion list, that will match the CDP hostname `cdp.pulsesecure.net` but not `host.cdp.pulsesecure.net` or `host-cdp.pulsesecure.net`.

To exclude all hosts within a domain (but not the host name that matches the domain name), start the domain name with a period (`.pulsesecure.net`). To exclude both the host and the domain `pulsesecure.net`, create two entries in the exclusion list (`.pulsesecure.net`, `pulsesecure.net`).

Wildcard matching for host or domain names is not supported.

The values `localhost` and `127.0.0.1` are included in the No Proxy For list by default.

6. Optionally, click the **Flush CRL Caches** button to purge all information in the TLS and TTLS CRL caches immediately. When the Flush CRL Caches button is clicked, all CRL entries for registered clients are purged from the in-memory cache and deletes all files from the CRL cache directories.

 **Note:** If you click the **Flush CRL Caches** button, the caches are purged immediately. You are not asked to confirm your action.

Configuring the Server

Depending on your authentication requirements, you may need to configure Steel-Belted Radius to work with an external SQL or LDAP database, RSA SecurID service, or TACACS+.

Configuring External Databases (Linux)

If you run Linux and want to use external databases for authentication or accounting purposes (and you did not configure this feature when prompted by the Steel-Belted Radius installation script), you can set up external database configuration settings.

To configure Steel-Belted Radius to work with an external database:

1. Optionally, perform the instructions in “Configuring SQL Authentication” and/or Chapter 19, “Configuring SQL Accounting”.
2. If you want to use Steel-Belted Radius with an LDAP database, review your LDAP database vendor’s documentation.
3. Perform the instructions in “Configuring LDAP Authentication”.

Configuring SecurID Authentication

If you want to use SecurID authentication, you must configure Steel-Belted Radius to communicate with the RSA SecurID server.

Perform the following steps to configure a Steel-Belted Radius server to work with an RSA SecurID server. If you are not familiar with the RSA SecurID server, contact your RSA SecurID server administrator for assistance.

1. Verify that the Steel-Belted Radius server has an entry on the RSA SecurID server.

Start the RSA SecurID server administration program and display the list of clients. If the list of clients does not include the Steel-Belted Radius server, select **Client > Add Client** and complete the Client window, giving the Steel-Belted Radius server a Client type of **Net OS Client**.

2. Copy the `sdconf.rec` file from the `VACE\data` directory on the RSA SecurID server to the appropriate directory on the Steel-Belted Radius server:
 - **Windows:** `C:\winnt\system32`
 - **Linux:** the directory that contains the radius daemon on the Steel-Belted Radius server.
3. Edit the `[SecurID]` section of `radius.ini`. The `radius.ini` file is found in the same directory as the Steel-Belted Radius service or daemon.

Verify that the **CachePasscodes** field is set to **yes** and the **SecondsToCachePasscodes** field is set to an appropriate number of seconds. These settings ensure that authenticated SecurID users can open a second B-channel during an ISDN connection.

4. Edit the [SecurID] section of the eap.ini file, which is found in the same directory as the Steel-Belted Radius service or daemon.

Verify that the EAP settings in this section are enabled (remove the semi-colon from the start of each line) if you plan to use RSA SecurID authentication with EAP Generic-Token protocol support. The client system must support this protocol as well for this combination to work.

5. If you copy the sdconf.rec file after the Steel-Belted Radius service (daemon) has been started, or if you edit the radius.ini or eap.ini files after Steel-Belted Radius has been started, stop and restart Steel-Belted Radius.
6. Verify connectivity between the Steel-Belted Radius server and the RSA SecurID server.

The RSA SecurID server offers a monitoring window on which it logs every authentication transaction, complete with the reason for the accept or reject decision. You can verify that pass-through to RSA SecurID is working, by creating a SecurID User called <ANY> and then attempting to access the network. Look for your request on the RSA SecurID monitor screen. If access is denied, you'll know that there's a configuration problem. Try these steps again, or contact your RSA SecurID administrator for assistance.

These steps complete initial setup of the two servers. To fully enable pass-through authentication to the RSA SecurID server, you must also set up the SecurID authentication method.

Configuring the Location of the sdconf.rec File

The VAR_ACE variable in the sbrd script file (Linux) lets you specify the directory holding the sdconf.rec file. The VAR_ACE variable must be exported so that Steel-Belted Radius can use it.

For example:

```
VAR_ACE="radiusdir/ace"
export VAR_ACE
```

This variable is set by default in the file to point to the radiusdir directory. If the variable is not set at all in the file, the server sets the value of this variable to

```
/var/ace.
```

Configuring TACACS+ Authentication

If you want to use TACACS+ authentication, you must configure Steel-Belted Radius to communicate with the TACACS+ server.

Perform the following steps to configure a Steel-Belted Radius server to work with a TACACS+ server.

1. Verify the tacplus.ini file is present in the Steel-Belted Radius directory.

The tacplus.ini file must be present in the same directory as the Steel-Belted Radius service (in the case of Windows, usually C:\Program Files (x86)\Pulse Secure\Steel-Belted Radius\Service), or daemon (in the case of Linux). This happens automatically following installation.

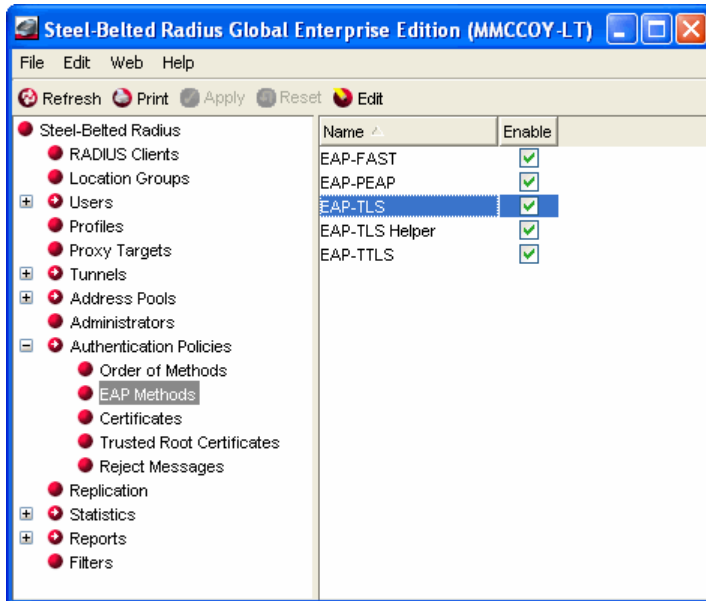
2. Edit the tacplus.ini file to identify the shared secret and host machine that you use for TACACS+. For more information on the tacplus.ini file, refer to the Steel-Belted Radius Reference Guide.
3. If you edit tacplus.ini after Steel-Belted Radius has been started, then you must stop and restart it before your changes take effect.

To enable pass-through authentication to the TACACS+ server, you must also set up the TACACS+ authentication method. For more information, see [“Configuring TACACS+ Authentication”](#).

Activating EAP Methods

The EAP Methods panel permits you to activate authentication methods and define the order in which different authentication methods are attempted.

Figure 136: EAP Methods Panel



To use the EAP Methods panel:

1. Select **Authentication Policies >EAP Methods** in the Sidebar.
2. Click the **Enable** check box to enable the EAP authentication methods you want Steel-Belted Radius to use.

To revert to the previous settings, click **Reset**.

Configuring EAP Settings

When Steel-Belted Radius receives a username, it does not know in advance to which authentication category this user belongs. It must try each method that it currently has configured and enabled. The authentication methods list allows you to fine-tune the sequence of authentication attempts.

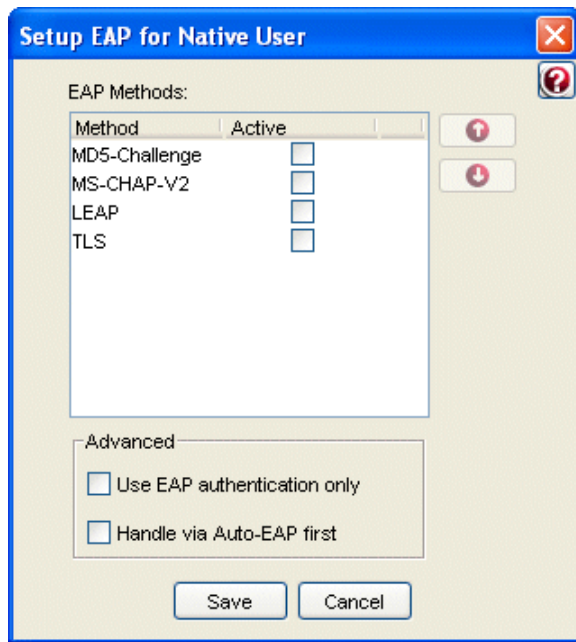
Note: The EAP Setup dialog displays the authentication methods that have been enabled (by editing the Enabled setting in the appropriate *.aut file).

To set up EAP settings for an authentication method:

1. Select the authentication method you want to set up in the Authentication Methods tab.
2. Click the **EAP Setup** button.

The Setup EAP dialog opens.

Figure 137: Setup EAP Dialog



- Optionally, change the order in which the methods are tried by highlighting a method and clicking the **Up** or **Down** buttons.
- To activate a method, (so that it can be used for authentication), click the **Active** check box.

If you want to deactivate a method (so that it is not used for authentication), unclick the applicable **Active** check box.

- If you want to restrict use of this authentication method to requests that contain EAP credentials, click the **Use EAP authentication only** check box.

When this option is enabled, Steel-Belted Radius prevents the authentication method from being called for any request that does not contain EAP credentials, and bypasses the authentication method if an authentication request specifically requests an EAP protocol that is not listed in the authentication method's **EAP-Type** list in the **eap.ini** file.

- If you want Steel-Belted Radius to use an automatic EAP helper to generate credentials for a user, click the **Handle via Auto-EAP first** check box.

You should unclick the check box if an authentication method is capable of handling EAP credentials on its own (without an EAP helper).

See ["First-Handle-Via-Auto-EAP Setting"](#).

- Click **Save** to return to the Authentication Methods tab.

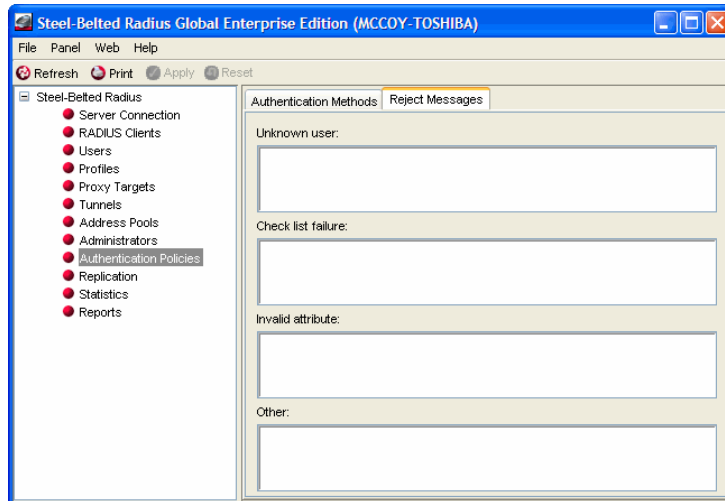
Configuring Authentication Rejection Messages

When Steel-Belted Radius issues an Access-Reject message in response to a failed authentication request, it can identify the reason why the request was rejected. You can configure the message text returned to the RADIUS client (and possibly to the user, if the RADIUS client forwards the message) when a particular error occurs. This text is inserted into the standard RADIUS attribute Reply-Message within the Access-Reject response.

To configure the text for authentication rejection messages:

1. Open the Authentication Policies panel.
2. Click the **Reject Messages** tab.

Figure 138: Authentication Policies Panel: Reject Messages Tab



3. Use the **Unknown User** field to specify the message Steel-Belted Radius returns when the username and password authentication failed.
4. Use the **Checklist failure** field to specify the message Steel-Belted Radius returns when the user was authenticated but is being rejected because the RADIUS request did not fulfill the requirements of the checklist.
5. Use the **Invalid attribute** field to specify the message Steel-Belted Radius returns when the request contained an attribute in violation of the RADIUS specification.
6. Use the **Other** field to specify the message Steel-Belted Radius returns when some other error, such as a resource failure, occurred.
7. When you are asked to confirm that you want to save your changes, click **Yes**.

Chapter 22

Setting Up EAP Authentication Policies via WebGUI

This chapter presents an overview of concepts relating to the Extensible Authentication Protocol (EAP) and describes how to configure Steel-Belted Radius to use EAP authentication methods and plug-ins via WebGUI.

About the Extensible Authentication Protocol

Steel-Belted Radius supports the Extensible Authentication Protocol (EAP), a standard for communication between network access devices and servers that provides for the future extensibility of authentication protocols.


EAP allows specialized knowledge about authentication protocols to be taken out of a NAD so that it acts solely as a conduit between authentication server and client. This means that new types of authentication can be supported by adding the appropriate functionality to server and client, without any changes to PPP or network access devices. When the authentication process is complete, the RADIUS server simply informs the NAD of the result.

Steel-Belted Radius supports several EAP authentication mechanisms, such as TTLS, TLS, PEAP, LEAP, MD5-Challenge, and Generic Token. Support for EAP has been designed to anticipate other authentication types as they become available.

TLS v1.2 (latest version) protocol provides improved flexibility and enhanced security. It supports modern encryption algorithms like SHA-256, AES cipher suites to communicate with RADIUS clients and avoid any weak cipher suite negotiations. OpenSSL is used to support TLS v1.2 and address various security vulnerabilities.

The [EapSettings] section of radius.ini initialization file contains two parameters: AllowTLSFallback and MinimumProtocolVersion.

- Parameter AllowTLSFallback enables fallback to support SSL/TLS protocol versions
- Parameter MinimumProtocolVersion specifies the protocol version (TLSv10/TLSv11/TLSv12) to be used for EAP

 **Note:** AllowTLSFallback option in radius.ini is applicable only for certificate based EAP plugins. The TLS fallback is a unique feature, aimed to provide backward compatibility to deprecated EAP client.

When AllowTLSFallback option is enabled in radius.ini, SBR EAP component will be initialized with protocol independent SSL structure. Depending on EAP client's hello message, SBR will either negotiate in TLS v1.2 or it can degrade itself till SSL v3 compliant server. This option is very specific to EAP plugins only.

For technical details about EAP, see RFC 2284, "PPP Extensible Authentication Protocol (EAP)," and RFC 2869, "RADIUS Extensions."


Handling EAP Requests

The flow of RADIUS packets in an EAP scenario is quite different from the transactions using standard user credentials (for example, PAP or CHAP). Standard user credentials involve the transmission of a RADIUS request from the NAD to Steel-Belted Radius and a response (either an Accept or Reject) from the server back to the

NAD.

With EAP, the first packet sent from the NAD to Steel-Belted Radius contains an EAP-Message attribute containing an EAP Identity Response. This is a signal sent by the system being authenticated that it wants to be authenticated by means of EAP. It is now up to Steel-Belted Radius to select the EAP protocol with which it is to authenticate the end-user.

The contents of the User-Name attribute is the only guideline available to Steel-Belted Radius in selecting the appropriate EAP protocol. Should Steel-Belted Radius select an EAP protocol that is not supported by the client, the client has the opportunity to send an EAP-NAK and to request a specific alternate protocol.

 **Note:** Given this general flow, a RADIUS request with EAP credentials must incur a minimum of two network round-trips between the RAS (or Access Point) and the Steel-Belted Radius before reaching a successful conclusion.

Automatic EAP Helpers

Automatic EAP helpers serve as intermediaries between EAP and traditional authentication methods. These helper modules can be configured (using an associated .eap file) to work with existing authentication methods to shield the authentication methods from the particulars of the selected EAP protocol.

Table 28 indicates whether each EAP type is implemented as an EAP helper or stand-alone module in Steel-Belted Radius.

Table 31: EAP Implementations

EAP-Type	Implemented As
EAP-TTLS	Standalone Authentication Method Module
EAP-TLS	Standalone Authentication Method Module
EAP-TLS	Automatic EAP helper
LEAP	Automatic EAP helper for MS-CHAP-v1
EAP Generic-Token	Standalone Authentication Method Module (SecurID)
EAP MD5-Challenge	Automatic EAP helper for CHAP
EAP MS-CHAP-v2	Automatic EAP helper for MS-CHAP-v2 (needed for PEAP)

Whether an automatic EAP helper can be used in conjunction with a specific authentication method depends on what types of credentials the authentication method supports.

The automatic EAP helper that implements EAP MD5-Challenge generates CHAP credentials, while the helper that implements LEAP generates MS-CHAP-v1 credentials. As such, EAP MD5-Challenge can be used only with authentication methods that support CHAP, and LEAP can be used only with authentication methods that support MS-CHAP-v1.

Table 29 summarizes the support for MS-CHAP-v1 and CHAP in the Steel-Belted Radius authentication methods.

Table 32: MS-CHAP-v1 and CHAP Support

Authentication Method	MS-CHAP-V1	CHAP
LDAP	Yes for BindName (password must be stored in the clear or encrypted using enc-md5 in LDAP server), No for Bind	Yes for BindName (password must be stored in the clear or encrypted using enc-md5 in LDAP server), No for Bind
Local	Yes	Yes
Proxy RADIUS	Yes	Yes
SecurID	No	No
SQL	Yes if password is in clear or encrypted using enc-md5 in SQL database	Yes if password is in clear or encrypted using enc-md5 in SQL database
TACACS+	No	Yes
UNIX User	No	No
UNIX Group	No	No
Windows Domain User	Yes (server must be running under SYSTEM account)	No
Windows Domain Group	Yes (server must be running under SYSTEM account)	No

Authentication Request Routing

The order in which authentication methods and automatic EAP helpers are called to handle an authentication request depends on two factors:


- The ordered list of enabled authentication methods (viewable in the Authentication Policies page in SBR Administrator). See “Activating EAP Methods” for information on using the Authentication Policies page.
- The EAP-related configuration for each of the enabled authentication methods in the eap.ini file, which you configure from the Authentication Policies page.

When Steel-Belted Radius receives an authentication request that does not contain EAP credentials, it passes the request to each enabled authentication method until one of the methods claims the request. The EAP settings in the eap.ini file come into play only when a request with EAP credentials is received. An authentication request contains EAP credentials if it includes one or more EAP-Message attributes and contains no other form of user credentials (for example, User-Password).

EAP-Only Setting

When an authentication method's EAP-Only setting is 1, Steel-Belted Radius prevents the authentication method

from being called for any request that does not contain EAP credentials. Under this setting, the authentication method is also bypassed if an authentication request specifically requests an EAP protocol that is not listed in the authentication method's EAP-Type list in the eap.ini file.

 **Note:** The PEAP authentication method plug-in converts the inner EAP/Generic Token credentials to PAP for security reasons. If you are using SecurID with PEAP, you should set the EAP-Only setting to 0.

First-Handle-Via-Auto-EAP Setting

If your configuration involves clients using more than one EAP protocol, Steel-Belted Radius must select an initial EAP protocol with which to proceed when receiving an authentication request with EAP credentials.

Selecting the incorrect EAP protocol is not fatal; the client simply sends an EAP NAK in response to the server's selected protocol and suggests an alternate one. After one additional network round-trip, the correct EAP protocol becomes active.

Depending on the capabilities of the authentication methods being used, you might be able to cut out this additional network round-trip that affects a portion of your EAP-based authentication requests.

If an authentication method can check for the existence of a user and can retrieve the user's password information with only the information available in the authentication request (for example, the username), it is said to be prefetch-capable. A prefetch-capable authentication method could be consulted first to see if a user exists in its database before committing to a specific EAP protocol.

If your authentication method is prefetch-capable, you would set First-Handle-Via-Auto-EAP to 0, indicating that the authentication method should have the first chance to handle the request. You would also set First-Handle-Via-Auto-EAP to 0 if the authentication method is capable of handling EAP credentials all on its own (clearly, it would not expect an automatic helper EAP method to do work on its behalf in this case).

By configuring the authentication method to be called first, Steel-Belted Radius can delay selection of an EAP protocol until it has ascertained whether the user exists in a particular authentication method's database. This is a useful technique when you plan to use more than one EAP protocol, but you do not know which one the client will want. Even in this scenario, automatic EAP helpers can still end up performing the EAP protocol processing; they will take over after the authentication method has retrieved a user's password information, rather than before.

The goal of an automatic EAP helper is to generate credentials against which traditional authentication methods (ones that do not understand EAP) can operate. Once an automatic EAP helper has generated these credentials, the authentication method that triggered the use of the helper is checked first for a password/credential match. Should this match not be present, the same traditional credentials are passed to all remaining enabled authentication methods in the master list (in the order in which they appear in the list).

Table 33: Authentication Method Prefetch Capability

Authentication Method	Prefetch Capable?
LDAP	Yes, if using BindName (rather than the Bind option)
Native User	Yes
SQL	Yes, if password does not need to be used as an input parameter in the SQL statement

Authentication Method	Prefetch Capable?
UNIX User	No
Windows Domain	No

Note: If you enable the lockout facility in Steel-Belted Radius and you use a tunneled authentication method (TTLS or PEAP) with a prefetch-capable method (native user, SQL, or LDAP) and an enabled EAP protocol (MS-CHAPv2, MD5-Challenge, LEAP, TLS), then you must enable First Handle via Auto- EAP in that prefetch-capable method to prevent the outer username (anonymous) from being added to the lockout list.

Otherwise, when Steel-Belted Radius receives an authentication request that uses an unconfigured EAP method, Steel-Belted Radius will reject the user (because the EAP method is not configured) and add the outer username (anonymous) to its lockout list. This will result in all users with an outer authentication name of anonymous being rejected until the lockout period expires.

EAP-NAK Notifications

If you are supporting only one type of client or only one EAP protocol, Steel-Belted Radius selects that EAP protocol for all EAP-based authentication requests it receives. If you are planning to support multiple EAP protocols and do not intend to maintain databases that track the appropriate EAP protocol on a user-by-user basis, Steel-Belted Radius automatically selects the appropriate EAP protocol for you.

When multiple EAP protocols are in play, you should configure each authentication method you plan to use with all the EAP protocols that can be used with it. In this configuration, when Steel-Belted Radius receives an authentication request containing EAP information, it chooses the first EAP protocol listed for the first authentication method that claims the request. Should the client require a different EAP protocol, it sends back an EAP-NAK that specifies the EAP protocol it would prefer to use.

After receiving an EAP-NAK, Steel-Belted Radius performs a scan of the authentication methods to find the first authentication method that has the requested EAP protocol listed (the authentication method might support this EAP protocol directly or with the help of an automatic EAP helper).

If the requested EAP protocol does not appear in any of the authentication methods' lists of supported EAP protocols, Steel-Belted Radius rejects the authentication request.

Reauthenticating Connections

Most Access Points understand only a limited number of attributes that can be included in a RADIUS response to signal that the user has been accepted. The Session-Timeout attribute is of particular significance in a WLAN realm as it instructs the Access Point how long to allow the user to remain connected to a WLAN before having to re-authenticate to Steel-Belted Radius.

You can configure your choice of Session-Timeout settings using standard Steel-Belted Radius reply-list items on a user-by-user basis. If you are using EAP-TLS or EAP-TTLS to authenticate users, you can also have these modules automatically generate Session-Timeout attributes based on policies set in their configuration files. This level of control is necessary for EAP-TLS and EAP-TTLS as these modules also support session resumption, a quicker method of re-authenticating users. The value in the Session-Timeout attribute might need to be dynamically calculated in these cases.

Note: Not all Access Points support the Session-Timeout attribute. You should check your Access Points' specifications to determine whether this configuration must be performed in a fixed manner on the Access Point or if the Access Point should defer to the server.

Certificates

A certificate is an electronic data structure used to identify an individual, a server, a company, or some other entity, and to associate that identity with a public key and an associated private key. Like a passport, a certificate provides generally recognized proof of an entity's identity. Certificates bind public key values to entities, so that remote users of an entity's public key can be certain the associated private key is owned by the correct person or system. Certificates help prevent the use of fake public keys for impersonation. Only the public key certified by the certificate will work with the corresponding private key possessed by the entity identified by the certificate. The most widely accepted format for certificates is defined by the ITU-T X.509 international standard, which is described in RFC 3280, "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile."

Certificate authorities (CAs) are entities that validate identities and issue certificates. An organization that wants to serve as its own CA can issue its own certificates, or an organization can purchase certificates from a trusted third-party CA. The methods used to validate an identity vary depending on the policies of a given CA. In general, before issuing a certificate, a CA must verify the identity of the entity and must digitally sign the certificate to ensure it cannot be modified. This ensures that a certificate issued by a CA binds a particular public key to the name of the entity the certificate identifies (such as the name of an employee).

In addition to a public key, a certificate includes the name of the entity it identifies, an expiration date, the name and URI of the CA that issued the certificate, a serial number, and the digital signature of the issuing CA, which creates a mathematical relationship between the signing CA certificate's public key and the public key of the certificate it signs. The CA's digital signature allows the certificate to function as a "letter of introduction" for users who know and trust the CA but don't know the entity identified by the certificate.

Because a certificate's expiration date is part of its signed contents, remote entities can verify that a certificate is valid and current.

Common types of certificates include the following:

- Certificate Authority certificates can sign other certificates.
- Server certificates are used on a server to enable a software client to verify the validity of the connection to a machine ("Am I really connecting to www.pulsesecure.net?") and to create an encrypted channel between a client and a server.
- Client certificates are used to allow a server to verify a client's identity (certificate based authentication) and to allow a user to digitally sign or encrypt data. Client certificates, which is digitally signed by a trusted certificate authority, is stronger proof of a client's identity than username/password credentials alone.

Certificate Chains

A certificate chain is a sequence of certificates, where each certificate in the chain is signed by the certificate above it in the chain. At the top of the chain is a self-signed certificate. Each CA in the chain vouches for the identity in the entity to which it issues a signed digital certificate. Certificate chains establish a chain of trust; if you trust the CA at the top of the chain, this implies you can trust the signed certificates below it in the chain.

Certificate Revocation Lists

Under normal circumstances, a certificate remains valid until it reaches its expiration date. However, a certificate

might become invalid before it expires. For example, if an employee whose identity is bound to a certificate terminates employment or if an enterprise suspects the confidentiality of the private key associated with a certificate's public key has been compromised, the certificate might be declared invalid and revoked before its expiration date.

When a CA revokes a certificate, it must let other entities know the certificate is no longer valid and should not be accepted. A certificate revocation list (CRL) is a signed data structure that identifies the serial numbers of certificates that have been issued and subsequently revoked by the CA. When a remote entity is asked to use a certificate to verify a remote user's identity, it can download a current copy of the applicable CRL from a CRL distribution point (CDP) and confirm that the certificate's serial number is not present. If a CRL has expired, the entity must connect to the CDP to download a new revocation list.

CRLs can be issued by a CA periodically (hourly, daily, or weekly) or as needed. When a certificate is revoked, its serial number is listed in the CRL, and that serial number remains in the CRL at least one period after the certificate's expiration date. CRLs, like certificates, can be distributed by untrusted servers and untrusted communications.

Under some circumstances, latency (the time between when a certificate is revoked and when the certificate's serial number appears on the CRL of the issuing CA) might be a concern. For example, if a revocation is reported today, that revocation will not be reliably notified to certificate-using systems until all currently issued CRLs are updated, which might take hours, days, or even weeks. Online revocation checking can reduce the latency between a revocation report and the distribution of the information to relying parties.

If CRL checking is enabled, Steel-Belted Radius uses the URI information contained in a client certificate to connect to the certificate's CDP. Steel-Belted Radius then uses HTTP, LDAP, or a network file system to retrieve the appropriate CRLs. Steel-Belted Radius stores these retrieved CRLs in the CRLCache directory under the radiusdir server directory.

When a client certificate is presented during EAP-TLS or EAP-TTLS authentication, Steel-Belted Radius can evaluate the client's certificate chain against its set of stored CRLs to verify none of the certificates in the chain have been revoked.

You can configure the following settings for CRL checking:

- **Static CDPs**—A static CDP is a CDP whose address (URI) is specified in the [Static_CDPs] section of a TLS or TTLS initialization file.
- **CRL expiration**—The CRL checking feature can be configured to operate in strict or lax mode.
 - In strict mode, a cached CRL that has expired will be immediately discarded; if Steel-Belted Radius cannot acquire a new CRL in the allotted time during a CRL check on a chain, the user is rejected.
 - In lax mode, you can configure Steel-Belted Radius to accept an expired CRL for a period past its expiration. Note that Steel-Belted Radius attempts to obtain a current CRL whether it is running in strict or lax mode.
- **Missing CDP attribute**—When a CRL check is performed on a certificate chain, Steel-Belted Radius reads the contents of the CDP attribute for each certificate past the root certificate and uses the CDP information to retrieve the appropriate CRL. If a non-root certificate in the chain does not contain a CDP attribute, no CRL checking will be performed for that certificate. You can configure EAP-TLS to reject the user if it encounters a non-root certificate that is missing a CDP attribute.
- **Incomplete LDAP CDP**—Some CAs can create certificates that contain an LDAP-style CDP (`//ldap:\...`) that does not specify the identity of the LDAP server to be queried. You can designate a default LDAP

server that will be used when such CDPs are encountered. If you do not designate a default LDAP server and an LDAP-style CDP is encountered, the CRL retrieval will fail.

- HTTP proxies for CRL checking—Network security policy may prevent Steel-Belted Radius from making a direct HTTP connection to a CDP. In such cases, you can configure Steel-Belted Radius to download CRLs through an HTTP proxy server on its local network. Optionally, you can specify the hosts or domains that do not require an HTTP proxy.
- CRL cache flushing—You can flush the CRL caches used for EAP-TLS and EAP-TTLS authentication at any time.

EAP-TLS

The EAP-TLS (Transport Layer Security) protocol requires that both user and authentication server have certificates for mutual authentication. While the mechanism is very strong, it requires that the corporation that deploys it maintain a certificate infrastructure for all of its users.

EAP-TLS can be deployed as an authentication method or as an automatic EAP helper.

- When EAP-TLS is deployed as an authentication method, EAP-TLS appears in the Authentication Policies page in SBR Administrator after it is deployed as an authentication method. You can use the Authentication Policies page to enable the EAP-TLS method and specify its sequence relative to other authentication methods Steel-Belted Radius uses.

When EAP-TLS is deployed as an authentication method, you can configure it to perform certificate revocation list (CRL) checking. When CRL checking is enabled, EAP-TLS confirms that the client's certificate chain traces back to one of the trusted root certificates installed at initialization and checks the serial number of each certificate in the chain against the contents of CRLs to verify that none of the certificates in the chain have been revoked.

You can configure the `tlsauth.aut` file to call a fixed profile when TLS-EAP is used. This profile specifies the attributes that are sent back in response to a successful authentication.

You cannot use secondary authorization when EAP-TLS is deployed as an authentication method.

- When EAP-TLS is deployed as an automatic EAP helper, you must list TLS in the EAP-Type list of an authentication method. When EAP-TLS is triggered, the `tlsauth` authentication goes through the TLS handshake required by the EAP-TLS specification. Assuming the user provides a certificate that the server can verify against a list of trusted root certificates, the EAP-TLS part of the exchange concludes successfully.

You might not want to grant access to your network to every user with a trusted certificate. By enabling the optional secondary authorization feature of the `tlsauth` plugin, you can have Steel-Belted Radius authorize users with valid certificates on a case-by-case basis. Secondary authorization also allows you to include user-specific attributes in an Access-Accept response; these attributes can be used to communicate options that are to be active for a user's connection to the NAD. Without secondary authorization, the only attributes returned on an Access-Accept are those generated by the `tlsauth` plug-in itself (termination-action and session-limit).

If you enable the TLS authentication method, secondary authorizations must be performed by local authentication methods (they cannot be proxied). The authentication method you select for secondary authorizations must be able to authenticate users in a single pass; it cannot challenge the authorization request and request additional information. The username employed during secondary authorization is derived from a field in the user's certificate. Since a user's certificate does not include a password, you must configure `tlsauth` to make the secondary authorization request with no

password or with a fixed password.

If you configure secondary authorization with no password, your selected authentication method must be capable of handling requests that do not include passwords; the only authentication methods that support this style of authentication and ship with Steel-Belted Radius are Native User, LDAP and SQL. If you configure secondary authorization with a fixed password, you can use any authentication method that supports PAP authentication. In this configuration all user records must have the same fixed password.

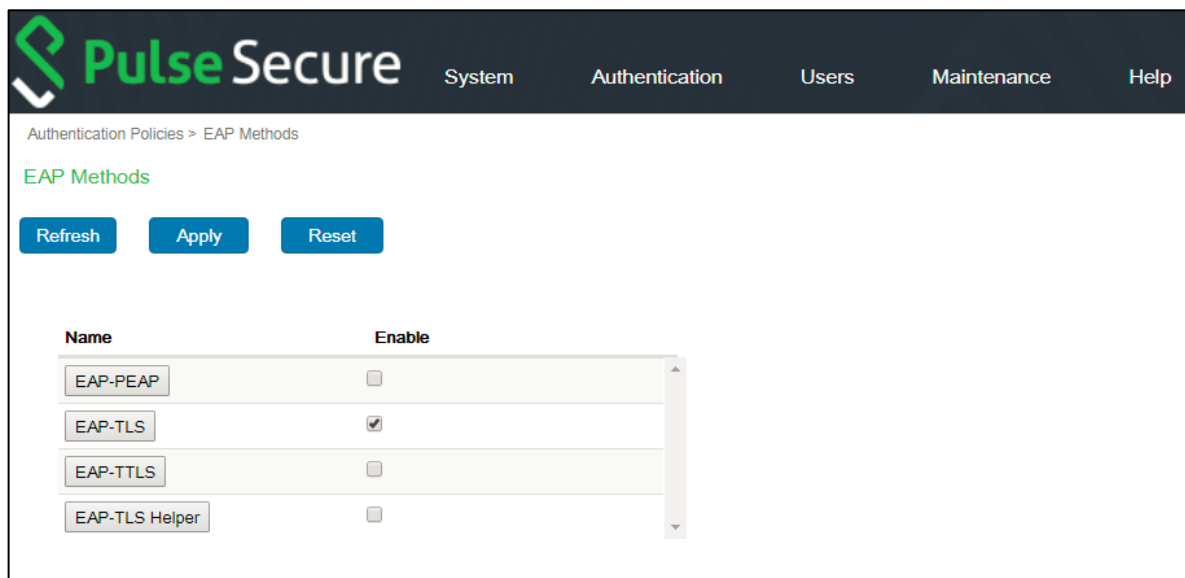
Configuring EAP-TLS as an Authentication Method

Note: You must configure the server certificate for the Steel-Belted Radius server before you use the EAP-TLS authentication method. For information on configuring your server certificate, see “Configuring Server Certificates”.

To configure EAP-TLS as an authentication method:

1. Select **Authentication > Authentication Policies > EAP Methods** from the menubar.

Figure 139: EAP Methods Page



2. Click the **Enable** check box for the EAP-TLS authentication method.
3. Click the EAP-TLS button to edit the EAP-TLS. The Edit TLS Authentication Method page opens.

Figure 140: Edit TLS Authentication Method page

Edit TLS Authentication method

Client Certificate Validation Session Resumption

Advanced Server Settings

Enable CRL Checking: ☐

Retrieval Timeout: seconds

Expiration Grace Period: seconds

Allow Missing CDP Attribute: ☒

☐ CRL Cache Timeout Period hours

Default LDAP Server Name :

Verify that Client Certificates are published to user accounts (Active Directory Accounts and EAP-TLS only) ☐

OK Cancel

4. Use the tabs in the Edit TLS Authentication Method page to configure the following settings:

- Client certificate validation
- Session resumption
- Advanced server settings

Each configuration task is described separately below.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the EAP-TLS protocol:

1. Click the **Client Certificate Validation** tab in the Edit TLS Authentication Method page.
2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. Enter the number of seconds that EAP-TLS will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

4. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

EAP-TLS always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), EAP-TLS does not accept a CRL that has expired.
- If you enter a value greater than 0 (lax expiration mode), EAP-TLS considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.

5. Click the Allow Missing CDP Attribute check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, EAP-TLS will not know how to retrieve a CRL and will not be able to perform a revocation check on the certificate.

If you click the Allow Missing CDP Attribute check box, EAP-TLS allows such certificates and skips CRL checking for them.

If you clear the Allow Missing CDP Attribute check box, EAP-TLS does not accept a CRL with a missing CDP attribute.

6. If you want to specify a CRL cache timeout period, click the CRL Cache Timeout Period check box and enter the number of hours in the timeout period in the hours field.
 - If you do not enable this setting, the CRL will be refreshed whenever it expires.
 - If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
 - If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

7. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the Default LDAP Server Name field.


CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

8. If your enterprise uses Active Directory and you want client certificates published to user accounts, click the Verify that Client Certificates are published to user accounts check box.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the EAP-TLS protocol:

1. Click the **Session Resumption** tab in the Edit TLS Authentication Method page.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the Termination Action field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the Resumption Limit field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and might not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-TLS protocol:

1. Click the Advanced Server Settings tab in the Edit TLS Authentication Method page.
2. Enter the maximum length of the TLS message that might be generated during each iteration of the TLS exchange. in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round trips required to conclude the TLS exchange. A value of 1400 might result in 6 round-trips, while a value of 500 might result in 15 round trips.

Some Access Points might have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enable the **Return MPPE Keys** check box to specify whether the TLS authentication method includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

4. Use the **DH Prime Bits** list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

5. Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.


6. Optionally, enable the **Verify User Name is Principal** check box if you want Steel-Belted Radius to verify that the contents of the RADIUS User-Name attribute match the Principal Name of the certificate used to authenticate the user.

Certificates issued by Microsoft's Windows 2000 Certificate Server typically include a Subject Alternative Name/Other Name attribute, where Principal Name set to something like **user@certtest.acme.com**.

The Windows XP client that supports EAP-TLS in conjunction with 802.1X extracts this attribute value from the client's certificate and uses it to respond to the Access Point's EAP Identity Request. The Access Point, in turn, packages up this value as the RADIUS User-Name attribute in requests it sends to a RADIUS server.

You should clear (disable) the check box if the certificates used do not include a Principal Name or if the client being used does not report the contents of Principal Name as the user's identity in response to an EAP Identity Request.

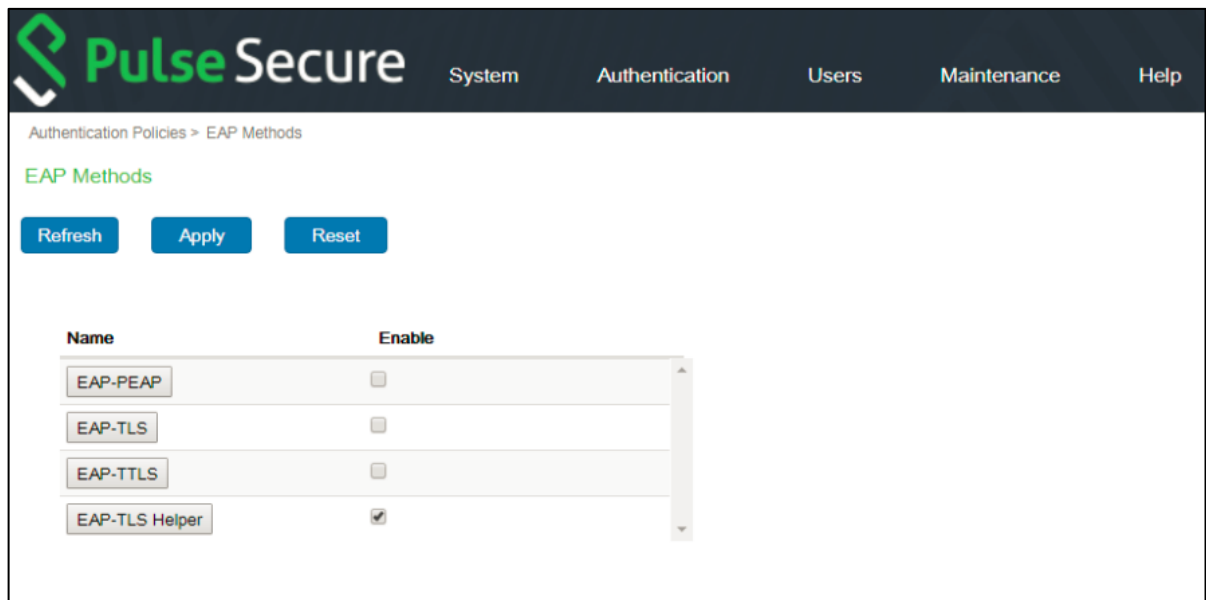
Configuring EAP-TLS as an Automatic EAP Helper

 **Note:** You must configure the server certificate for the Steel-Belted Radius server before you use the TLS EAP helper. For information on configuring your server certificate, see "Configuring Server Certificates."

To configure EAP-TLS as an EAP helper:

1. Select Authentication Policies > EAP Methods to open the EAP Methods page.
(Figure 141: EAP Methods Page).

Figure 141: EAP Methods Page



2. Click the Enable check box for the EAP-TLS Helper method.
3. Click the EAP-TLS Helper button to edit the EAP-TLS Helper.

The Edit TLS EAP Helper Method page opens.

Figure 142: Edit TLS EAP Helper Method page

Edit TLS EAP Helper method

Client Certificate Validation Secondary Authorization

Session Resumption Advanced Server Settings

Enable CRL Checking: ☐

Retrieval Timeout: seconds

Expiration Grace Period: seconds

Allow Missing CDP Attribute: ☒

☐ CRL Cache Timeout Period hours

Default LDAP Server Name :

OK Cancel

4. Use the tabs in the Edit TLS EAP Helper Method page to configure the following settings:

- Client certificate validation
- Secondary authorization
- Session resumption
- Advanced server settings

Each configuration task is described separately below.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Client Certificate Validation** tab in the Edit TLS EAP Helper Method page.

2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. Enter the number of seconds that the TLS EAP helper will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

4. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

The TLS EAP helper always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), the TLS EAP helper does not accept a CRL that has expired.
- If you enter a value greater than 0 (lax expiration mode), the TLS EAP helper considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.

5. Click the **Allow Missing CDP Attribute** check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, the TLS EAP helper will not know how to retrieve a CRL and will not be able to perform a revocation check on the certificate.

If you click the **Allow Missing CDP Attribute** check box, the TLS EAP helper allows such certificates and skips CRL checking for them.

If you clear the **Allow Missing CDP Attribute** check box, the TLS EAP helper does not accept a CRL with a missing CDP attribute.

6. If you want to specify a CRL cache timeout period, click the **CRL Cache Timeout Period** check box and enter the number of hours in the timeout period in the **hours** field.

- If you do not enable this setting, the CRL will be refreshed whenever it expires.
- If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
- If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

7. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the **Default LDAP Server Name** field.

CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

Configuring Secondary Authentication

Secondary authorization settings let you specify whether secondary authorization is performed and, if it is, what information is used in the secondary authorization request.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Secondary Authorization** tab in the Edit TLS EAP Helper Method page.
2. Click the **Enable Secondary Authorization** check box to enable secondary authorization checking.

If secondary authorization is disabled, the EAP-TLS plug-in accepts the user upon proof of ownership of a private key that matches a valid certificate.

If secondary authorization is enabled, a secondary authorization check against a traditional authentication method such as an SQL plug-in is performed.

3. Specify whether you want user names to be converted to Subject CN names or principal names.

After the EAP-TLS module has concluded its processing, it might still defer to a traditional authentication method (core or plug-in) for final authorization. To do so, it must provide a user name and password to the traditional authentication method.

- If you click the **Subject CN** option button, the EAP-TLS module parses the Subject attribute of the client's certificate for the least significant 'CN=' and takes the value of this attribute (for example, 'George Washington') as the user name being passed to the traditional authentication method.
 - If you click the **Principal Name** option button, the EAP-TLS module uses the principal name (Subject Alternate Name or Other Name) from the client certificate (for example, joe@acme.com) as the user name being passed to the traditional authentication method.
4. If you plan to use secondary authorization against an authentication method (for example, LDAP) that cannot be configured to ignore the lack of user credentials, specify a fixed password that the plug-in uses on all secondary authorization checks in the **Fixed Password** field.

By default, the secondary authorization check includes a user name but no other user credentials, because no password or similar credential for the client is available at the conclusion of the TLS handshake. Some authentication methods (Native User, LDAP, and SQL) can be configured to not require user credentials.

5. If you want the EAP-TLS plug-in to add four attributes to the request before the secondary authorization check is performed, click the Include Certificate Info check box.

When the Include Certificate Info check box is clicked, Steel-Belted Radius adds the following attributes to the request:

- The Funk-Peer-Cert-Subject attribute contains the value of the Subject attribute in the client certificate.
- The Funk-Peer-Cert-Principal attribute contains the value of the principal name (Subject Alternate Name or Other Name) attribute of the client certificate.
- The Funk-Peer-Cert-Issuer attribute contains the value of the Issuer attribute in the client certificate.
- The Funk-Peer-Cert-Hash attribute contains a hexadecimal ASCII representation of the SHA1

hash of the client certificate.

These attributes are ignored if the authentication method that performs the authentication check does not use them.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the TLS EAP helper protocol:

1. Click the **Session Resumption** tab in the Edit TLS EAP Helper Method page.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the Termination Action field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the TLS EAP helper protocol:

1. Click the **Advanced Server Settings** tab in the Edit TLS EAP Helper Method dialog.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter the maximum number of seconds you want to allow for the EAP authentication sequence in the **Max Transaction Time** field.

If the EAP authentication sequence takes longer than the number of seconds specified in this field, Steel-Belted Radius terminates the user authentication.

4. Enable the **Return MPPE Keys** check box to specify whether the TLS EAP helper includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the **DH Prime Bits** list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, “The TLS Protocol Version 1.2,” and other TLS-related RFCs and draft RFCs.

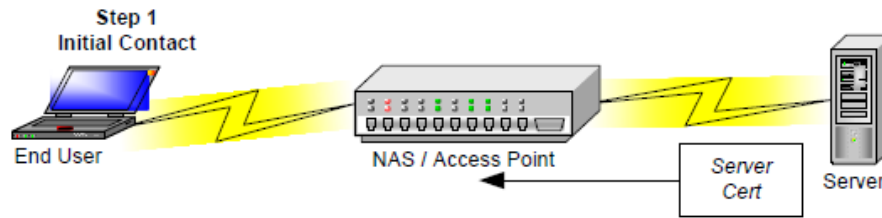
Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

EAP-TTLS

EAP-TTLS (Tunneled Transport Layer Security) is designed to provide authentication that is as strong as EAP-TLS, but it does not require that each user be issued a certificate. Instead, only the authentication servers are issued certificates. User authentication is performed by password; but the password credentials are transported in a securely encrypted “tunnel” established based upon the server certificates.

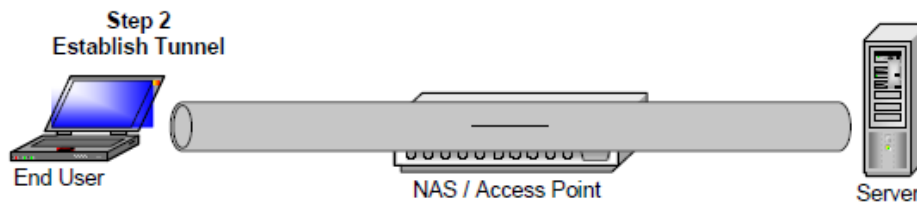
1. After the authentication server determines that the user has made an authentication request, it sends its certificate to the user’s system.

Figure 143: Server Certificate Sent to RAS



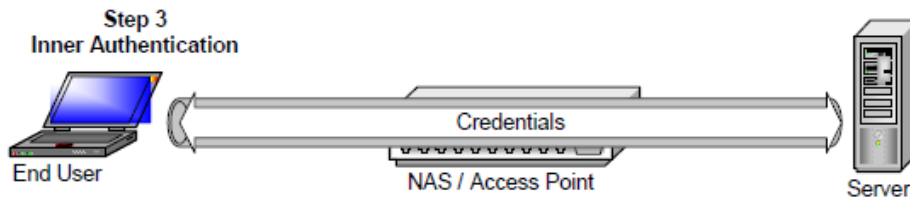
2. The authentication server's certificate is used to establish a tunnel between the user and the server.

Figure 144: Tunnel Established



3. Once the tunnel is established, credentials can be exchanged safely between the server and the user since tunnels encrypt all data in a secure fashion. This stage is called *inner authentication*.

Figure 145: Inner Authentication



With EAP-TTLS, it is not necessary to create a new infrastructure of user certificates. User authentication is performed against the same security database that is already in use on the corporate LAN; for example, Windows Domain Controllers, SQL or LDAP databases, or token systems.

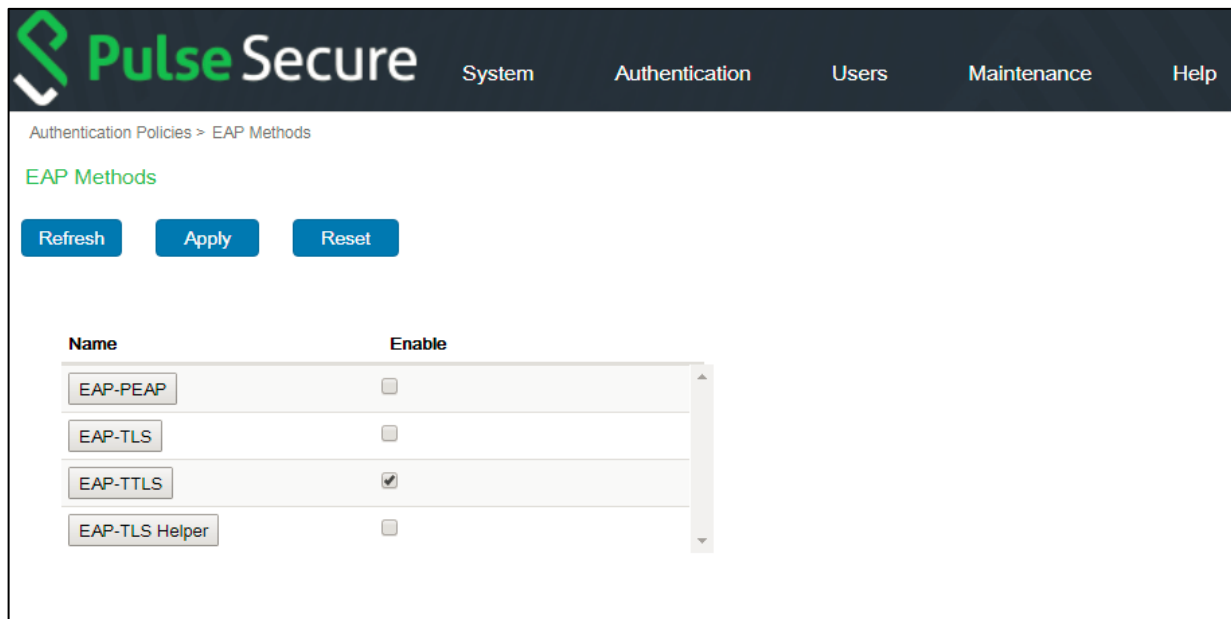
The routing of the inner authentication request can be handled either by means of standard Steel-Belted Radius authentication request routing or by means of a directed realm. If your EAP-TTLS tunnel ends at a dedicated server and all the inner authentication requests are to be performed by other servers, you should use standard request routing so the proxy realm target can be determined in a standard fashion (that is, the decoration of the username revealed by inner authentication). If your EAP-TTLS tunnel and inner authentication are handled by the same server, you can use a directed realm to specify which authentication method(s) handle the inner authentication.

Configuring EAP-TTLS

To configure EAP-TTLS as an authentication method:

1. Choose **Authentication > Authentication Policies > EAP Methods** from the menubar.

Figure 146: EAP Methods Page



Pulse Secure

System Authentication Users Maintenance Help

Authentication Policies > EAP Methods

EAP Methods

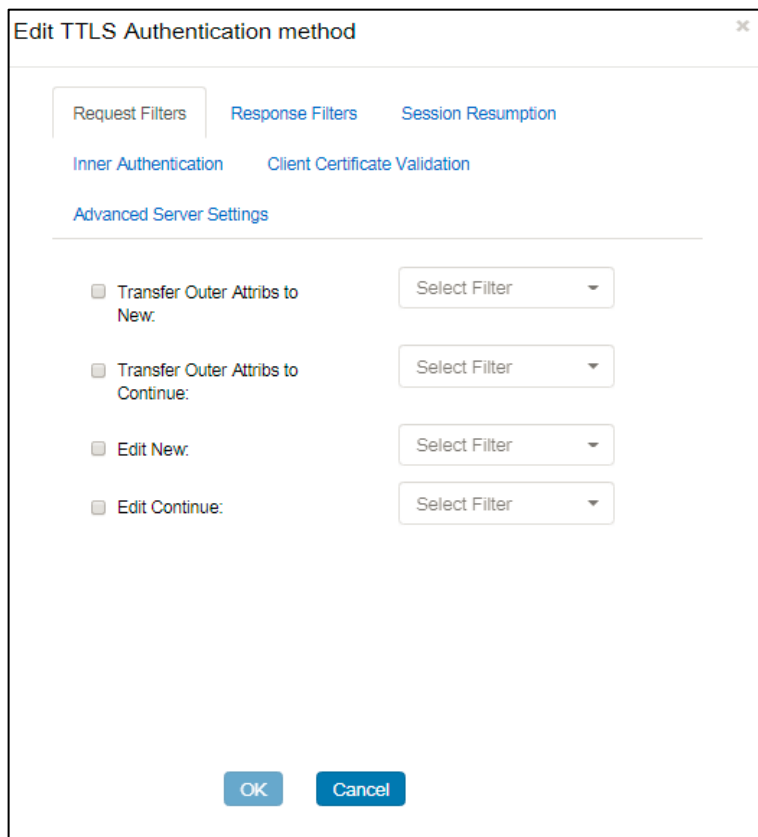
Refresh Apply Reset

Name	Enable
EAP-PEAP	<input type="checkbox"/>
EAP-TLS	<input type="checkbox"/>
EAP-TTLS	<input checked="" type="checkbox"/>
EAP-TLS Helper	<input type="checkbox"/>

2. Click the **Enable** check box for the EAP-TTLS method.
3. Click the EAP-TTLS button to edit the EAP-TTLS.

The Edit TTLS Authentication Method page opens.

Figure 147: Edit TTLS Authentication Method page



Edit TTLS Authentication method

Request Filters Response Filters Session Resumption

Inner Authentication Client Certificate Validation

Advanced Server Settings

☐ Transfer Outer Attribs to New: Select Filter

☐ Transfer Outer Attribs to Continue: Select Filter

☐ Edit New: Select Filter

☐ Edit Continue: Select Filter

OK Cancel

Use the tabs in the Edit TTLS Authentication Method page to configure the following settings:

- Request filters
- Response filters
- Client certificate validation
- Session resumption
- Inner authentication
- Advanced server settings

Each configuration task is described separately below.

Configuring Request Filters

Request filters affect the attributes of inner authentication requests. By default, Steel-Belted Radius does not use request filters.

To configure request filtering for the EAP-TTLS protocol:

1. Click the **Request Filters** tab in the Edit TTLS Authentication method page.
2. Optionally, click the **Transfer Outer Attribs to New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests).

- If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.
- If this filter is not specified, no attributes from the outer request are transferred to the inner request.

3. Optionally, click the **Transfer Outer Attribs to Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

4. Optionally, click the **Edit New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 2) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

5. Optionally, click the **Edit Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than a new inner authentication request). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 3) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

Configuring Response Filters

Response filters affect the attributes in the final response (Access-Accept or Access-Reject) returned to the originating NAD. By default, Steel-Belted Radius does not use response filters.

To configure response filtering for the EAP-TTLS protocol:

1. Click the **Response Filters** tab in the Edit TTLS Authentication method page.
2. Optionally, click the **Transfer Inner Attribs to Accept** check box and select the filter you want to use from the dropdown list.

This filter affects only an outer Access-Accept response that is sent back to a network access device.

- If this filter is specified, the filter is applied to the inner authentication response and all resulting attributes are transferred to the outer authentication response.
 - If this filter is not specified, no inner authentication response attributes are transferred to the outer authentication response.
3. Optionally, click the **Transfer Inner Attribs to Reject** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

Configuring Client Certificate Validation

Client certificate validation settings let you specify how Steel-Belted Radius performs certificate revocation list (CRL) checking.

To configure session resumption for the EAP-TTLS protocol:

1. Click the **Client Certificate Validation** tab in the Edit TTLS Authentication Method page.
2. Click the **Enable CRL Checking** check box to enable CRL checking.
3. If you want to require that the client must provide a certificate as part of the TTLS exchange, click the **Require Client Certificate** check box.
4. Enter the number of seconds that EAP-TTLS will wait for a CRL checking transaction to complete when the CRL check involves a CRL retrieval in the **Retrieval Timeout** field.

When CRL retrieval takes longer than the specified time, the user's authentication request results in a reject.

5. Enter the number of seconds during which a CRL is still considered acceptable after it has expired in the **Expiration Grace Period** field.

EAP-TTLS always attempts to retrieve a new CRL when it is presented with a certificate chain and it finds an expired CRL in its cache.

- If you enter 0 (strict expiration mode), EAP-TTLS does not accept a CRL that has expired.
 - If you enter a value greater than 0 (lax expiration mode), EAP-TTLS considers the expired CRL as an acceptable stand-in from the time the CRL expires to the time the grace period ends.
6. Click the **Allow Missing CDP Attribute** check box if you want Steel-Belted Radius to accept a non-root certificate that does not have a CDP attribute.

Without a CDP attribute, EAP-TTLS will not know how to retrieve a CRL and will not be able to perform a revocation check on the certificate.

- If you click the **Allow Missing CDP Attribute** check box, EAP-TTLS allows such certificates and skips CRL checking for them.
 - If you clear the **Allow Missing CDP Attribute** check box, EAP-TTLS does not accept a CRL with a missing CDP attribute.
7. If you want to specify a CRL cache timeout period, click the **CRL Cache Timeout** Period check box and enter the number of hours in the timeout period in the **hours** field.
 - If you do not enable this setting, the CRL will be refreshed whenever it expires.
 - If you enable this setting and enter 0, Steel-Belted Radius always regards the CRL in the cache as expired and downloads a new CRL every time it receives a client certificate request.
 - If you enable this setting and enter a number greater than 0, the CRL begins to expire when the age of the CRL in the cache exceeds the number of hours specified in this field or when the scheduled CRL expiration time occurs, whichever comes first.

After a CRL has expired (because its scheduled expiration time has passed or because the CRL cache has timed out), Steel-Belted Radius uses the expiration grace period to determine whether it should use the current CRL.

8. Enter the name of the LDAP server to use if the CDP contains a value that begins with the string //ldap:\\ in the Default LDAP Server Name field.

CDPs generated by some CAs do not include the identity of the LDAP server. If you expect to encounter certificates with this style CDP, specify the name of the LDAP server that contains the CRLs.

If you don't specify a server name and such certificates are encountered, the CRL retrieval fails.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to reauthenticate after the session timer has expired.

To configure session resumption for the EAP-TTLS protocol:

1. Click the Session Resumption tab in the Edit TLS Authentication Method page.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.
 - If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.
 - If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the **Termination Action** field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Inner Authentication Settings

The inner authentication settings let you specify the way in which the inner authentication step is to operate.

To configure inner authentication settings for the EAP-TTLS protocol:

1. Click the **Inner Authentication** tab in the Edit TLS Authentication Method page.
2. If you want requests to be routed based on the methods listed in the directed realm, enter the name of a directed realm in the **Directed Realm** field.

Omitting this setting causes the inner authentication request to be handled like any other request received from a network access device.

3. If you want requests to be processed by means of a realm selection script, enter the name of a script in the **Realm Selection Script** field.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-TTLS protocol:

1. Click the Advanced Server Settings tab in the Edit TTLS Authentication Method page.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter the maximum number of seconds you want to allow for the EAP authentication sequence in the **Max Transaction Time** field.

If the EAP authentication sequence takes longer than the number of seconds specified in this field, Steel-Belted Radius terminates the user authentication.

4. Enable the **Return MPPE Keys** check box to specify whether the TTLS authentication method includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the DH Prime Bits list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the Cipher Suites field.

These cipher suites are documented in RFC 2246, “The TLS Protocol Version 1.2,” and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

EAP-PEAP

The EAP-PEAP (Protected EAP) protocol is similar to EAP-TTLS. Unlike EAP-TTLS, which can tunnel any kind of authentication request (such as PAP or CHAP) and extended attributes, PEAP can tunnel only other EAP protocols inside its connection.

EAP-PEAP works in two phases:

- In Phase 1, the client authenticates the server and uses a TLS handshake to create an encrypted tunnel.

- In Phase 2, the server authenticates the user or machine credentials using an EAP authentication protocol. The EAP authentication is protected by the encrypted tunnel created in Phase 1. The authentication type negotiated during Phase 2 can be any valid EAP type, such as GTC (Generic Token Card) or MS-CHAPv2.


Microsoft's implementation of PEAP and Cisco's implementation of PEAP supports different methods of client authentication through the TLS tunnel.

- The Microsoft PEAP implementation requires MS-CHAP-V2 for client authentication.
- The Cisco PEAP implementation supports client authentication by EAP-Generic Token, which Cisco uses both for authenticating token cards and for authenticating users against Windows domain/Active Directory accounts.

The Cisco PEAP implementation supports the ability to hide username identities until the TLS encrypted tunnel is established and authentication phase is complete. The Microsoft PEAP implementation sends the username in clear text in Phase 1 of PEAP authentication.

Steel-Belted Radius supports both Microsoft PEAP and Cisco PEAP.

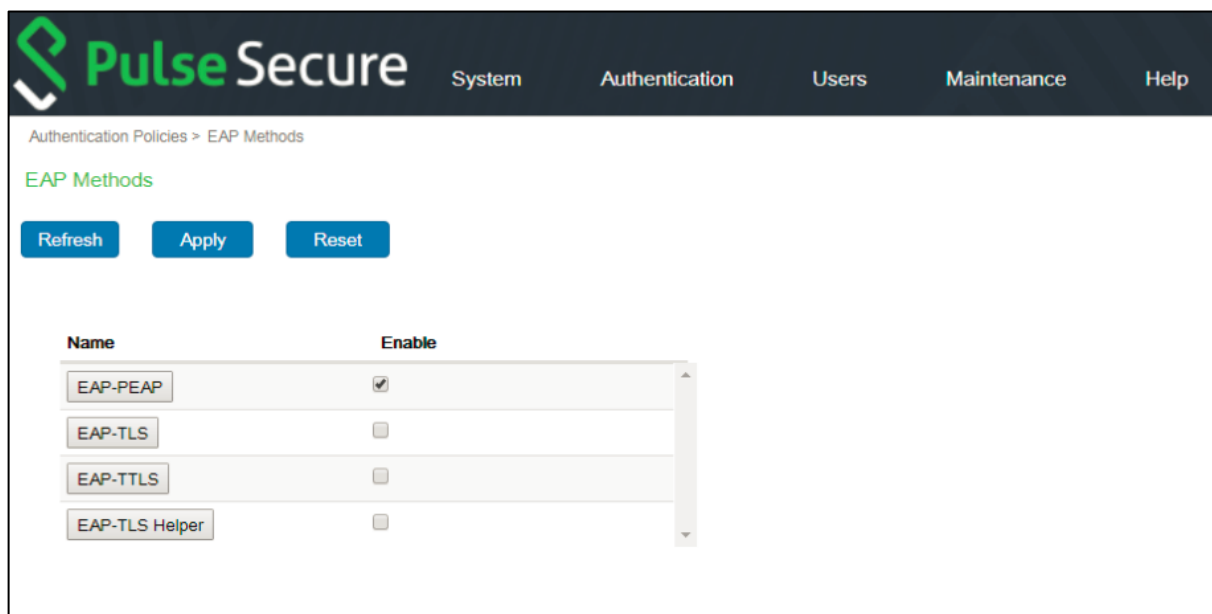
Configuring EAP-PEAP

 **Note:** You must configure the server certificate for the Steel-Belted Radius server before you use the EAP-PEAP authentication method. For information on configuring your server certificate, see [“Configuring Server Certificates”](#).

To configure EAP-PEAP on a Steel-Belted Radius server:

1. Choose **Authentication > Authentication Policies > EAP Methods** from the menubar.

Figure 148: EAP Methods Page



2. Click the **Enable** check box for the EAP-PEAP authentication method.
3. Click the EAP-PEAP button to edit the EAP_PEAP.

The Edit PEAP Authentication Method page opens.

Figure 149: Edit PEAP Authentication Method Page

Edit PEAP Authentication method

[Request Filters](#) [Response Filters](#) [Session Resumption](#)
[Inner Authentication](#) [Advanced Server Settings](#)

☐ Transfer Outer Attribs to New: Select Filter

☐ Transfer Outer Attribs to Continue: Select Filter

☐ Edit New: Select Filter

☐ Edit Continue: Select Filter

OK Cancel


4. Use the tabs in the Edit PEAP Authentication Method page to configure the following settings:

- Request filters
- Response filters
- Session resumption
- Inner authentication
- Advanced server settings

Each configuration task is described separately below.

Configuring Request Filters

Request filters affect the attributes of inner authentication requests. By default, Steel-Belted Radius does not use request filters.

 **Note:** You must configure filters using the Filters page before you can associate them with the EAP- PEAP authentication method. For information on configuring filters, see “[Setting Up Filters](#)”.

To configure request filtering for the EAP-PEAP protocol:

1. Click the **Request Filters** tab in the Edit PEAP Authentication method page.
2. Optionally, click the **Transfer Outer Attribs to New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests).

- If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.
- If this filter is not specified, no attributes from the outer request are transferred to the inner request.

3. Optionally, click the Transfer Outer Attribs to Continue check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

4. Optionally, click the **Edit New** check box and select the filter you want to use from the dropdown list.

This filter affects only a new inner authentication request (rather than continuations of previous requests). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 2) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

5. Optionally, click the **Edit Continue** check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than a new inner authentication request). If this filter is specified, it is applied to the inner request that is the cumulative result of attributes transferred from the outer request (by the filter specified in Step 3) and attributes included in the inner authentication request sent through the tunnel by the client.

If this filter is not specified, the request remains unaltered.

Configuring Response Filters

Response filters affect the attributes in the final response (Access-Accept or Access-Reject) returned to the originating NAD. By default, Steel-Belted Radius does not use response filters.

To configure response filtering for the EAP-PEAP protocol:

1. Click the **Response Filters** tab in the Edit PEAP Authentication method page.
2. Optionally, click the **Transfer Inner Attribs to Accept** check box and select the filter you want to use from the dropdown list.

This filter affects only an outer Access-Accept response that is sent back to a network access device.

- If this filter is specified, the filter is applied to the inner authentication response and all resulting attributes are transferred to the outer authentication response.
 - If this filter is not specified, no inner authentication response attributes are transferred to the outer authentication response.

3. Optionally, click the Transfer Inner Attribs to Reject check box and select the filter you want to use from the dropdown list.

This filter affects only a continued inner authentication request (rather than the first inner authentication request). If this filter is specified, all attributes from the outer request are transferred to the inner request and this filter is applied. The transfer occurs and the filter is applied before any attributes specified in the inner authentication are added to the request.

If this filter is not specified, no attributes from the outer request are transferred to the inner request.

Configuring Session Resumption

Session resumption settings let you specify whether session resumption is permitted and under what circumstances session resumption is performed.

 **Note:** For session resumption to work, the network access device must be configured to handle the Session-Timeout return list attribute, because the network access device must be able to tell the client to re-authenticate after the session timer has expired.

To configure session resumption for the EAP-PEAP protocol:

1. Click the **Session Resumption** tab in the Edit PEAP Authentication method page.
2. Enter the maximum number of seconds you want the client to remain connected to the network access device before having to re-authenticate in the **Session Timeout** field.

If you enter a number greater than 0, the lesser of this value and the remaining resumption limit is sent in a Session-Limit attribute to the RADIUS client on the RADIUS Access-Accept response.

If you enter 0, no Session-Limit attribute is generated. This does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

Entering a value such as 600 (10 minutes) does not necessarily cause a full re-authentication to occur every 10 minutes. You can configure the resumption limit to make most re-authentications fast and computationally cheap.

3. Enter the value that you want returned in a Termination-Action attribute in the **Termination Action** field.

The Termination-Action attribute is a standard attribute supported by most Access Points and determines what happens when the session timeout is reached. Valid values are:

- -1: Do not send the attribute.
- 0: Send the Termination-Action attribute with a value of 0.
- 1: Send the Termination-Action attribute with a value of 1.

Default value is -1. Note that this does not prevent the authentication methods performing secondary authorization from providing a value for this attribute.

4. Enter the maximum number of seconds you want the client to be able to re-authenticate using the TLS session resumption feature in the **Resumption Limit** field.

This type of re-authentication is fast and computationally cheap. It does, however, depend on previous authentications and may not be considered as secure as a complete (computationally expensive) authentication. Specifying a value of 0 disables the session resumption feature.

Configuring Inner Authentication Settings

Inner authentication settings let you specify the manner in which the inner authentication step operates. To configure inner authentication settings for the EAP-PEAP protocol:

1. Click the **Inner Authentication** tab in the Edit PEAP Authentication method page.
2. Optionally, enter the name of a directed realm in the **Directed Realm** field.

Specifying the name of a directed realm causes the request to be routed based on the methods listed in the directed realm. Omitting this setting causes the inner authentication request to be handled like any other request received from a network access device.

3. Optionally, enter the name of a realm selection script in the **Realm Selection Script** field.

You must license the Steel-Belted Radius scripting module to use realm selection scripts. For information on the Steel-Belted Radius scripting module, refer to the Steel-Belted Radius Scripting Guide.

Configuring Advanced Server Settings

Advanced server settings specify the manner in which the inner authentication step operates. To configure advanced server settings for the EAP-PEAP protocol:

1. Click the Advanced Server Settings tab in the Edit PEAP Authentication method page.
2. Enter the maximum length of the TLS message that may be generated during each iteration of the TLS exchange in the **TLS Message Fragment Length** field.

Enter a number in the range 500–4096. This value affects the number of RADIUS challenge/response round-trips required to conclude the TLS exchange. A value of 1400 may result in 6 round-trips, while a value of 500 may result in 15 round-trips.

Some Access Points may have problems with RADIUS responses or EAP messages that exceed the size of one Ethernet frame (1500 bytes including IP/UDP headers).

The default length for TLS messages is 1020 bytes, which prevents the RADIUS challenge response (carried in a UDP packet) from exceeding one Ethernet frame.

3. Enter xxx in the **Max Transaction** Time field.

4. Enable the **Return MPPE Keys** check box to specify whether the EAP-PEAP module includes RADIUS MS-MPPE-Send-Key and MS-MPPE-Recv-Key attributes in the final RADIUS Access-Accept response sent to the Access Point.

You should enable this option if the Access Point needs to key the WEP encryption. If the Access Point is authenticating only end-users and WEP is not being used, you can clear this check box.

5. Use the DH Prime Bits list to specify the number of bits in the prime number that the module uses for Diffie-Hellman exponentiation.

Selecting a longer prime number makes the system less susceptible to certain types of attacks but requires more CPU processing to compute the Diffie-Hellman key agreement operation.

Valid values are 512, 1024, 1536, 2048, 3072, and 4096 bits.

6. Enter the TLS cipher suites (in order of preference) that the server is to use in the **Cipher Suites** field.

These cipher suites are documented in RFC 2246, "The TLS Protocol Version 1.2," and other TLS-related RFCs and draft RFCs.

Default value is 0x3C, 0x3D, 0x67, 0x6B, 0x40, 0x6A, 0x9C, 0x9D, 0x9E, 0x9F, 0xA2, 0xA3.

7. Enter the minimum version of the PEAP protocol that the server should negotiate in the **PEAP Minimum Version** field.

If you enter 0, the server negotiates version 0, which is compatible with Microsoft's initial PEAP implementation (shipped in Microsoft XP Service Pack 1).


If you enter 1, the server negotiates version 1, which is compatible with Cisco's initial PEAP implementation (shipped in Cisco ACU).

 **Note:** The value entered in this setting must be less than or equal to the value entered for the PEAP Maximum Version field.

8. Enter the maximum version of the PEAP protocol that the server should negotiate in the PEAP Maximum Version field.

If you enter 0, the server negotiates version 0, which is compatible with Microsoft's initial PEAP implementation (shipped in Microsoft XP Service Pack 1).

If you enter 1, the server negotiates version 1, which is compatible with Cisco's initial PEAP implementation (shipped in Cisco ACU).

 **Note:** The value entered in this setting must be equal to or greater than the value entered for the **PEAP Minimum Version** field.

Configuring Server Certificates

You must install cert if

Adding a Server Certificate

To add a certificate to the Steel-Belted Radius server:

1. Choose **Authentication > Authentication Policies > Certificates** from the menubar.

Figure 150: Certificates Page

Pulse Secure

System Authentication Users Maintenance Help

Authentication Policies > Certificates

Certificates

Refresh Apply Reset Delete

Current Certificate

Issued to:

Issued by:

Expiration:

Friendly name:

Choose Files No file chosen

Import

Advanced

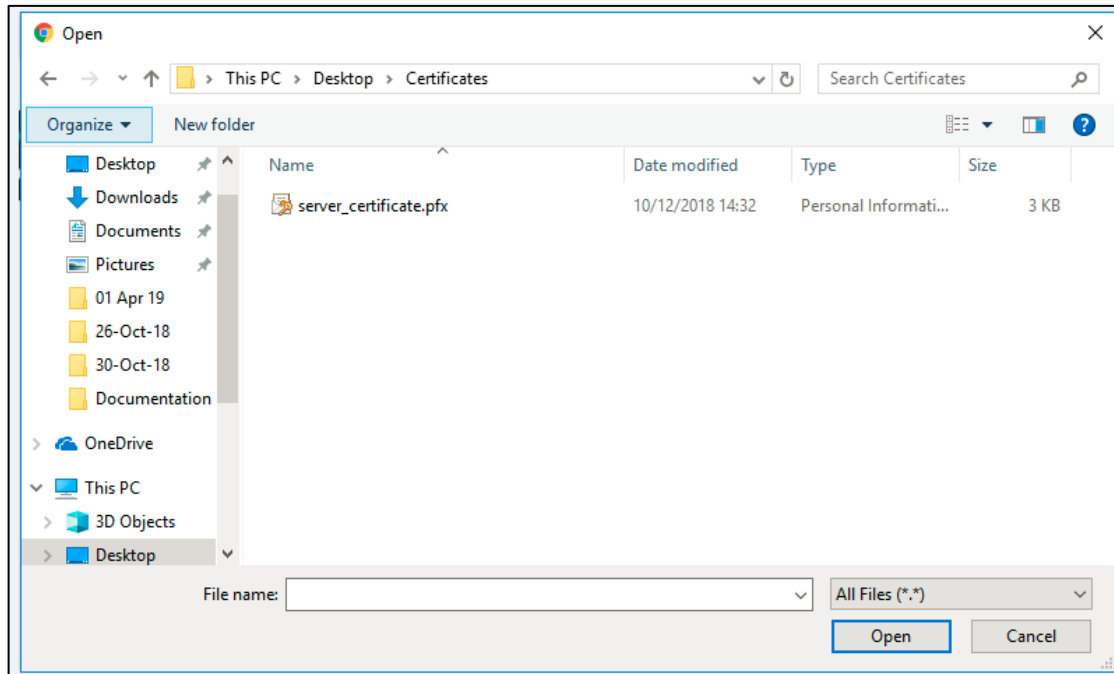
Create certificate request:

Certificate expiration warning: days

2. Click the **Choose File/Browse** button.
3. When the Select Server Certificate page opens (Figure 151: Select Server Certificate Page), navigate to the location of your server certificate, select the .pfx extension certificate you want to use, and click **Open**.

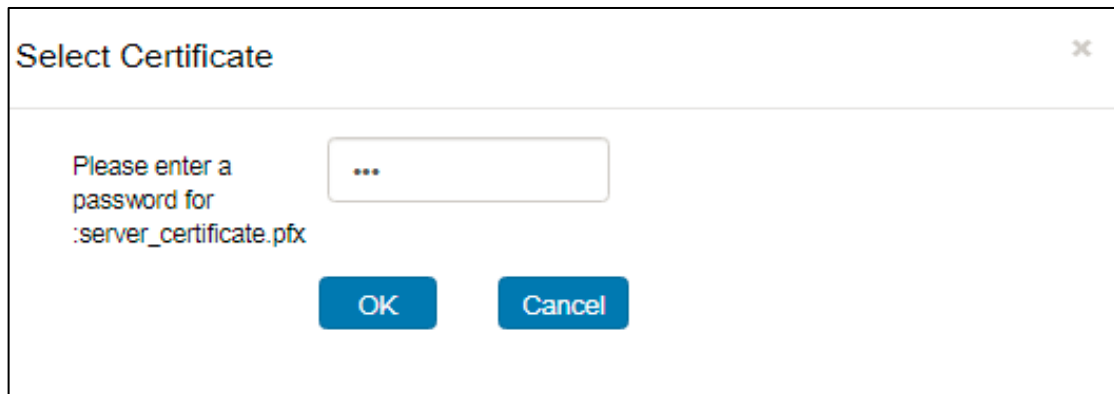
 **Note:** The new WebGUI Administrator accepts certificates with only .pfx extension.

Figure 151: Select Server Certificate Page



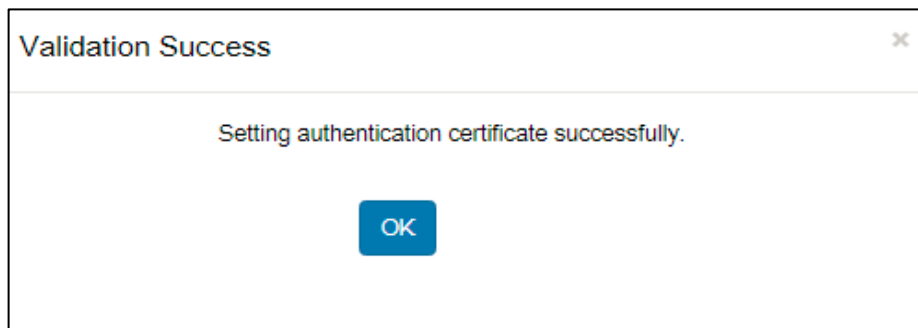
4. When the Select Certificate page (Figure 133) opens, enter the password for the certificate you selected and click **OK**.

Figure 152: Select Certificate Page



5. When the Validation Success dialog appears, click **OK**.

Figure 153: Validation Success Page



Configuring a CDP Web Proxy

Your network security policies may prohibit Steel-Belted Radius from making a direct HTTP connection to a CRL distribution points (CDP). You can configure an HTTP proxy server to relay requests from Steel-Belted Radius for updated certificate revocation lists to an external CDP.

To configure a CDP web proxy server:

1. Choose **Authentication > Authentication Policies > CDP Web Proxy Configuration** from the menubar.

Figure 154: CDP Web Proxy Configuration Page

The screenshot shows the Pulse Secure web interface for configuring CDP Web Proxy. The breadcrumb trail is 'Authentication Policies > CDP Web Proxy Configuration'. There are three buttons at the top: 'Refresh', 'Apply', and 'Reset'. The main heading is 'CRL Web Proxy Settings'. Under this heading, there are two radio button options: 'Connect Directly to the Internet' (which is selected) and 'Connect to the Internet using a Proxy'. Below these options are three input fields: 'HTTP Proxy:', 'Port:', and 'No Proxy for:'. At the bottom of the form is a 'Flush CRL Caches' button.

2. Specify whether you want Steel-Belted Radius to use a proxy to connect to an external CDP.
 - If you click **Connect Directly to the Internet**, Steel-Belted Radius can connect to an external CDP without going through an HTTP proxy. If you select this option, you can skip the rest of this procedure.
 - If you click **Connect to the Internet Using a Proxy**, Steel-Belted Radius must go through an HTTP proxy to connect to a CDP.
3. Enter the name or IP address of the HTTP proxy in the **HTTP Proxy** field.
4. Enter the port number to use for the HTTP proxy in the **Port** field.
5. Optionally, identify the hosts for which no HTTP proxy is required in the **No Proxy For** field. If a CDP host matches an entry in this field, Steel-Belted Radius bypasses the HTTP proxy and attempts to open a connect to the host directly.

You can enter the names or IP addresses of hosts or the names of domains, separating each entry

with a comma or semi-colon. Steel-Belted Radius compares IP addresses and host names using an exact string match. For example, if you enter `cdp.pulsesecure.net` in the exclusion list, that will match the CDP hostname `cdp.pulsesecure.net` but not `host.cdp.pulsesecure.net` or `host-cdp.pulsesecure.net`.

To exclude all hosts within a domain (but not the host name that matches the domain name), start the domain name with a period (`.pulsesecure.net`). To exclude both the host and the domain `pulsesecure.net`, create two entries in the exclusion list (`.pulsesecure.net`, `pulsesecure.net`).

Wildcard matching for host or domain names is not supported.

The values `localhost` and `127.0.0.1` are included in the No Proxy For list by default.

6. Optionally, click the **Flush CRL Caches** button to purge all information in the TLS and TTLS CRL caches immediately. When the Flush CRL Caches button is clicked, all CRL entries for registered clients are purged from the in-memory cache and deletes all files from the CRL cache directories.



Note: If you click the **Flush CRL Caches** button, the caches are purged immediately. You are not asked to confirm your action.

Configuring the Server

Depending on your authentication requirements, you may need to configure Steel-Belted Radius to work with an external SQL or LDAP database, RSA SecurID service, or TACACS+.

Configuring External Databases (Linux)

If you run Linux and want to use external databases for authentication or accounting purposes (and you did not configure this feature when prompted by the Steel-Belted Radius installation script), you can set up external database configuration settings.

To configure Steel-Belted Radius to work with an external database:

1. Optionally, perform the instructions in “Configuring SQL Authentication” and/or Chapter 19, “Configuring SQL Accounting”.
2. If you want to use Steel-Belted Radius with an LDAP database, review your LDAP database vendor’s documentation.
3. Perform the instructions in “Configuring LDAP Authentication”.

Configuring SecurID Authentication

If you want to use SecurID authentication, you must configure Steel-Belted Radius to communicate with the RSA SecurID server.

Perform the following steps to configure a Steel-Belted Radius server to work with an RSA SecurID server. If you are not familiar with the RSA SecurID server, contact your RSA SecurID server administrator for assistance.

1. Verify that the Steel-Belted Radius server has an entry on the RSA SecurID server.

Start the RSA SecurID server administration program and display the list of clients. If the list of clients does not include the Steel-Belted Radius server, select **Client > Add Client** and complete the Client window, giving the Steel-Belted Radius server a Client type of **Net OS Client**.

2. Copy the `sdconf.rec` file from the `VACE\data` directory on the RSA SecurID server to the appropriate directory on the Steel-Belted Radius server:

- **Windows:** C:\winnt\system32
 - **Linux:** the directory that contains the radius daemon on the Steel-Belted Radius server.
3. Edit the [SecurID] section of radius.ini. The radius.ini file is found in the same directory as the Steel-Belted Radius service or daemon.

Verify that the **CachePasscodes** field is set to **yes** and the **SecondsToCachePasscodes** field is set to an appropriate number of seconds. These settings ensure that authenticated SecurID users can open a second B-channel during an ISDN connection.
 4. Edit the [SecurID] section of the eap.ini file, which is found in the same directory as the Steel-Belted Radius service or daemon.

Verify that the EAP settings in this section are enabled (remove the semi-colon from the start of each line) if you plan to use RSA SecurID authentication with EAP Generic-Token protocol support. The client system must support this protocol as well for this combination to work.
 5. If you copy the sdconf.rec file after the Steel-Belted Radius service (daemon) has been started, or if you edit the radius.ini or eap.ini files after Steel-Belted Radius has been started, stop and restart Steel-Belted Radius.
 6. Verify connectivity between the Steel-Belted Radius server and the RSA SecurID server.

The RSA SecurID server offers a monitoring window on which it logs every authentication transaction, complete with the reason for the accept or reject decision. You can verify that pass-through to RSA SecurID is working, by creating a SecurID User called <ANY> and then attempting to access the network. Look for your request on the RSA SecurID monitor screen. If access is denied, you'll know that there's a configuration problem. Try these steps again, or contact your RSA SecurID administrator for assistance.

These steps complete initial setup of the two servers. To fully enable pass-through authentication to the RSA SecurID server, you must also set up the SecurID authentication method.

Configuring the Location of the sdconf.rec File

The VAR_ACE variable in the sbrd script file (Linux) lets you specify the directory holding the sdconf.rec file. The VAR_ACE variable must be exported so that Steel-Belted Radius can use it.

For example:

```
VAR_ACE="radiusdir/ace"
export VAR_ACE
```

This variable is set by default in the file to point to the radiusdir directory. If the variable is not set at all in the file, the server sets the value of this variable to

```
/var/ace.
```

Configuring TACACS+ Authentication

If you want to use TACACS+ authentication, you must configure Steel-Belted Radius to communicate with the TACACS+ server.

Perform the following steps to configure a Steel-Belted Radius server to work with a TACACS+ server.

1. Verify the tacplus.ini file is present in the Steel-Belted Radius directory.

The tacplus.ini file must be present in the same directory as the Steel-Belted Radius service (in the case of Windows, usually C:\Program Files (x86)\Pulse Secure\Steel-Belted Radius\Service), or daemon (in the case of Linux). This happens automatically following installation.

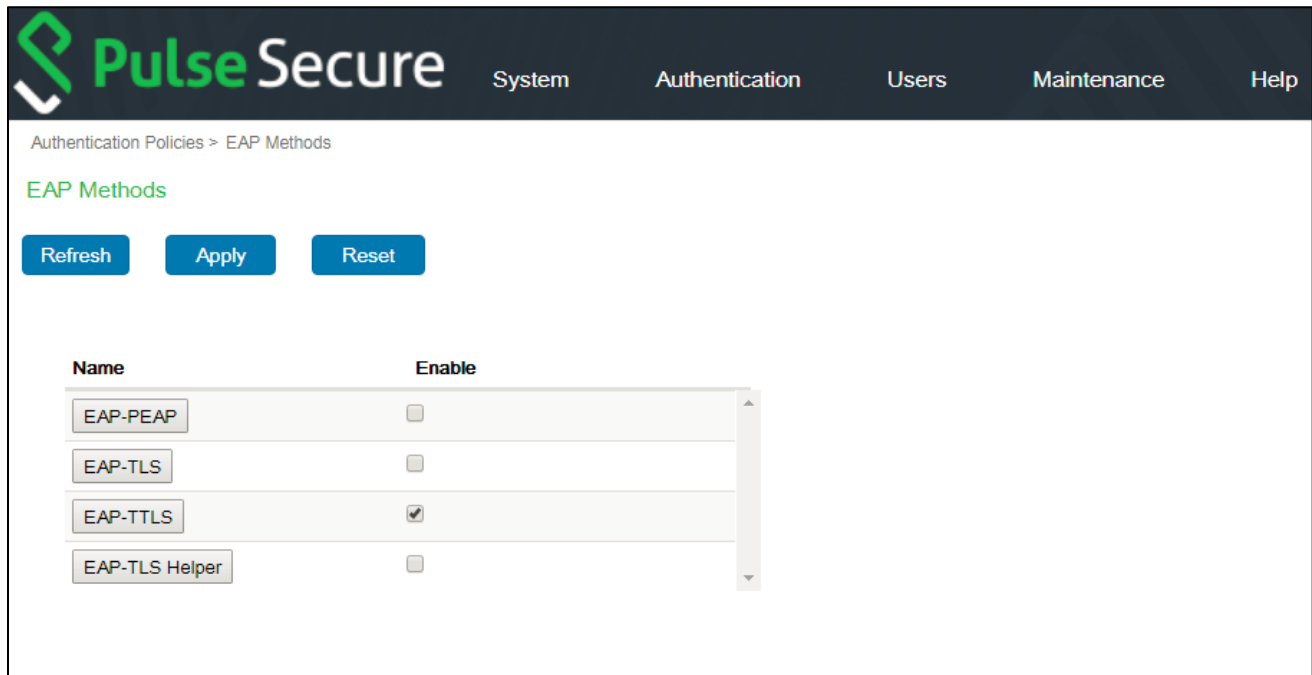
2. Edit the tacplus.ini file to identify the shared secret and host machine that you use for TACACS+. For more information on the tacplus.ini file, refer to the Steel-Belted Radius Reference Guide.
3. If you edit tacplus.ini after Steel-Belted Radius has been started, then you must stop and restart it before your changes take effect.

To enable pass-through authentication to the TACACS+ server, you must also set up the TACACS+ authentication method. For more information, see [“Configuring TACACS+ Authentication”](#).

Activating EAP Methods

The EAP Methods page permits you to activate authentication methods and define the order in which different authentication methods are attempted.

Figure 155: EAP Methods Page



To use the EAP Methods page:

1. Choose **Authentication > Authentication Policies > EAP Methods** from the menubar.
2. Click the **Enable** check box to enable the EAP authentication methods you want Steel-Belted Radius to use.

To revert to the previous settings, click **Reset**.

Configuring EAP Settings

When Steel-Belted Radius receives a username, it does not know in advance to which authentication category this user belongs. It must try each method that it currently has configured and enabled. The authentication methods list allows you to fine-tune the sequence of authentication attempts.

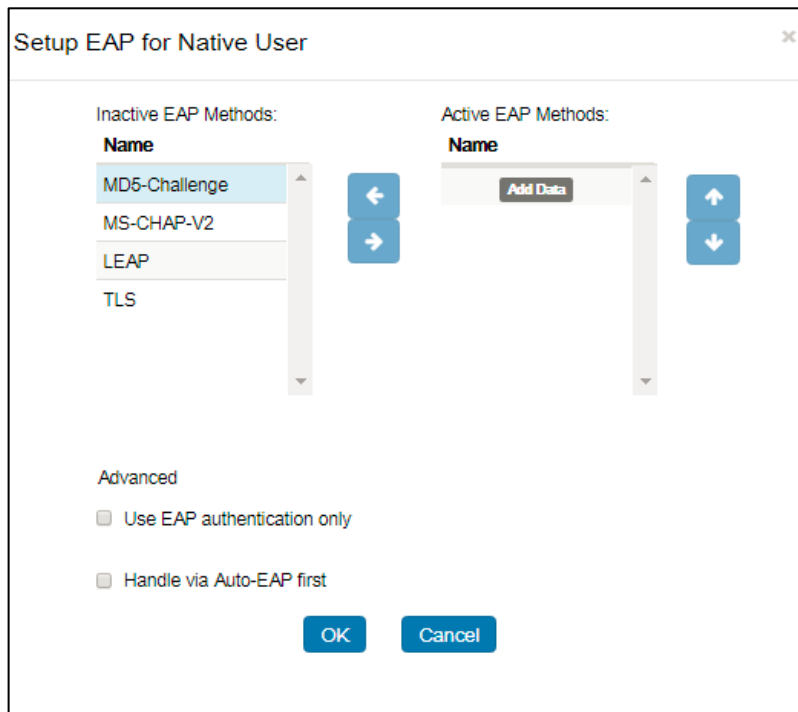
Note: The EAP Setup dialog displays the authentication methods that have been enabled (by editing the Enabled setting in the appropriate *.aut file).

To set up EAP settings for an authentication method:

1. Select the authentication method you want to set up in the Authentication Methods tab.
2. Click the **EAP Setup** button.

The Setup EAP page opens.

Figure 156: Setup EAP Page



3. Optionally, change the order in which the methods are tried by highlighting a method and clicking the **Up** or **Down** buttons.
4. To activate a method, (so that it can be used for authentication), move the methods from Inactive EAP Methods to Active EAP Methods.

If you want to deactivate a method (so that it is not used for authentication), move the methods from Active EAP Methods to Inactive EAP Methods.

Active check box.

5. If you want to restrict use of this authentication method to requests that contain EAP credentials, click the **Use EAP authentication only** check box.

When this option is enabled, Steel-Belted Radius prevents the authentication method from being called for any request that does not contain EAP credentials, and bypasses the authentication method if an authentication request specifically requests an EAP protocol that is not listed in the authentication method's **EAP-Type** list in the **eap.ini** file.

6. If you want Steel-Belted Radius to use an automatic EAP helper to generate credentials for a user, click the **Handle via Auto-EAP first** check box.

You should unclick the check box if an authentication method is capable of handling EAP credentials on its own (without an EAP helper).

See [“First-Handle-Via-Auto-EAP Setting”](#).

7. Click **OK** to return to the Authentication Methods tab.

Configuring Authentication Rejection Messages

When Steel-Belted Radius issues an Access-Reject message in response to a failed authentication request, it can identify the reason why the request was rejected. You can configure the message text returned to the RADIUS client (and possibly to the user, if the RADIUS client forwards the message) when a particular error occurs. This text is inserted into the standard RADIUS attribute Reply-Message within the Access-Reject response.

To configure the text for authentication rejection messages:

1. Choose Authentication > Authentication Policies > Reject Messages from the menubar.

Figure 157: Authentication Policies Page: Reject Messages Tab

Pulse Secure System Authentication Users Maintenance Help

Authentication Policies > Reject Messages

Reject Messages

Refresh Apply Reset

Unknown User

Check List Failure

Invalid Attribute

Other

2. Use the **Unknown User** field to specify the message Steel-Belted Radius returns when the username and password authentication failed.
3. Use the **Checklist failure** field to specify the message Steel-Belted Radius returns when the user was

authenticated but is being rejected because the RADIUS request did not fulfill the requirements of the checklist.

4. Use the **Invalid attribute** field to specify the message Steel-Belted Radius returns when the request contained an attribute in violation of the RADIUS specification.
5. Use the **Other** field to specify the message Steel-Belted Radius returns when some other error, such as a resource failure, occurred.
6. When you are asked to confirm that you want to save your changes, click **Yes**.

Chapter 23

Configuring Replication via Legacy SBR Administrator

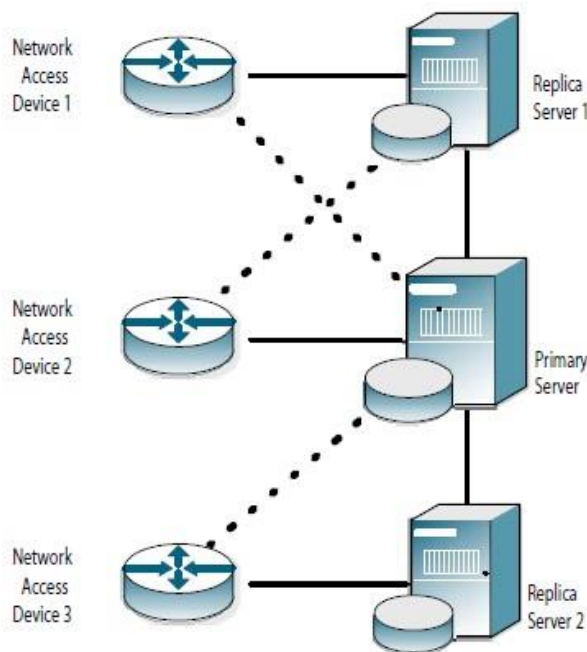
This chapter describes how to configure and use the centralized configuration management (CCM) feature to coordinate Steel-Belted Radius server settings in a replication environment via SBR administrator.

About Replication

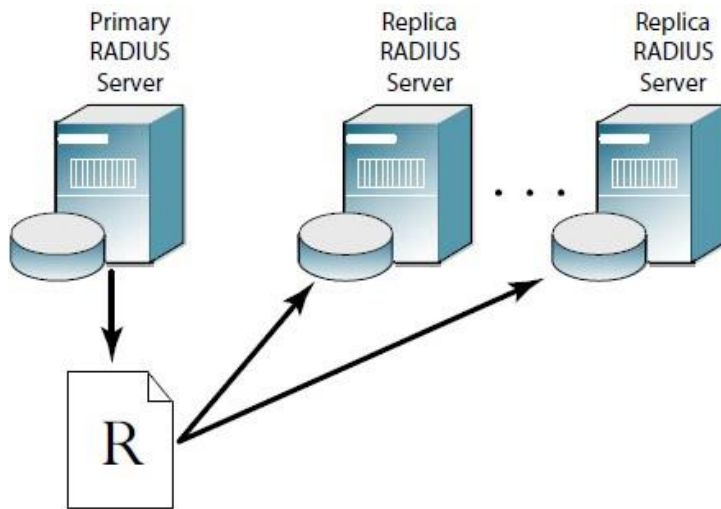
Steel-Belted Radius supports the replication of RADIUS configuration data from a primary server to one or more replica servers within a replication realm. Replication provides administrators with an easy way to configure multiple servers that require the same information. Depending on network configuration, you can use replication to increase AAA capacity, balance AAA traffic across RADIUS servers, or ensure that authentication services are not interrupted if access to a primary or replica server is interrupted (redundancy).

Figure 158 illustrates an environment where RADIUS traffic is load-balanced by configuring each network access device to authenticate users through a different RADIUS server (solid line). If a RADIUS server becomes unavailable, the NAD can fail over to its backup RADIUS server (dotted line).

Figure 158: Using Replication for Load Balancing and Redundancy



All the servers within a realm reflect the current configuration specified by the network administrator: the network administrator modifies the configuration on the primary server, and the primary server propagates the new configuration to its replica servers. For example, after a network administrator configures a new RADIUS client or profile on the primary server, the network administrator tells the primary server to publish a date-stamped configuration package file that contains the updated configuration information. After publication, the primary server notifies each replica server that a new configuration package is ready. Each replica server then downloads and installs the configuration package to update its settings.

Figure 159: Publication and Distribution of Replication Packages

The primary server maintains a list of the replica servers that have registered with it. The primary server uses this list to track which servers to notify after it publishes an updated configuration package to resynchronize the configuration of replica servers.

Note: You should limit access to the directory in which you store configuration packages on Windows servers to the CREATOR OWNER, SYSTEM, and Administrators. To set file access permissions for the \Radius\Service directory, right-click the directory icon, click the Security tab, click the Allow and Deny check boxes to limit access to authorized users.

By default, file permissions for configuration packages on Linux servers are set to rw-rw----, which excludes users other than the file owner and the owner's group from displaying the contents of file packages.

If the primary server needs to be taken out of service for an extended period, the network administrator promotes one of the replica servers to be the new primary server. Thereafter, the other replica servers copy the configuration package from the promoted primary server.

The following types of information are included in a replication package.

Server information


- RADIUS client information
- User information
- Profile information
- Proxy target information
- EAP method configurations
- Filters
- RADIUS tunnel information
- Name parsing information

- Authentication method information
- Authentication realm information
- Rejection messages
- Javascript (.jsi) files

You administer this information by connecting the SBR Administrator to the primary server: the information is propagated to the replica servers in the domain. (If you connect the SBR Administrator to a replica server, you can view this information, but you cannot modify it.)

The following types of information are not included in a replication package:

- Address pool information—You administer address pools for a server by connecting the SBR Administrator to that server. Because an address must not be assigned to two users at the same time, each server in a realm must have its own address pools, and these pools must not overlap.
- Administrator information—Administrator information must be configured for each primary and replica server separately.
- Statistics information—Server statistics are not replicated. You can view statistics for replica servers when you connect SBR Administrator to the primary server.
- Report information—Report information is not replicated. To obtain report information for a primary or replica server, connect SBR Administrator to the applicable server.
- Steel-Belted Radius configuration files— Configuration files (*.ini files (other than filter.ini and eap.ini), *.aut files (other than peapauth.aut, ttlsauth.aut, tlsauth.aut, and talsauth.eap), and *.dir files are not replicated. When you change configuration files on the primary server, you must copy the modified files to the appropriate directory on each replica server.

 **Note:** Configuration packages are retained until they are replaced. An old configuration package is automatically deleted 24 hours after a new configuration package is published.

Replication Requirements

Servers in a replication realm must comply with the following requirements.

- All servers in a replication realm must be running the same operating system (Windows or Linux).
- All servers in a replication realm must be running the same version and edition (Global Enterprise Edition, Service Provider Edition, or Enterprise Edition) of Steel-Belted Radius.
- All servers in a replication realm must be configured to support the same types of users (domain, host, RSA SecurID, TACACS+, or UNIX).
- If RSA SecurID is enabled on the primary server, RSA SecurID must be enabled on the replica servers, and all servers in the realm must have consistent sdconf.rec files.
- The system clocks on servers in a replication realm must be synchronized to within 10 minutes of one another and their time zones must be configured correctly. Steel-Belted Radius uses the system clock value and time zone setting to convert local time to Universal Time Coordinated (also known as Greenwich Mean Time) when evaluating synchronization. If possible, you should use a Network Time Protocol (NTP) server to set the system clock on all servers automatically.

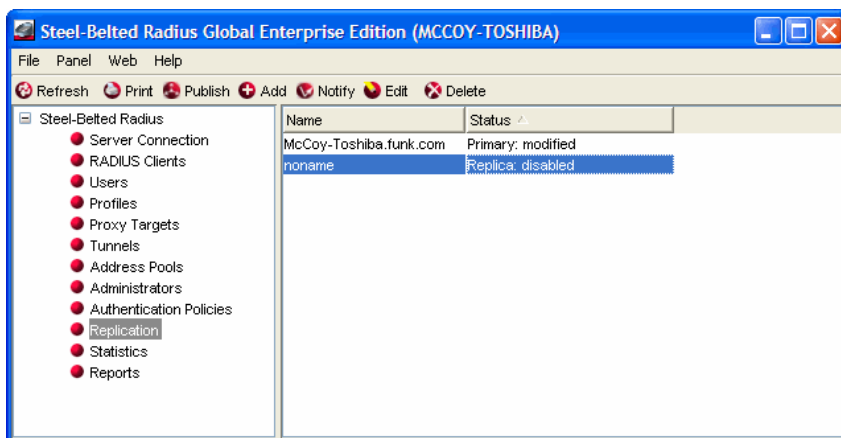
- All servers in a replication realm must use the same TCP port to exchange replication information. The default port for replication communication is TCP 1812, though you can specify another port for replication traffic by modifying the radius.ini file.
- If a firewall stands between servers in a replication realm, the firewall must be configured to pass traffic on the port used for replication communication.

Configuring Replica Servers

The Replication panel (Figure 160) lets you add servers to a replication realm, initiate publication of a replication package by a primary server, and notify replica servers that they should download and install a new replication package.

Adding a Replica Server

Figure 160: Replication Panel



In most situations, you add a replica server to a realm as follows:

1. Copy the replica.ccmpkg configuration package file from the primary server to a directory on the host you want to add as a replica server.

Note: The replica.ccmpkg file contains sensitive information, and should not be stored in a publicly accessible location, such as a file server or shared directory.

2. Install the Steel-Belted Radius server software on the host you want to add as a replica server.
3. When the installer (Windows) or configuration script (Linux) asks what kind of server you are installing, choose **Replica** and, when prompted, enter the path to the replica.ccmpkg file.
4. Restart the host you want to add as a replica server.

The replica server registers itself with the primary server automatically after it is restarted. Thereafter, the replica server automatically connects to the primary server once an hour to check whether an updated configuration package is available.

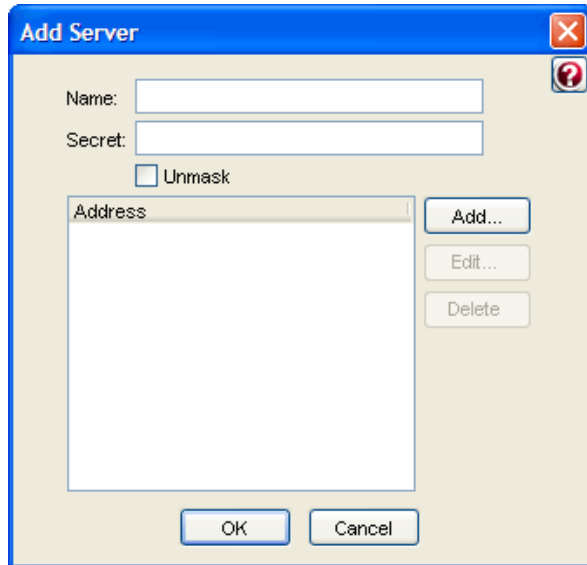
In some circumstances, however, you may want to add a replica server to the server list on the primary server manually so that it shows up immediately. To register a replica server manually:

1. Run SBR Administrator and connect to the primary server.

2. Open the Replication panel.
3. Click the **Add** button.

The Add Server dialog opens.

Figure 161: Add Server Dialog



4. Enter the name of the RADIUS server in the **Name** field.

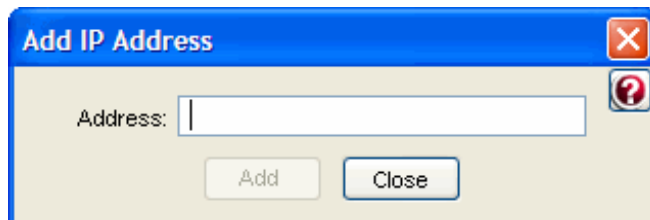
Although you can assign any name to a RADIUS server, you should use the device's hostname to avoid confusion.

5. Enter the replication secret for the RADIUS server in the **Secret** field.

For privacy, asterisks are echoed as you type. You can click the **Unmask** check box to display the characters in the shared secret.

6. Enter one or more IP addresses for your server.
 - a. Click the **Add** button.
 - b. When the Add IP Address dialog (Figure 162) opens, enter an IP address you want to associate with the server in the **Address** field and click **Add**.

Figure 162: Add IP Address Dialog



- c. Repeat Step 5b until you have finished adding IP addresses for the server.
 - d. Click **Close**.

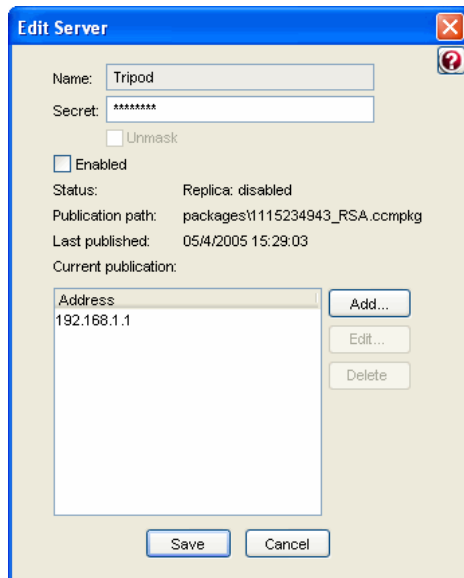
Enabling a RADIUS Server

To enable a RADIUS server:

1. Open the Replication panel.
2. Select the RADIUS server you want to enable and click the **Edit** button (or double-click the RADIUS server entry).

The Edit Server dialog opens.

Figure 163: Edit Server Dialog



3. Click the **Enabled** check box.
4. Click the **Save** button.

Deleting a RADIUS Server

To delete a replica server from a realm:

1. Open the Replication panel.
2. Select the RADIUS server entry you want to delete.
3. Click the Delete button on the SBR Administrator toolbar.
4. When you are prompted to confirm the deletion request, click Yes.

Publishing Server Configuration Information

If you change the configuration of your primary server, you must publish the modified configuration so that your replica servers can download the modified settings.

To publish server configuration information:

1. Open the Replication panel.
2. Click the Publish button on the toolbar.

This creates a file called `/radius/packages/timestamp_RSA.ccmpkg` (Linux) or `\Radius\Service\packages\timestamp_RSA.ccmpkg` (Windows), where `timestamp` reflects the date and time the package was created.

Notifying Replica RADIUS Servers

Under normal circumstances, a replica server connects to its primary server every hour to check whether a new `replica.ccmpkg` file has been published. If necessary, a network administrator can manually notify a replica server to download and install the current configuration package from the primary server. Manual notification is useful when network issues prevent the automatic download and installation of a configuration package when it is first published, and the configuration on the replica no longer matches the configuration on the primary server.

 **Note:** You can display the Replication panel to determine the status of your replica servers.

To notify replica servers that new configuration information has been published:

1. Open the Replication panel.
2. Select the replica server you want to notify.
3. Click the Notify button on the toolbar.

The replica server downloads and installs its configuration package from the primary server. After the package is installed, the replica server is resynchronized with the primary server.

Designating a New Primary RADIUS Server

You can change which server within a realm is designated as the primary server for that realm.

To designate a new primary server:

1. Stop the RADIUS service on the replica server.
2. Log into the replica server as root.
3. Open a command window and navigate to the `\Radius\Service` directory (Windows) or `/opt/PSsbr/radius` directory (Linux).
4. Run the `sbrsetuptool` utility with the `promote` option.

```
# sbrsetuptool -promote
```

The utility creates a configuration package to change this server to the primary server.

5. Restart the updated replica server to make it the new primary server.
6. Publish a new configuration package administratively to configure all replica servers to use the new primary server.

After you designate a new primary server for a realm, the old primary server becomes a replica server automatically.

Recovering a Replica After a Failed Download

If a replica server fails during the download of a configuration package, its configuration may be corrupted or it may have a stale secret.

To recover after a failed download:

1. Stop the RADIUS service on the replica server.
2. Log into the replica server as root.
3. Open a command window and navigate to the \Radius\Service directory (Windows) or /opt/PSsbr/radius directory (Linux).
4. Run the sbrsetuptool utility with the identity option and information on where to download configuration information.

To obtain configuration from a configuration package, issue the following command:

```
# sbrsetuptool -identity REPLICA -reppkg pathname
```

where pathname specifies the path to a replica.ccmpkg package.

To obtain configuration from the primary server for the realm, issue the following command:

```
# sbrsetuptool -identity REPLICA -primary name address secret
```

where name specifies the DNS name of the primary server, address specifies the IP address of the primary server, and secret specifies the shared secret used to authenticate configuration downloads.

5. Restart the updated replica server so that it can load its new configuration.

After the replica server is restarted, it will be re-synchronized with the current primary server.

Changing the Name or IP Address of a Server

You may need to change the DNS name or IP address assigned to a primary or replica server if your network changes.

To change the DNS name or IP address of a primary or replica server:

1. Stop the RADIUS service on the RADIUS server you want to change.
2. Log into the RADIUS server as root.
3. Open a command window and navigate to the \Radius\Service directory (Windows) or /opt/PSsbr/radius directory (Linux).
4. Run the sbrsetuptool (Linux) utility with the identity option. To

rename a primary server, enter the following command:

```
# sbrsetuptool -identity PRIMARY
```

To rename a replica server, enter the following command:

```
# sbrsetuptool -identity REPLICA
```

5. Restart the updated server so that it can load its new configuration.
6. Run the SBR Administrator and modify the DNS name or IP address for the server you want to rename. Verify that the secret on the renamed server is correct.

You may need to use the Replication panel to delete the old server name from the list of servers in

the realm.

- Publish the modified configuration to propagate the name change to the replica servers.

Replication Error Messages

The following tables list possible causes for error messages caused by replication issues.

Error Messages on Replica Servers

Table 34 lists possible causes for error messages on replica servers in a replication realm.

Table 34: Error Messages on Replica Servers

Error Type	Error Message	Possible Cause
Post Errors (Errors with Notification from Primary)	CRadManagedServerNotifyPost:: ExecutePost invalid signature!	Mismatched replication secret.
	CRadManagedServerNotifyPost:: ExecutePost invalid sequence number	Two posts have the same sequence number. The clocks on the primary and replica are more than 10 minutes apart.
	CRadManagedServerNotifyPost:: ExecutePost decrypt failed	Shared secret failed to decrypt. Bad Replication Secret secret.
	CRadManagedServerNotifyPost:: ExecutePost invalid <body> missing parameters	Post had an invalid xml request.
Update Errors (Errors with Published package from Primary)	CRadManagedServerUpdate:: DoStart Failed to open 'file_name' for writing	Temp directory does not exist. Temp directory or file have incorrect permissions.
	CRadManagedServerUpdate:: StartUpdates has already started update	Update is already in progress.
	CRadManagedServerUpdate:: DownloadPackage HTTP POST error:errCode Primary ID	Error in transmitting request to Primary (timeout during transmit).
	CRadManagedServerUpdate:: DownloadPackage HTTP headers parsing error	Error in receiving package. Typically caused by a timeout during receive resulting from an invalid package.
	CRadManagedServerUpdate:: DownloadPackage connection primary IP Addr error: errCode Primary ID	Replica failed to connect with Primary. Primary not running.
	CRadManagedServerUpdate:: DownloadPackage exceeded iterations limit while communicating with CCM	Update failed after three attempts.
	CRadManagedServerUpd	Secrets on Replica and Primary do not match.

Error Type	Error Message	Possible Cause
Update Errors (Errors with Published package from Primary)	ate:: ProcessPackage signature mismatch	
	CRadManagedServerUpdate:: ProcessPackage CCM error: 'Error String' 'Parameter'	Error parsing downloaded packages.
	CRadManagedServerUpdate:: ProcessPackage Failed to open \'\' << file_name << \'\' for writing	Temp directory does not exist. Temp directory or file has incorrect permissions.
	CRadManagedServerUpdat e:: ProcessPackage thumbprint mismatch	Invalid package. Republish the package.
Proxy Errors (Statistics retrieve errors)	CRadProxyPost:: ExecutePost invalid signature!	Mismatched replication secret.
	(Statistics retrieve	Two posts have the same sequence number. The clocks on the primary and replica are more than 10 minutes apart.
	errors)	Shared secret failed to decrypt. Bad Replication Secret.
	CRadProxyPost:: ExecutePost invalid <body> missing parameters	Post had an invalid XML request.

Error Messages on Primary Servers

Table 35 lists possible causes for error messages on primary servers in a replication realm.

Table 35: Error Messages on Primary Servers

Error Type	Error Message	Possible Cause
Notify Target (Both Notify and Publish send a notification)	CRadConfigManagedServerHTTP Notification::NotifyTarget failed to fetch	Replica does not exist in database. This can occur if two administrators are running instances of SBR Administrator, one administrator deletes a replica, then the other administrator tries to publish to that replica.
	CRadConfigManagedServerHTTP Notification::NotifyTarget failed replicad	Notify failed to communicate with replica, Replica is not running, or check Replica DCF log for more information.
Publication Provider (requests from GUI to Notify or Publish)	CRadConfigPublicationProvider:: UpdateResource notify invoked when not Primary	Attempted to Notify as a Replica, this is only allowed from a Primary.
	CRadConfigPublicationProvider:: UpdateResource publish invoked when not Primary	Replica attempted to publish; publication is permitted only from a Primary.
Publication Post (parsing of Post from replica to get data)	CRadConfigServerProviderPost:: ExecutePost	Replica and Primary have different replication secrets.

Error Type	Error Message	Possible Cause
Proxy Errors (Statistics retrieve errors)	signature mismatch with server: CRadConfigServerProvider:: GetResource invoked when not Primary	Another Replica is requesting a download from this server which is a replica. Replica that is requesting a download needs to be reconfigured (see disaster recovery in docs).
	CRadProxyClient:: Send failed to fetch	Replica does not exist in database. This can occur if two administrators are running instances of SBR Administrator, one administrator deletes a replica, then the other administrator tries to publish to that replica.
	CRadProxyClient:: SendData HTTP POST error:	Connection error with replica.

Chapter 24

Configuring Replication via WebGUI

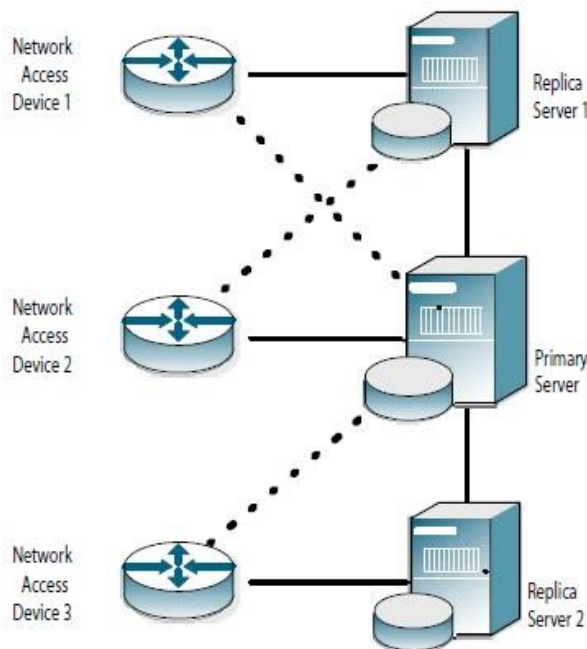
This chapter describes how to configure and use the centralized configuration management (CCM) feature to coordinate Steel-Belted Radius server settings in a replication environment via WebGUI.

About Replication

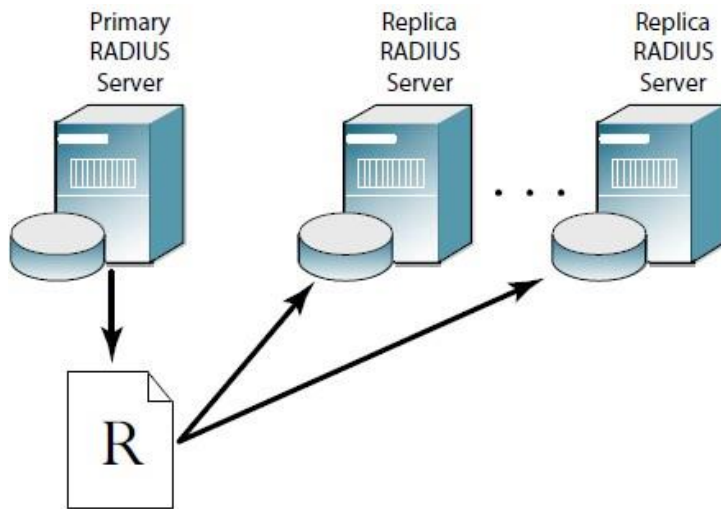
Steel-Belted Radius supports the replication of RADIUS configuration data from a primary server to one or more replica servers within a replication realm. Replication provides administrators with an easy way to configure multiple servers that require the same information. Depending on network configuration, you can use replication to increase AAA capacity, balance AAA traffic across RADIUS servers, or ensure that authentication services are not interrupted if access to a primary or replica server is interrupted (redundancy).

Figure 164: Using Replication for Load Balancing and Redundancy illustrates an environment where RADIUS traffic is load-balanced by configuring each network access device to authenticate users through a different RADIUS server (solid line). If a RADIUS server becomes unavailable, the NAD can fail over to its backup RADIUS server (dotted line).

Figure 164: Using Replication for Load Balancing and Redundancy



All the servers within a realm reflect the current configuration specified by the network administrator: the network administrator modifies the configuration on the primary server, and the primary server propagates the new configuration to its replica servers. For example, after a network administrator configures a new RADIUS client or profile on the primary server, the network administrator tells the primary server to publish a date-stamped configuration package file that contains the updated configuration information. After publication, the primary server notifies each replica server that a new configuration package is ready. Each replica server then downloads and installs the configuration package to update its settings.

Figure 165: Publication and Distribution of Replication Packages

The primary server maintains a list of the replica servers that have registered with it. The primary server uses this list to track which servers to notify after it publishes an updated configuration package to resynchronize the configuration of replica servers.



Note: You should limit access to the directory in which you store configuration packages on Windows servers to the CREATOR OWNER, SYSTEM, and Administrators. To set file access permissions for the \Radius\Service directory, right-click the directory icon, click the Security tab, click the Allow and Deny check boxes to limit access to authorized users.

By default, file permissions for configuration packages on Linux servers are set to rw-rw----, which excludes users other than the file owner and the owner's group from displaying the contents of file packages.

If the primary server needs to be taken out of service for an extended period, the network administrator promotes one of the replica servers to be the new primary server. Thereafter, the other replica servers copy the configuration package from the promoted primary server.

The following types of information are included in a replication package.

Server information


- RADIUS client information
- User information
- Profile information
- Proxy target information
- EAP method configurations
- Filters
- RADIUS tunnel information
- Name parsing information
- Authentication method information

- Authentication realm information
- Rejection messages
- Javascript (.jsi) files

You administer this information by connecting the SBR Administrator to the primary server: the information is propagated to the replica servers in the domain. (If you connect the SBR Administrator to a replica server, you can view this information, but you cannot modify it.)

The following types of information are not included in a replication package:

- Address pool information—You administer address pools for a server by connecting the SBR Administrator to that server. Because an address must not be assigned to two users at the same time, each server in a realm must have its own address pools, and these pools must not overlap.
- Administrator information—Administrator information must be configured for each primary and replica server separately.
- Statistics information—Server statistics are not replicated. You can view statistics for replica servers when you connect SBR Administrator to the primary server.
- Report information—Report information is not replicated. To obtain report information for a primary or replica server, connect SBR Administrator to the applicable server.
- Steel-Belted Radius configuration files— Configuration files (*.ini files (other than filter.ini and eap.ini), *.aut files (other than peapauth.aut, ttlsauth.aut, tlsauth.aut, and talsauth.eap), and *.dir files are not replicated. When you change configuration files on the primary server, you must copy the modified files to the appropriate directory on each replica server.

 **Note:** Configuration packages are retained until they are replaced. An old configuration package is automatically deleted 24 hours after a new configuration package is published.

Replication Requirements

Servers in a replication realm must comply with the following requirements.

- All servers in a replication realm must be running the same operating system (Windows or Linux).
- All servers in a replication realm must be running the same version and edition (Global Enterprise Edition, Service Provider Edition, or Enterprise Edition) of Steel-Belted Radius.
- All servers in a replication realm must be configured to support the same types of users (domain, host, RSA SecurID, TACACS+, or UNIX).
- If RSA SecurID is enabled on the primary server, RSA SecurID must be enabled on the replica servers, and all servers in the realm must have consistent sdconf.rec files.
- The system clocks on servers in a replication realm must be synchronized to within 10 minutes of one another and their time zones must be configured correctly. Steel-Belted Radius uses the system clock value and time zone setting to convert local time to Universal Time Coordinated (also known as Greenwich Mean Time) when evaluating synchronization. If possible, you should use a Network Time Protocol (NTP) server to set the system clock on all servers automatically.
- All servers in a replication realm must use the same TCP port to exchange replication information.

The default port for replication communication is TCP 1812, though you can specify another port for replication traffic by modifying the `radius.ini` file.

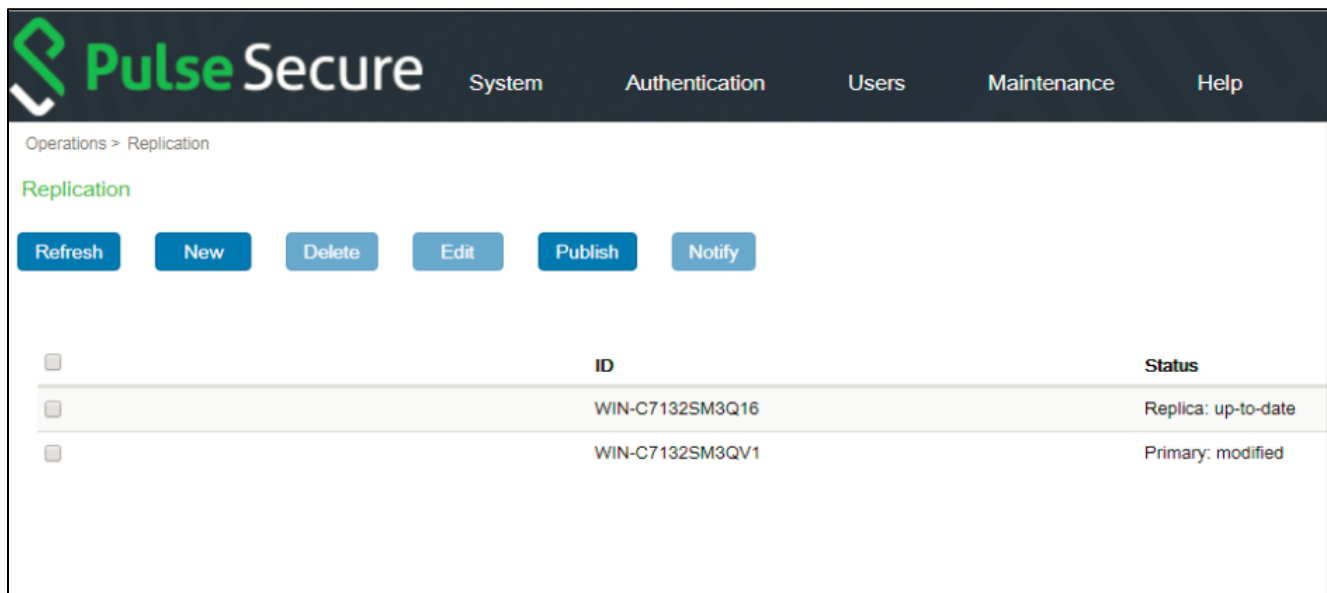
- If a firewall stands between servers in a replication realm, the firewall must be configured to pass traffic on the port used for replication communication.

Configuring Replica Servers

The Replication page (Figure 166: Replication Page) lets you add servers to a replication realm, initiate publication of a replication package by a primary server, and notify replica servers that they should download and install a new replication package.

Adding a Replica Server

Figure 166: Replication Page



In most situations, you add a replica server to a realm as follows:

1. Copy the `replica.ccmpkg` configuration package file from the primary server to a directory on the host you want to add as a replica server.

Note: The `replica.ccmpkg` file contains sensitive information, and should not be stored in a publicly accessible location, such as a file server or shared directory.

2. Install the Steel-Belted Radius server software on the host you want to add as a replica server.
3. When the installer (Windows) or configuration script (Linux) asks what kind of server you are installing, choose **Replica** and, when prompted, enter the path to the `replica.ccmpkg` file.
4. Restart the host you want to add as a replica server.

The replica server registers itself with the primary server automatically after it is restarted. Thereafter, the replica server automatically connects to the primary server once an hour to check whether an updated configuration package is available.

In some circumstances, however, you may want to add a replica server to the server list on the primary server

manually so that it shows up immediately. To register a replica server manually:

1. Run SBR Administrator and connect to the primary server.
2. Choose **Maintenance > Operations > Replication** to open the Replication page.
3. Click the **New** button.

The New Server page opens.

Figure 167: New Server Page

Operations > Add Server

Add Server

Name:

Secret:

☐ Unmask

Port:

☐ Enabled

Status:

Publication Path:

Last Published:

Current Publication:

Address▼

Address

Add

Edit

Delete

OK Cancel

4. Enter the name of the RADIUS server in the **Name** field.

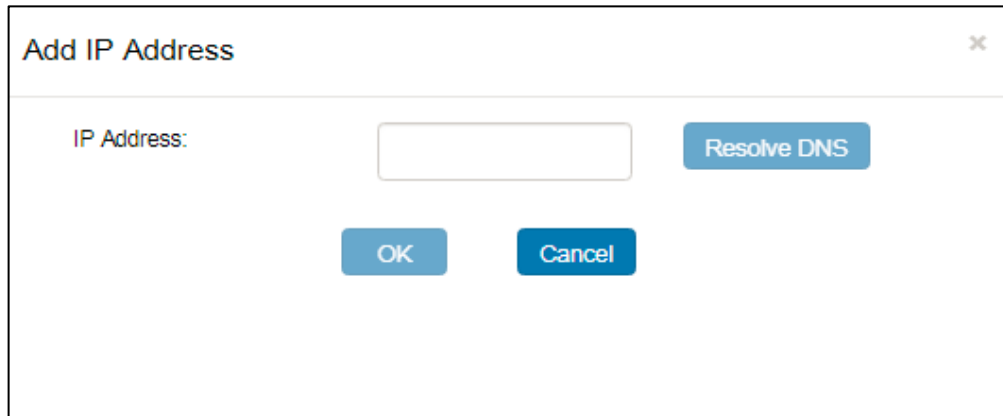
Although you can assign any name to a RADIUS server, you should use the device's hostname to avoid confusion.

5. Enter the replication secret for the RADIUS server in the **Secret** field.

For privacy, asterisks are echoed as you type. You can click the **Unmask** check box to display the characters in the shared secret.

6. Enter one or more IP addresses for your server.
 - a. Click the **Add** button.
 - b. When the Add IP Address page (Figure 162) opens, enter an IP address you want to associate with the server in the **Address** field and click **Add**.

Figure 168: Add IP Address Page



- c. Repeat Step 5b until you have finished adding IP addresses for the server.
 - d. Click **Close**.

Enabling a RADIUS Server

To enable a RADIUS server:

1. Choose **Maintenance > Operations > Replication** to open the Replication page.
2. Select the RADIUS server you want to enable and click the **Edit** button (or double-click the RADIUS server entry).

The Edit Server page opens.

Figure 169: Edit Server Page

Operations > Edit Server

Edit Server

Name: WIN-C7132SM3Q16

Secret: *****

☐ Unmask

Port: 1812

☒ Enabled

Status: Replica: up-to-date

Publication Path: packages\1553852706_SBR.ccm pkg

Last Published: 1553852706

Current Publication: 1553852706

Address▼

Address

10.96.178.58

Add

Edit

Delete

OK Cancel

3. Click the **Enabled** check box.
4. Click the **Save** button.

Deleting a RADIUS Server

To delete a replica server from a realm:

1. Choose **Maintenance > Operations > Replication** to open the Replication page.
2. Select the RADIUS server entry you want to delete.
3. Click the Delete button.
4. When you are prompted to confirm the deletion request, click Yes.

Publishing Server Configuration Information

If you change the configuration of your primary server, you must publish the modified configuration so that your replica servers can download the modified settings.

To publish server configuration information:

1. Choose **Maintenance > Operations > Replication** to open the Replication Page.
2. Click the Publish button.

This creates a file called `/radius/packages/timestamp_RSA.ccmpkg` (Linux) or `\Radius\Service\packages\timestamp_RSA.ccmpkg` (Windows), where timestamp reflects the date and time the package was created.

Notifying Replica RADIUS Servers

Under normal circumstances, a replica server connects to its primary server every hour to check whether a new `replica.ccmpkg` file has been published. If necessary, a network administrator can manually notify a replica server to download and install the current configuration package from the primary server. Manual notification is useful when network issues prevent the automatic download and installation of a configuration package when it is first published, and the configuration on the replica no longer matches the configuration on the primary server.



Note: You can display the Replication page to determine the status of your replica servers.

To notify replica servers that new configuration information has been published:

1. Choose **Maintenance > Operations > Replication** to open the Replication page.
2. Select the replica server you want to notify.
3. Click the Notify button.

The replica server downloads and installs its configuration package from the primary server. After the package is installed, the replica server is resynchronized with the primary server.

Designating a New Primary RADIUS Server

You can change which server within a realm is designated as the primary server for that realm.

To designate a new primary server:

1. Stop the RADIUS service on the replica server.
2. Log into the replica server as root.
3. Open a command window and navigate to the `\Radius\Service` directory (Windows) or `/opt/PSsbr/radius` directory (Linux).
4. Run the `sbrsetuptool` utility with the promote option.

```
# sbrsetuptool -promote
```

The utility creates a configuration package to change this server to the primary server.

5. Restart the updated replica server to make it the new primary server.

6. Publish a new configuration package administratively to configure all replica servers to use the new primary server.

After you designate a new primary server for a realm, the old primary server becomes a replica server automatically.

Recovering a Replica After a Failed Download

If a replica server fails during the download of a configuration package, its configuration may be corrupted or it may have a stale secret.

To recover after a failed download:

1. Stop the RADIUS service on the replica server.
2. Log into the replica server as root.
3. Open a command window and navigate to the \Radius\Service directory (Windows) or /opt/PSsbr/radius directory (Linux).
4. Run the sbrsetuptool utility with the identity option and information on where to download configuration information.

To obtain configuration from a configuration package, issue the following command:

```
# sbrsetuptool -identity REPLICA -reppkg pathname
```

where pathname specifies the path to a replica.ccmpkg package.

To obtain configuration from the primary server for the realm, issue the following command:

```
# sbrsetuptool -identity REPLICA -primary name address secret
```

where name specifies the DNS name of the primary server, address specifies the IP address of the primary server, and secret specifies the shared secret used to authenticate configuration downloads.

5. Restart the updated replica server so that it can load its new configuration.

After the replica server is restarted, it will be re-synchronized with the current primary server.

Changing the Name or IP Address of a Server

You may need to change the DNS name or IP address assigned to a primary or replica server if your network changes.

To change the DNS name or IP address of a primary or replica server:

1. Stop the RADIUS service on the RADIUS server you want to change.
2. Log into the RADIUS server as root.
3. Open a command window and navigate to the \Radius\Service directory (Windows) or /opt/PSsbr/radius directory (Linux).
4. Run the sbrsetuptool (Linux) utility with the identity option. To

rename a primary server, enter the following command:

```
# sbrsetuptool -identity PRIMARY
```

To rename a replica server, enter the following command:

```
# sbrsetuptool -identity REPLICA
```

- Restart the updated server so that it can load its new configuration.
- Run the SBR Administrator and modify the DNS name or IP address for the server you want to rename. Verify that the secret on the renamed server is correct.

You may need to use the Replication page to delete the old server name from the list of servers in the realm.

- Publish the modified configuration to propagate the name change to the replica servers.

Replication Error Messages

The following tables list possible causes for error messages caused by replication issues.

Error Messages on Replica Servers

Table 39 lists possible causes for error messages on replica servers in a replication realm.

Table 36: Error Messages on Replica Servers

Error Type	Error Message	Possible Cause
Post Errors (Errors with Notification from Primary)	CRadManagedServerNotifyPost:: ExecutePost invalid signature!	Mismatched replication secret.
	CRadManagedServerNotifyPost:: ExecutePost invalid sequence number	Two posts have the same sequence number. The clocks on the primary and replica are more than 10 minutes apart.
	CRadManagedServerNotifyPost:: ExecutePost decrypt failed	Shared secret failed to decrypt. Bad Replication Secret secret.
	CRadManagedServerNotifyPost:: ExecutePost invalid <body> missing parameters	Post had an invalid xml request.
Update Errors (Errors with Published package from Primary)	CRadManagedServerUpdate:: DoStart Failed to open 'file_name' for writing	Temp directory does not exist. Temp directory or file have incorrect permissions.
	CRadManagedServerUpdate:: StartUpdates has already started update	Update is already in progress.
	CRadManagedServerUpdate:: DownloadPackage HTTP POST error:errCode Primary ID	Error in transmitting request to Primary (timeout during transmit).
	CRadManagedServerUpdate:: DownloadPackage HTTP headers parsing error	Error in receiving package. Typically caused by a timeout during receive resulting from an invalid package.
	CRadManagedServerUpdate:: DownloadPackage connection primary IP	Replica failed to connect with Primary. Primary

Error Type	Error Message	Possible Cause
Update Errors (Errors with Published package from Primary)	Addr error: errCode Primary ID	not running.
	CRadManagedServerUpdate:: DownloadPackage exceeded iterations limit while communicating with CCM	Update failed after three attempts.
	CRadManagedServerUpd ate:: ProcessPackage signature mismatch	Secrets on Replica and Primary do not match.
	CRadManagedServerUpdate:: ProcessPackage CCM error: 'Error String' 'Parameter'	Error parsing downloaded packages.
	CRadManagedServerUpdate:: ProcessPackage Failed to open \\' << file_name << "\' for writing	Temp directory does not exist. Temp directory or file has incorrect permissions.
Proxy Errors (Statistics retrieve errors)	CRadManagedServerUpdat e:: ProcessPackage thumbprint mismatch	Invalid package. Republish the package.
	CRadProxyPost:: ExecutePost invalid signature!	Mismatched replication secret.
	(Statistics retrieve	Two posts have the same sequence number. The clocks on the primary and replica are more than 10 minutes apart.
	errors)	Shared secret failed to decrypt. Bad Replication Secret.
	CRadProxyPost:: ExecutePost invalid <body> missing parameters	Post had an invalid XML request.

Error Messages on Primary Servers

Table 40 lists possible causes for error messages on primary servers in a replication realm.

Table 37: Error Messages on Primary Servers

Error Type	Error Message	Possible Cause
Notify Target (Both Notify and Publish send a notification)	CRadConfigManagedServerHTTP Notification::NotifyTarget failed to fetch	Replica does not exist in database. This can occur if two administrators are running instances of SBR Administrator, one administrator deletes a replica, then the other administrator tries to publish to that replica.
	CRadConfigManagedServerHTTP Notification::NotifyTarget failed replicald	Notify failed to communicate with replica, Replica is not running, or check Replica DCF log

Error Type	Error Message	Possible Cause
Publication Provider (requests from GUI to Notify or Publish)	CRadConfigPublicationProvider:: UpdateResource notify invoked when not Primary	for more information. Attempted to Notify as a Replica, this is only allowed from a Primary.
	CRadConfigPublicationProvider:: UpdateResource publish invoked when not Primary	Replica attempted to publish; publication is permitted only from a Primary.
Publication Post (parsing of Post from replica to get data)	CRadConfigServerProviderPost:: ExecutePost signature mismatch with server:	Replica and Primary have different replication secrets.
	CRadConfigServerProvider:: GetResource invoked when not Primary	Another Replica is requesting a download from this server which is a replica. Replica that is requesting a download needs to be reconfigured (see disaster recovery in docs).
Proxy Errors (Statistics retrieve errors)	CRadProxyClient:: Send failed to fetch	Replica does not exist in database. This can occur if two administrators are running instances of SBR Administrator, one administrator deletes a replica, then the other administrator tries to publish to that replica.
	CRadProxyClient:: SendData HTTP POST error:	Connection error with replica.

Chapter 25

LDAP Configuration Interface

This chapter describes:

- The file used to enable and configure the LDAP configuration interface (LCI)
- An overview of the LCI and LDAP utilities
- A description of the LDAP virtual schema
- Information about how to use LDAP utilities to configure the Steel-Belted Radius database
- Sample LDIF files that control the execution of LDAP utilities
- Information about how to view rate statistics variables with LDAP utilities

LDAP Configuration Interface File

The radius.ini file establishes settings for the LDAP configuration interface. For more information about radius.ini, refer to the *Steel-Belted Radius Reference Guide*.

Table 38: LDAP Configuration Interface Files

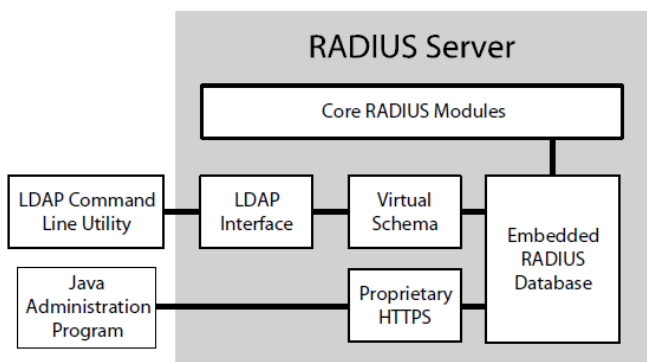
File Name	Function
radius.ini	Specifies whether the LCI is enabled, the port used for LCI communication, and the interfaces on which Steel-Belted Radius listens for LCI requests.

About the LDAP Configuration Interface

The LDAP Configuration Interface (LCI) provided by Steel-Belted Radius consists of an LDAP interface in the Steel-Belted Radius server and an LDAP virtual schema. The LDAP virtual schema presents the structure of the Steel-Belted Radius database in a manner that can be understood by the LDAP client utilities. The LCI uses the virtual schema to retrieve, modify, and delete entries in the database.

Figure 170 illustrates the relationship between LDAP components, the Administrator, and the configuration database.

Figure 170: LDAP Components



LDAP Utilities

Freeware LDAP utilities, such as `ldapsearch`, `ldapdelete`, and `ldapmodify`, act as clients of the LDAP interface. LDAP utilities let you read and modify an LDAP database.

- `ldapsearch`—The `ldapsearch` utility locates and retrieves LDAP directory entries. The `ldapsearch` utility opens a connection to an LDAP interface using the specified distinguished name and password, binds, and locates entries based on the specified search filter. A search can return a single entry, an entry's immediate subentries, or an entire tree or subtree. Search results are returned in LDAP Data Interchange Format (LDIF) format.
- `ldapdelete`—The `ldapdelete` utility deletes entries from an existing LDAP directory. `ldapdelete` opens a connection to the specified server using the distinguished name and password you provide, binds, and deletes the entry or entries.
- `ldapmodify`—The `ldapmodify` utility adds or modifies entries in an existing LDAP directory. `ldapmodify` opens a connection to an LDAP interface using the distinguished name and password you supply, binds, and adds or modifies the entries based on the LDIF update statements contained in a specified file. Because `ldapmodify` uses LDIF update statements, `ldapmodify` can do everything `ldapdelete` can do.

LDAP Requests

LDAP requests are submitted in two ways:

- By specifying options on the LDAP configuration interface command line.
- By placing instructions and data into an LDIF file, which you then process by invoking an LDAP command line utility using the `-f` option.

Because communication between the LDAP client and server is unencrypted, the LDAP utilities should be run on the same computer as Steel-Belted Radius.

Downloading the LDAP Utilities (Windows)

To use the LCI, you need the `ldapsearch`, `ldapmodify`, and `ldapdelete` utilities. You can download freeware Windows LDAP utilities as follows:

1. Use a browser to navigate to <http://www.sun.com/download/products.xml?id=/3ec28dbd>.
2. When the Sun ONE Directory SDK (software development kit) download page appears, click the Download link at the bottom of the page.
3. If you are prompted to register yourself, complete the registration form.
4. When you are prompted to accept the license agreement, click the Accept button and then click Continue.
5. Download the SDK by clicking the link for the version of the SDK that is appropriate for your computer. Versions of the SDK are available for Linux, and Windows.
6. When the download is completed, extract the files from the compressed image to a directory on your computer.

To run the LDAP utilities, execute them from this directory. Note that, if you set the path environment variable to point to this directory, you can run them from any location on the system.



Note: The examples that follow assume you are using the LDAP utilities provided as part of the Sun ONE Directory SDK. If you are using LDAP utilities from another source, the command options you use may be different. Consult the documentation for your LDAP utilities for more information.

LDAP Version Compliance

The LDAP interface in Steel-Belted Radius complies with version 2 of the LDAP specification. You should use the -V 2 command option to direct the utilities to use version 2 features. For example:

```
ldapmodify -c -V 2 -p 354 -D "cn=admin,o=radius" -w radius -f filename
```

Configuring the LDAP TCP Port

To avoid conflicts with LDAP services that may already be installed, the default port number for communication between Steel-Belted Radius and the LDAP client is 667. You can configure Steel-Belted Radius to use a different TCP port to communicate with an LDAP client. For example, you can change this port number to 389, the standard LDAP TCP port, if you are certain doing so will not create port number conflicts with other applications.

The following example configures Steel-Belted Radius to use TCP port 354.

1. In the radius.ini file, uncomment the [LDAP] section, set Enable to 1, and set the TCPPort field to the port number you want to use. For example:

```
[LDAP]
```

```
Enable = 1
```

```
TCPPort = 354
```

2. If you want to specify the interfaces on which Steel-Belted Radius listens for LCI requests, add a [LDAPAddresses] section to the radius.ini file. This section should contain a list of IP addresses, one per line. For example:

```
[LDAPAddresses]
```

```
192.168.12.45
```

```
10.10.10.25
```

If the [LDAPAddresses] section is omitted or empty, Steel-Belted Radius listens for LCI requests on all bound IP interfaces.

You must specify the port number (by means of the -p option) when you run the LDAP utilities. For example:

```
ldapsearch -V 2 -p 354 -D "cn=admin,o=radius" -w radius -s sub -T -b "radiusclass=Client,o=radius"
radiusname=*
```

Example

The Steel-Belted Radius server at the Good Times Clock Company has two network interfaces. The first interface (192.168.10.40) connects to the corporate network. The second interface (192.168.20.50) connects to a dedicated administrative VLAN accessible only from the local subnet. To limit access to the LCI to network

administrators, the [LDAPAddresses] section of radius.ini specifies that LCI requests must come through the administrative interface (192.168.20.50). LCI requests coming through the corporate network interface (192.168.10.40) are ignored.

Configuring the LCI Password

After you enable the LCI, you should change the default LCI password to prevent unauthorized LDAP clients from accessing your database. After you install the LDAP utilities and verify that they work, perform the following steps:

1. Create a text file called temp.ldif with the following contents:

```
dn:radiusclass=server,o=radius
```

```
changetype: modify
```

```
replace: server-password
```

```
server-password: new-password
```

where new-password is the LCI password you want to use.

2. Change the radius.ini [LDAP] setting to Enable=1.
3. Restart Steel-Belted Radius.
4. Execute the following command:

```
ldapmodify -V 2 -h ip-address -p port -D "cn=admin,o=radius" -w oldpassword -f temp.ldif
```

where:

-h ip-address specifies the IP address of the Steel-Belted Radius server.

-p port specifies the port number specified in the [LDAP] section of the radius.ini file.

-w oldpassword specifies the current password (which is radius by default).

5. Verify that the password change was successful by executing the following command:

```
ldapsearch -V 2 -h ip-address -p port -D "cn=admin,o=radius" -w newpassword -s sub -T -b "o=radius" radiusclass=server
```

where:

-h ip-address specifies the IP address of the Steel-Belted Radius server.

-p port specifies the port number specified in the [LDAP] section of the radius.ini file.

-w newpassword specifies the password configured in the temp.ldif file.


After you verify that the password change has been successful, delete the temp.ldif file and any other file that contains a cleartext copy of the modified LCI password.



Note: The LDAP Configuration Interface does not support Secure Sockets Layer (SSL).


LDAP Virtual Schema

The LDAP interface uses the virtual schema (illustrated in Figure 171 – Figure 175) to represent the structure of the Steel- Belted Radius database. LDAP clients use the virtual schema to exchange configuration data over the LDAP configuration interface.

 **Note:** Your edition of Steel-Belted Radius may not support all branches of the schema illustrated in Figure 171 through Figure 175.

Many of the top-level items in the LDAP virtual schema correspond to windows and panels in the SBR Administrator.

Table 39: LDAP Schema and SBR Administrator Dialogs

Item	See
radiusclass=client	"Administering RADIUS Clients"
radiusclass=native-user, securid-user, ...	"Administering Users"
radiusclass=profile	"Administering Profiles"
radiusclass=proxy	"Administering Proxy RADIUS"
radiusclass=tunnel	"Administering RADIUS Tunnels"
radiusclass=server	"RADIUS Server Configuration"
radiusclass=ip-addr-pool	"Setting Up IP Address Pools"
radiusclass=ipx-addr-pool	"Setting Up IPX Address Pools"
radiusstatus=statistics	"Displaying Statistics"
radiusstatus=sessions	"Displaying the Current Sessions List"
 Note: LDAP searches that call radiusstatus=sessions can adversely affect Steel-Belted Radius performance. When possible, you should search using the sessions_ by keywords.	

 **Note:** radiusstatus items can be read, but they cannot be modified.

Figure 171: LDAP Schema (Slide 1 of 5)

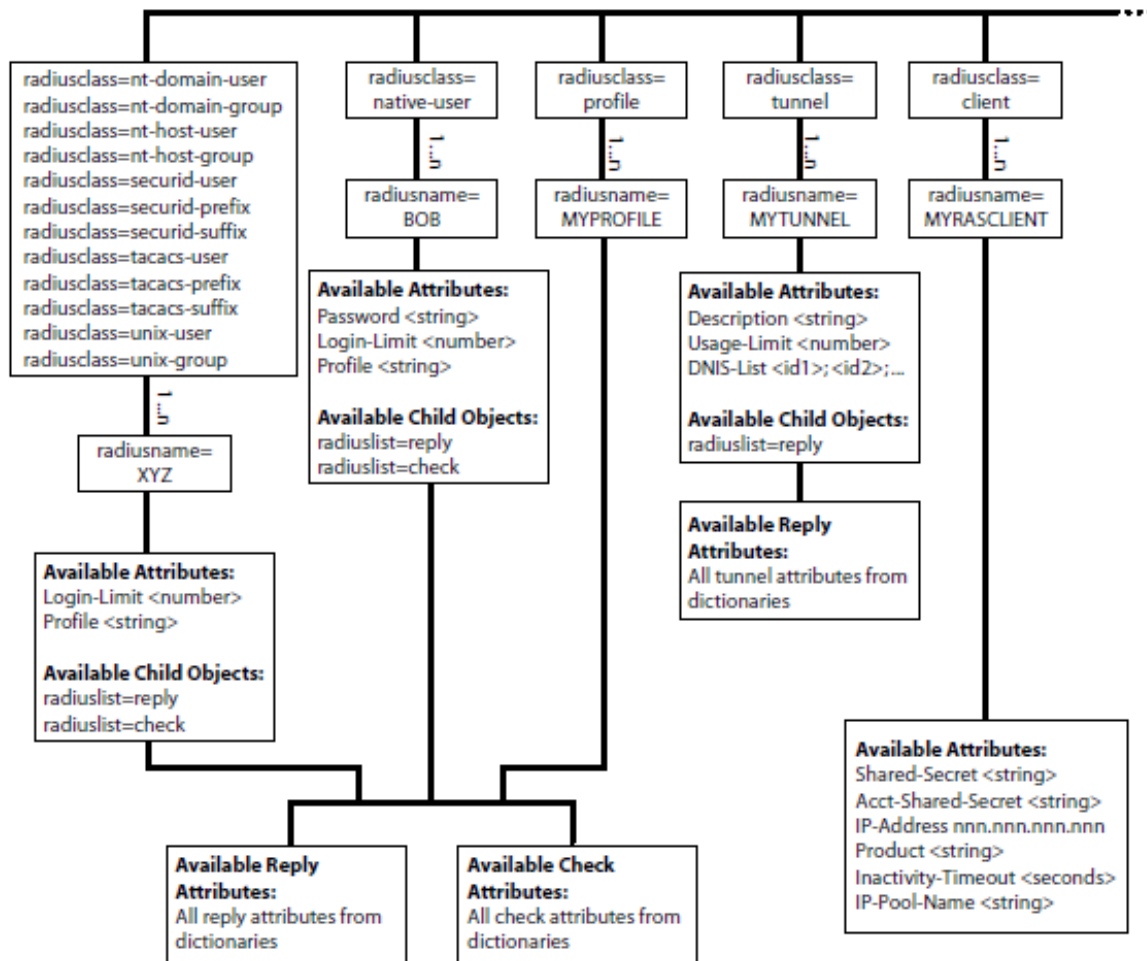


Figure 172: LDAP Schema (Slide 2 of 5)

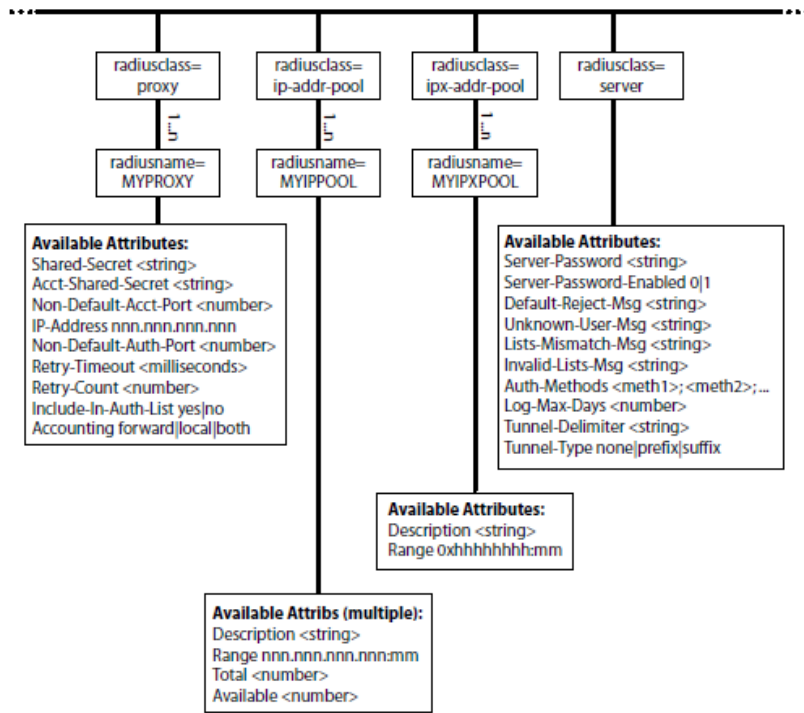


Figure 173: LDAP Schema (Slide 3 of 5)

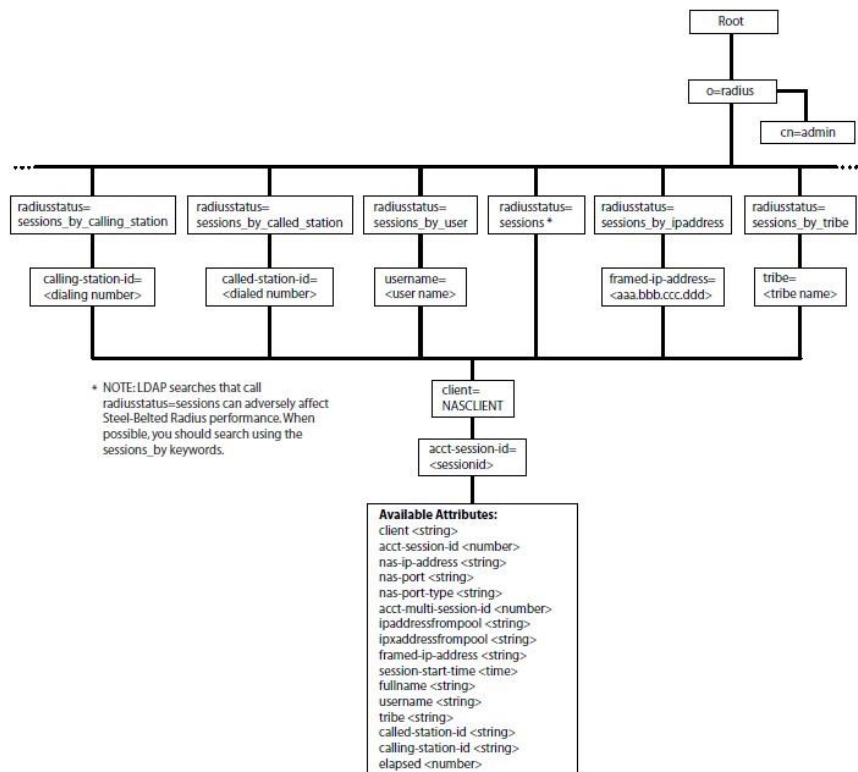
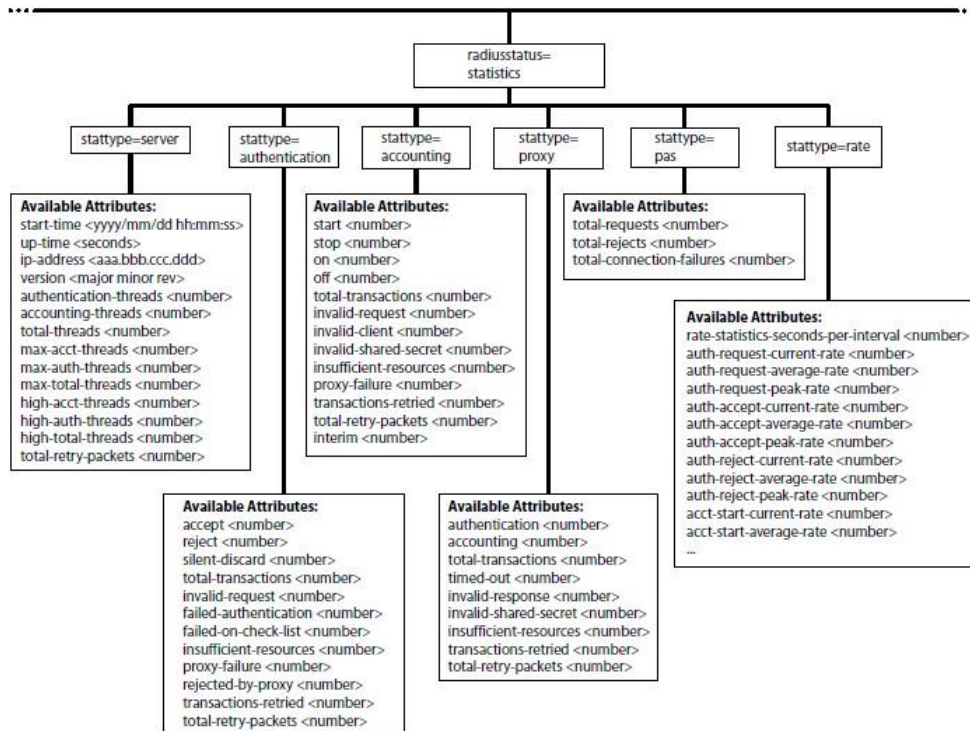
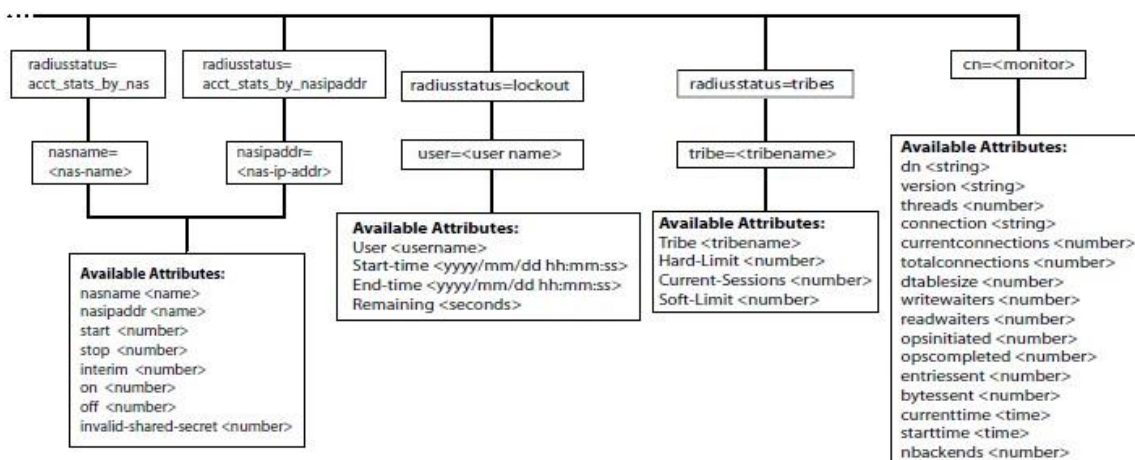


Figure 174: LDAP Schema (Slide 4 of 5)



Note: The Enterprise Edition of Steel-Belted Radius with the optional LCI add-on does not support the Statistics items.

Figure 175: LDAP Schema (Slide 5 of 5)



LDAP Rules and Limitations

While the LDAP virtual schema diagram shows as much of the detail of the LDAP virtual schema as possible, the following rules and limitations should be considered.

- **Bind request**—All attempts to perform operations on the virtual schema must be preceded by an LDAP Bind request that authenticates the administrator to the Steel-Belted Radius server. The Bind

request must reference a Steel-Belted Radius administrative account and must provide the password that authenticates that account. This translates into the following command line options for each invocation of the LDAP utilities:

```
-D "cn=AdminName,o=radius" -w AdminPassword
```

where AdminName is the administrative account name and AdminPassword is its password.

- **Uppercase and lowercase**—The uppercase/lowercase rules for object names are the same as in the SBR Administrator; that is, almost all object names are stored in the database in uppercase format. The exception to this rule is that UNIX User/Group, SecurID User/Prefix/Suffix and TACACS+ User/Prefix/Suffix names are maintained in the case specified in the LDIF files.
- **Attributes**—When you enter attributes, make sure that the attribute name matches the name found in the dictionary and that the attribute's value is consistent with the syntax type for the attribute. Note that the LDAP virtual schema does not list all the dictionary attributes that are available in Steel-Belted Radius.
- **IP addresses**—The ipaddr-pool type in the dictionary can represent an IP address or a pool name. If the value specified begins with the marker string [pool], the token that follows the marker string is assumed to be an IP pool name; otherwise, it must be a valid IP address. If it is neither, the operation fails.

Address ranges in IP address pool objects are specified in the form IPAddress:NumberOfAddresses. An example of a valid range is 128.22.12.45:34.

- **IPX addresses**—The ipxaddr-pool syntax type in the dictionary lets you enter an IPX network address (up to 8 hexadecimal digits using the format 0xhhhhhhh) or choose a pool name. If the value specified begins with the string [pool], the token that follows the marker is assumed to be an IPX pool name; otherwise, it must be a valid IPX address. If it is neither, the operation fails.

Address ranges in IPX address pool objects are specified in the form IPXNetAddress:NumberOfAddresses. An example of a valid range is 0xa020443b:34.

- **Substrings**—Some attribute may have a value that consists of a list of strings. For example, the DNIS list in a tunnel entry and the authentication method list may consist of multiple substrings. The rule for specifying the data portion for these lists is that semicolons must delimit substrings. For example, a DNIS list for a tunnel entry might be specified as 555-1212;5551212. If a semicolon needs to appear inside a substring, it must be escaped by placing a backslash character (\) before it.
- **Hexadecimal values**—Hexadecimal numbers (for attributes of syntax type hex1, hex2, or hex4) require a 0x prefix before the hexadecimal digits; for example 0x0000149a.
- **Password syntax**—Passwords that are retrieved from the database may consist of one of the following:
 - A clear-text password of the form {x-clear} clear-text-password-string if the password is weakly encrypted in the database.
 - A string of the form {x-md5}xxxxxxxxxxxxxxxxxxxxxxxxxxxx if the password is stored as a one-way md5 hash.
 - A string of the form {x-md5}[encrypt]clear-text-password-string indicates that, although the password is specified in clear-text form, it is to be stored as a hash.

- SBR 6.2 also supports SHA, SSHA, SHA-256, SSHA-256, SHA-512, SSHA-512 password formats also. Password prefix:

SHA-1

{SHA}XXXXXXXXXXXXXXXXXX

{SSHA}XXXXXXXXXXXXXXXXXX

(Following feature exclusively added in 6.2)

SHA256

{SHA256}XXXXXXXXXXXXXXXXXX

{SSHA256}XXXXXXXXXXXXXXXXXX

SHA512

{SHA512}XXXXXXXXXXXXXXXXXX

{SSHA512}XXXXXXXXXXXXXXXXXX

White space in a password is treated as follows:

- When clear-text passwords are specified, the password is assumed to begin immediately after the right brace or right bracket. Adding a white space character, such as a space or tab, after the right brace or right bracket causes the white space to be considered part of the password.
 - White space entered at the beginning of the attribute (before the left brace or left bracket) is ignored.
 - White space entered between the right brace of {x-md5} and the left bracket of [encrypt] is ignored.
 - All white space specified in the hexadecimal sequence describing a password hash is ignored.
- **Profiles, checklists, and return lists**—Steel-Belted Radius supports user definitions that include attribute subtractions of profile entries. To specify that a user attribute is to be considered a subtraction of a profile attribute, preface the attribute value with the string %subtract%.

Steel-Belted Radius permits user and profile checklists to include default values for attributes. Configuring a default value for an attribute means that, if a RADIUS request does not include this attribute, the request should not be rejected. Instead, the value supplied as the default should be used as if it were received as part of the request. To specify that a checklist attribute is to be considered a default attribute, preface the attribute value with the string %default%.

Steel-Belted Radius permits user and profile return lists to include attributes whose values are set by copying the contents of received attributes. This feature is referred to as “attribute echoing.” To specify that a return list attribute is to be treated as an echo attribute, enter %echo% for the attribute value.

- **Unspecified or 0.0.0.0 RAS IP address**—When you display acct_stats_by_nasipaddr information, any RAS entries with an unspecified IP address or an IP address of 0.0.0.0 are omitted. Similarly, when you display acct_stats_by_nas information, any RAS entries with an unspecified IP address or an IP address of 0.0.0.0 will have their nasipaddr attribute omitted.
- **Duplicate RAS IP addresses**—When displaying acct_stats_by_nasipaddr information, two RAS entries that contain the same (non-zero) IP address cause information about one of the entries to be displayed twice. This is the result of the ambiguity of the query and is not a bug.

- **RADIUS client information displayed after deletion**—If you define a RADIUS client entry, send some accounting traffic to it, and then delete the entry, the output of `ldapsearch` queries will continue to list the deleted RADIUS client so that the per-RAS statistics add up to the total RAS statistics.

LDAP Command Examples

This section explains how to use the `ldapdelete`, `ldapmodify`, and `ldapsearch` utilities to configure the server.

Searching for Records



You can use the `ldapsearch` command to extract information from the LDAP tree. The command shown in Figure 176 lets you extract information about all RADIUS Native Users.

Figure 176: ldapsearch Command

```
ldapsearch -V 2 -p 354 -h 192.168.45.12
-D "cn=oper,o=radius" -w radadmin -s sub -T -b
"radiusclass=Native-User,o=radius" radiusname=*
```

Note there must be a blank space between each option (for example, `-p`) and its value (for example, `354`). Command syntax is case-sensitive.

Table 40: Searching for Records Using the ldapsearch Command

ldapsearch Option	Meaning
-V 2	Use LDAP Version 2 to communicate with the server. This option is not required, but it improves the performance of the transaction.
-p 354	Use TCP port 354 to communicate with the LDAP interface of the server. The <code>-p</code> value must match the <code>TCPPort</code> setting in the <code>[LDAP]</code> section of <code>radius.ini</code> . If the <code>-p</code> option is not specified, the LDAP utilities contact Steel-Belted Radius on the default port number (TCP port 389).
-h 192.168.45.12	Contact a remote host at the specified address or name. By default, <code>ldapsearch</code> tries to connect to the local host.
-D "cn=oper,o=radius"	Use the <code>oper</code> administrative account to authenticate the command.  Note: You can use any administrative account name in place of <code>oper</code> in this example. Do not change the <code>o=radius</code> argument.
-w radadmin	Use an authentication password of <code>radadmin</code> .  Note: The <code>-w</code> parameter value (in this case, <code>radadmin</code>) must match the password of the account named by the <code>-D</code> parameter.
-s sub	Perform a recursive subtree search from the base.
-T	Do not wrap long output lines to the next line.

Idapsearch Option	Meaning
-b "radiusclass=Client,o=radius"	Specifies the base from which the search operation starts.
radiusname=*	Specifies the selection criteria for the search.

Executing the Idapsearch command shown in Figure 176 against a Steel-Belted Radius server containing two Native User definitions would produce an LDIF file similar to the output shown in Figure 177.

Figure 177: Search Results

```
dn: radiusname=KEVIN,radiusclass=Native-User,o=radius
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: KEVIN
password: {x-clear}secret1
profile: ISDN
login-limit: 2

dn: radiusname=MICHAEL,radiusclass=Native-User,o=radius
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: MICHAEL
password: {x-clear}secret99
profile: ISDN
login-limit: 2
```

Modifying Records



You can use the Idapmodify utility to update the Steel-Belted Radius configuration.

```
Idapmodify -c -V 2 -h example.host.com -p 354
-D "cn=oper,o=radius" -w radadmin -f filename
```

Note there must be a blank space between each option (for example, -p) and its value (for example, 354). Command syntax is case-sensitive

Table 41: Modifying Records Using the Idapmodify Command

Idapmodify Option	Meaning
-c	Run the command in continuous mode; do not stop on errors.
-V 2	Use LDAP Version 2 to communicate with the server. This option is not required, but it improves the performance of the transaction.
-h example.host.com	Contact a remote host at the specified address or name. If the -h option is not used, Idapsearch connects to the local database.
-p 354	Use TCP port 354 to communicate with the LDAP interface of the server. The -p value must match the TCPPort setting in the [LDAP] section of radius.ini. If the -p option is

Idapmodify Option	Meaning
	not specified, the LDAP utilities contact Steel-Belted Radius on the default port number (TCP port 389).
-D "cn=oper,o=radius"	Use the oper administrative account to authenticate the command.  Note: You can use any administrative account name in place of oper in this example. Do not change the o=radius argument.
-w radadmin	Use an authentication password of radadmin.  Note: The -w parameter value (in this case, radadmin) must match the password of the account named by the -D parameter.
-f filename	Specifies the input LDIF file to process.

The LDIF files generated by `ldapsearch` differ from those required for input to `ldapmodify`. The `ldapmodify` input files must contain a `changetype` entry immediately after each `dn` entry. The `changetype` entry specifies how to use the data to change the LDAP database.

The full syntax for `changetype` within each transaction is as follows:

dn: distinguished-name-of-entry

changetype: keyword

subkeyword: attribute

attribute: value

changetype: keyword

subkeyword: attribute

attribute: value

: where:

- keyword can be add, modify, or delete.
- subkeyword can be (respectively): add, replace, or delete.
- attribute can be any LDAP attribute in the entry.
- value is the value to assign to the attribute.

Repeated `changetype: keyword` entries are not required within a transaction unless you change the keyword. From top to bottom within the transaction, the latest keyword applies until another `changetype: keyword` entry is provided. The following syntax is valid if the same keyword applies throughout the transaction:

dn: distinguished-name-of-entry

changetype: keyword

subkeyword: attribute

attribute: value

subkeyword: attribute

attribute: value

```
subkeyword: attribute
```

```
attribute: value
```

```
:
```

subkeyword: attribute entries are optional and indicate that you want to apply the change to a specific attribute within the entry. If no subkeyword: attribute entries in the transaction are found, the change applies to the entire entry. For example, it is faster to delete an entire entry:

```
dn: radiusname=TINYCO.COM,radiusclass=Proxy,o=radius
```

```
changetype: delete
```

but if you want to delete only a few attributes from the entry, you can do so:

```
dn: radiusname=TINYCO.COM,radiusclass=Proxy,o=radius
```

```
changetype: delete
```

```
delete: retry-count
```

```
-
```

```
delete: include-in-auth-list
```

If the subkeyword is add or replace, an attribute: value entry must appear immediately following the subkeyword: attribute entry. If the subkeyword is delete, the attribute: value entry does not apply and should be omitted.

The following sample LDIF file could be used with an ldapmodify command.

Figure 178: Sample LDIF File

```
dn: radiusname=BIGCO.COM,radiusclass=Proxy,o=radius
changetype: add
radiusname: BIGCO.COM
ip-address: 194.132.5.89
accounting: both
retry-count: 3
retry-timeout: 5000
shared-secret: testing123
include-in-auth-list: no

dn: radiusname=BIGGERCO.COM,radiusclass=Proxy,o=radius
changetype: modify
replace: shared-secret
shared-secret: hereisthesecond
-
replace: ip-address
ip-address: 192.7.2.121

dn: radiusname=TINYCO.COM,radiusclass=Proxy,o=radius
changetype: modify
delete: include-in-auth-list
```



Note: To delete the proxy entry for TINYCO.COM, issue the following command: dn:

```
radiusname=TINYCO.COM,radiusclass=Proxy,o=radius
```

```
changetype: delete
```

Importing Records From Another LDAP Database

To import entries from one LDAP database into another, run the `ldapsearch` command on the first database. Request only the attributes you want for the new database. When `ldapsearch` completes processing, edit the output LDIF file. After each line that begins with `dn:`, add a single line containing the text `changetype: add`. Once your editing is complete, run an `ldapmodify -f` command that references the new LDIF file. After the `ldapmodify` command is executed, your new database is populated with the records you extracted from the old database.

The LDIF file shown in

Figure 179 is derived from the output of the `ldapsearch` command. When specified as the input to an `ldapmodify -f` command, the contents of the file are added to the target database.

Figure 179: Adding Records With an LDIF File

```
dn: radiusname=KEVIN,radiusclass=Native-User,o=radius
changetype: add
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: KEVIN
password: {x-clear}secret1
profile: ISDN
login-limit: 2

dn: radiusname=MICHAEL,radiusclass=Native-User,o=radius
changetype: add
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: MICHAEL
password: {x-clear}secret99
profile: ISDN
login-limit: 2
```

Deleting Records

The `ldapdelete` command allows you to remove records from the LDAP database. For example, to delete entries named `USER1` through `USER5`, add the information shown in Figure 180 to a file called `deletedemo.ldf`.

Figure 180: Deleting Records With an LDIF File

```
radiusname=USER1,radiusclass=Native-User,o=radius
radiusname=USER2,radiusclass=Native-User,o=radius
radiusname=USER3,radiusclass=Native-User,o=radius
radiusname=USER4,radiusclass=Native-User,o=radius
radiusname=USER5,radiusclass=Native-User,o=radius
```

Now, pass the `deletedemo.ldf` file to the `ldapdelete` command.

```
ldapdelete -V2 -h hostname -p 667
-D "cn=admin,o=radius" -w password -f deletedemo.ldf
```

Note: Verify that the dn: values that usually appear in these entries are not a part of the entries in your file, because this will cause the command to fail.

You can use `ldapdelete` to remove records from the LDAP database without having to supply a file. For example, to delete the native user record identified as `USER1`, you would enter the following:

```
ldapdelete -V2 -h hostname -p 667
-D "cn=admin,o=radius" -w password
"radiusname=USER1,radiusclass=native-user,o=radius"
```

You can cause records to be deleted by means of the `ldapmodify` command, if the entries in the text file contain the line `changetype: delete`. Consider the sample LDIF file named `deletemodify.ldf` shown in Figure 181.

Figure 181: deletemodify.ldf Example

```
dn: radiusname=barry,radiusclass=Native-User,o=radius
changetype: delete
dn: radiusname=maurice,radiusclass=Native-User,o=radius
changetype: delete
dn: radiusname=robin,radiusclass=Native-User,o=radius
changetype: delete
```

The `deletemodify.ldf` file can be passed to the `ldapmodify` command as follows:

```
ldapmodify -V2 -h hostname -p 667 -D"cn=admin,o=radius"
-w password -f deletemodify.ldf
```

Note: On some LDAP servers, an error could cause the deletion of a container without prompting for confirmation. This could, in turn, cause the entire directory server to fail.

LDIF File Examples

This section explains how to construct LDIF files that, when input to the `ldapmodify` command, add entries to the Steel-Belted Radius database.

Adding RADIUS Clients with LDIF

The sample LDIF entry shown in Figure 182 adds a RADIUS client named `ANNEX105` to the Steel-Belted Radius database.

Figure 182: Adding RADIUS Clients

```
dn: radiusname=ANNEX105,radiusclass=Client,o=radius
changetype: add
objectclass: top
objectclass: Client
radiusname: ANNEX105
ip-address: 193.162.45.12
product: Nortel Networks Remote Annex
shared-secret: testing123
```

The syntax in this LDIF entry is shown in Figure 183.

Figure 183: LDIF Syntax

```
dn: radiusname=String,radiusclass=Client,o=radius
changetype: add
objectclass: top
objectclass: Client
radiusname: String
ip-address: IPAddressOfTheClientDevice
product: Make&ModelChoiceFromVendor.IniFile | ...
shared-secret: SharedSecretThatWasConfiguredOnTheClientDevice
RASClientField: RASClientFieldValue
RASClientField: RASClientFieldValue
:
```

Adding Users with LDIF

The sample LDIF entry shown in Figure 184 adds a Local (Native) User named KEVIN to the Steel-Belted Radius database.

Figure 184: Adding Users

```
dn: radiusname=KEVIN,radiusclass=Native-User,o=radius
changetype: add
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: KEVIN
password: {x-clear}secret1
profile: ISDN
login-limit: 2
```

The syntax in this LDIF entry is shown in Figure 185.

Figure 185: LDIF Syntax

```
dn: radiusname=String,radiusclass=Native-User |
    Solaris-User |..., o=radius
changetype: add
objectclass: top
objectclass: Native-User | Solaris-User | ...
objectclass: user
radiusname: String
password: {x-clear}PString | {x-md5}Hash |
    {x-md5}{encrypt}PString |...
profile: NameOfProfileEntryInTheServerDatabase
login-limit: IntegerGivingConcurrentConnectionLimit
UserField: UserFieldValue
UserField: UserFieldValue
:
```

The LDIF file shown in Figure 186 add a local (native) user named CHRISTIAN, who has various attribute/value pairs assigned to his checklist and return list.

Figure 186: Adding a Native User

```

dn: radiusname=christian,radiusclass=native-user,o=radius
changetype: add
objectclass: top
objectclass: Native-User
objectclass: user
radiusname: CHRISTIAN
password: {x-clear}password
login-limit: 2

dn: radiuslist=check,radiusname=CHRISTIAN,radiusclass=Native-User,o=radius
changetype: add
objectclass: top
objectclass: check
radiuslist: check
NAS-IP-Address: 50.50.50.50
Framed-protocol: PPP

dn: radiuslist=reply,radiusname=CHRISTIAN,radiusclass=Native-User,o=radius
changetype: add
objectclass: top
objectclass: reply
radiuslist: reply
framed-ip-address: 100.100.100.100
framed-IP-Netmask: 255.255.255.224

```

Checklists and return lists are objects in the LDAP virtual schema, but the individual RADIUS attributes are not. Therefore, you must use a separate LDIF entry for each checklist and return list object, but each LDIF entry can name multiple attribute/value pairs.

To indicate that a transaction applies to the user's checklist (rather than to the user entry itself), use the keyword `check` as the value for `radiuslist` and `objectclass` within the transaction. You must assign this value to `radiuslist` in the distinguished name, and again before the list of attributes. You must also assign the value to `objectclass`, above the second `radiuslist` entry.

To indicate the return list, use the keyword `reply`.

The LDIF syntax to add a user entry, complete with a checklist and return list, is shown in Figure 187. Note that the `radiusname` and `radiusclass` values for all of the transactions that apply to the same User entry must be the same.

Figure 187: Adding a User With Checklist and Return List Attributes

```

dn: radiusname=String,radiusclass=Native-User | ...,o=radius
changetype: add
objectclass: top
objectclass: Native-User | Solaris-User| ...
objectclass: user
radiusname: String
password: {x-clear}PString | {x-md5}Hash | {x-md5}{encrypt}PString |...
profile: NameOfProfileEntryInTheServerDatabase
login-limit: IntegerGivingConcurrentConnectionLimit
UserField: UserFieldValue
UserField: UserFieldValue

dn: radiuslist=check,radiusname=String,radiusclass=Native-User | ...,o=radius
changetype: add
objectclass: top
objectclass: check
radiuslist: check
AttributeName: AttributeValue
AttributeName: AttributeValue
:
dn: radiuslist=reply,radiusname=String,radiusclass=
Native-User | ...,o=radius
changetype: add
objectclass: top
objectclass: reply
radiuslist: reply
AttributeName: AttributeValue
AttributeName: AttributeValue
:
:

```

Adding Proxy Targets with LDIF

The sample LDIF entry shown in Figure 188 adds the proxy RADIUS target BIGCO.COM to the Steel-Belted Radius database.

Figure 188: Adding Proxy Targets

```

dn: radiusname=BIGCO.COM,radiusclass=Proxy,o=radius
changetype: add
objectclass: top
objectclass: Proxy
radiusname: BIGCO.COM
ip-address: 194.132.5.89
accounting: both
retry-count: 3
retry-timeout: 5000
shared-secret: testing123
include-in-auth-list: no

```

The syntax in this LDIF entry is shown in Figure 189.

Figure 189: LDIF Syntax

```
dn: radiusname=StringToParseAsProxyName, radiusclass=Proxy, o=radius
changetype: add
objectclass: top
objectclass: Proxy
radiusname: StringToParseAsProxyName
ip-address: IPAddressOfTheTargetServer
accounting: Both | ...
retry-count: Integer
retry-timeout: Integer
shared-secret: SharedSecretThatWasConfiguredOnTheTargetServer
include-in-auth-list: Yes | No
ProxyField: ProxyFieldValue
ProxyField: ProxyFieldValue
:
```

Adding Tunnels with LDIF

The sample LDIF entry shown in Figure 190 adds the tunnel ACME.COM to the Steel-Belted Radius database.

Figure 190: Adding Tunnels

```
dn: radiusname=ACME.COM,radiusclass=Tunnel,o=radius
changetype: add
objectclass: top
objectclass: Tunnel
radiusname: ACME.COM
dnis-list: 8005551212;6171231234;12343210
description: Tunnel configuration for Acme Corp.
usage-limit: 24
```

The syntax in this LDIF entry is shown in Figure 191.

Figure 191: LDIF Syntax

```
dn: radiusname=StringToParseAsTunnelName,radiusclass=Tunnel,o=radius
changetype: add
objectclass: top
objectclass: Tunnel
radiusname: StringToParseAsTunnelName
dnis-list: PhoneNumber;PhoneNumber;etc
description: StringDescribingTunnel
usage-limit: IntegerGivingConcurrentConnectionLimit
TunnelField: TunnelFieldValue
TunnelField: TunnelFieldValue
:
```

Adding IP Address Pools with LDIF

The sample LDIF entry shown in Figure 192 adds an IP address pool named POOL1 to the Steel-Belted Radius database.

Figure 192: Adding IP Address Pools

```
dn: radiusname=POOL1,radiusclass=IP-Addr-Pool,o=radius
changetype: add
objectclass: top
objectclass: IP-Addr-Pool
radiusname: POOL1
description: Address pool for common users
range: 198.187.100.1:50
range: 198.187.101.1:50
```

The syntax in this LDIF entry is shown in Figure 193.

Figure 193: LDIF Syntax

```
dn: radiusname=String,radiusclass=IP-Addr-Pool,o=radius
changetype: add
objectclass: top
objectclass: IP-Addr-Pool
radiusname: String
description: StringDescribingPool
range: IPAddress:Range
range: IPAddress:Range
:
```

Adding IPX Address Pools with LDIF

The sample LDIF entry shown in Figure 194 adds an IPX address pool named NETWARE1 to the Steel-Belted Radius database.

Figure 194: Adding IPX Address Pools

```
dn: radiusname=NETWARE1,radiusclass=IPX-Addr-Pool,o=radius
changetype: add
objectclass: top
objectclass: IPX-Addr-Pool
radiusname: NETWARE1
description: IPX network numbers for dial in users
range: 0xffff0a00:500
```

The syntax in this LDIF entry is shown in Figure 195. You may provide multiple IPX address ranges using the range field.

Figure 195: LDIF Syntax

```
dn: radiusname=String,radiusclass=IPX-Addr-Pool,o=radius
changetype: add
objectclass: top
objectclass: IPX-Addr-Pool
radiusname: String
description: StringDescribingPool
range: IPXAddress:Range
range: IPXAddress:Range
:
```

Configuring a RADIUS Server with LDIF

The sample LDIF entry shown in Figure 196 lets you configure your Steel-Belted Radius server by adding the Native User authentication method and defining conventions for tunnel name parsing.

Figure 196: Adding a RADIUS Server

```
dn: radiusclass=Server, o=radius
changetype: add
objectclass: top
objectclass: RadiusClass
radiusclass: Server
auth-methods: Native User
tunnel-delimiter: $
tunnel-type: prefix
```

The syntax in this LDIF entry is shown in Figure 197.

Figure 197: LDIF Syntax

```
dn: radiusclass=Server, o=radius
changetype: add
objectclass: top
objectclass: RadiusClass
radiusclass: Server
auth-methods: Native User | Solaris User | SecurID Prefix | ...
tunnel-delimiter: Character
tunnel-type: Prefix | Suffix | Neither
ConfigurationField: ConfigurationFieldValue
ConfigurationField: ConfigurationFieldValue
:
```

Statistics Variables

Server statistics counters record the number of certain types of events. The LCI allows you to read these statistics to monitor the performance of your Steel-Belted Radius server.



Note: The Enterprise Edition of Steel-Belted Radius with the optional LCI add-on does not support the Statistics items.

Counter Statistics

The statistics counters can be accessed via the LCI by executing the following one line command:

```
ldapsearch -V 2 -h 127.0.0.1 -p 667 -D "cn=admin,o=radius" -w radius -s sub -T -b
"radiusstatus=statistics,o=radius" stattype=typeofstatus
```

The following sections illustrate the variables displayed for different settings of the stattype parameter.

stattype: server

```
dn: stattype=server,radiusstatus=statistics,o=radius
```

```
objectclass: top
objectclass: radiusstatus
radiusstatus: statistics
stattype: server
start-time: 2002/05/08 13:29:08
up-time: 26188
ip-address: 192.168.21.142
version: v 2.20.33
authentication-threads: 0
accounting-threads: 0
total-threads: 0
max-auth-threads: 100
max-acct-threads: 100
max-total-threads: 200
high-auth-threads: 2
high-acct-threads: 0
high-total-threads: 2
```

stattype: authentication

```
dn: stattype=authentication,radiusstatus=statistics,o=radius
objectclass: top
objectclass: radiusstatus
radiusstatus: statistics
stattype: authentication
accept: 1
reject: 0
```

silent-discard: 0
total-transactions: 8
invalid-request: 0
failed-authentication: 0
failed-on-check-list: 0
insufficient-resources: 0
proxy-failure: 0
rejected-by-proxy: 0
transactions-retried: 0
total-retry-packets: 0

stattype: accounting

dn: stattype=accounting,radiusstatus=statistics,o=radius
objectclass: top
objectclass: radiusstatus
radiusstatus: statistics
stattype: accounting
start: 0
stop: 0
on: 0
off: 0
total-transactions: 0
invalid-request: 0
invalid-client: 0
invalid-shared-secret: 0
insufficient-resources: 0
proxy-failure: 0
transactions-retried: 0
total-retry-packets: 0

stattype: proxy

dn: stattype=proxy,radiusstatus=statistics,o=radius
objectclass: top
objectclass: radiusstatus
radiusstatus: statistics

```

statttype: proxy
authentication: 0
accounting: 0
total-transactions: 0
timed-out: 0
invalid-response: 0
invalid-shared-secret: 0
insufficient-resources: 0
transactions-retried: 0
total-retry-packets: 0

```

Rate Statistics Rate

statistics are derived from existing counter statistics by taking time into consideration. Rate values calculated for each of these counter statistics consist of the following:

- Current rate—The rate measured over the most recent rate interval.
- Average rate—The rate measured since the Steel-Belted Radius server was started or since the last time statistics were reset to zero.
- Peak rate—The highest rate observed since the Steel-Belted Radius server was started or since the last time statistics were reset to zero.

Additionally, there is a (read-only) time value used in calculations:

- Rate statistics seconds-per interval—The duration (in seconds) of the interval over which the rate statistics are gathered. To read rate statistics from the LCI, you must set statttype: rate. This results in output such as the following: rate-statistics-seconds-per-interval: 1

```

auth-request-current-rate: 0
auth-request-average-rate: 0
auth-request-peak-rate: 7
auth-accept-current-rate: 0
auth-accept-average-rate: 0
auth-accept-peak-rate: 1
auth-reject-current-rate: 0
auth-reject-average-rate: 0
auth-reject-peak-rate: 0
acct-start-current-rate: 0
acct-start-average-rate: 0
acct-start-peak-rate: 0

```

acct-stop-current-rate: 0
acct-stop-average-rate: 0
acct-stop-peak-rate: 0
proxy-auth-request-current-rate: 0
proxy-auth-request-average-rate: 0
proxy-auth-request-peak-rate: 0
proxy-acct-request-current-rate: 0
proxy-acct-request-average-rate: 0
proxy-acct-request-peak-rate: 0
proxy-fail-timeout-current-rate: 0
proxy-fail-timeout-average-rate: 0
proxy-fail-timeout-peak-rate: 0
proxy-fail-badresp-current-rate: 0
proxy-fail-badresp-average-rate: 0
proxy-fail-badresp-peak-rate: 0
proxy-fail-badsecret-current-rate: 0
proxy-fail-badsecret-average-rate: 0
proxy-fail-badsecret-peak-rate: 0
proxy-fail-missingresr-current-rate: 0
proxy-fail-missingresr-average-rate: 0
proxy-fail-missingresr-peak-rate: 0
proxy-retries-current-rate: 0
proxy-retries-average-rate: 0
proxy-retries-peak-rate: 0
proxy-auth-rej-proxy-current-rate: 0
proxy-auth-rej-proxy-average-rate: 0
proxy-auth-rej-proxy-peak-rate: 0
proxy-acct-fail-prox-current-rate: 0
proxy-acct-fail-prox-average-rate: 0
proxy-acct-fail-prox-peak-rate: 0
proxy-auth-rej-proxy-error-current-rate: 0
proxy-auth-rej-proxy-error-average-rate: 0
proxy-auth-rej-proxy-error-peak-rate: 0

Chapter 26

Configuring SQL Authentication

This chapter presents an overview of SQL authentication and describes how to configure SQL authentication in Steel-Belted Radius.


About SQL Authentication

Steel-Belted Radius can authenticate against records stored in an external SQL database. Any attribute or set of attributes, such as username and password, can be used to query the database.

External database authentication is typically used when an organization already has a large amount of user information stored in a SQL database, and this information is to be used to authenticate these users using RADIUS. Authentication against an existing database extends authentication services to user accounts without requiring an administrator to enter user information into the Steel-Belted Radius database.

Steel-Belted Radius offers the SQL authentication feature as a plug-in software module. Key features of the SQL plug-in include:

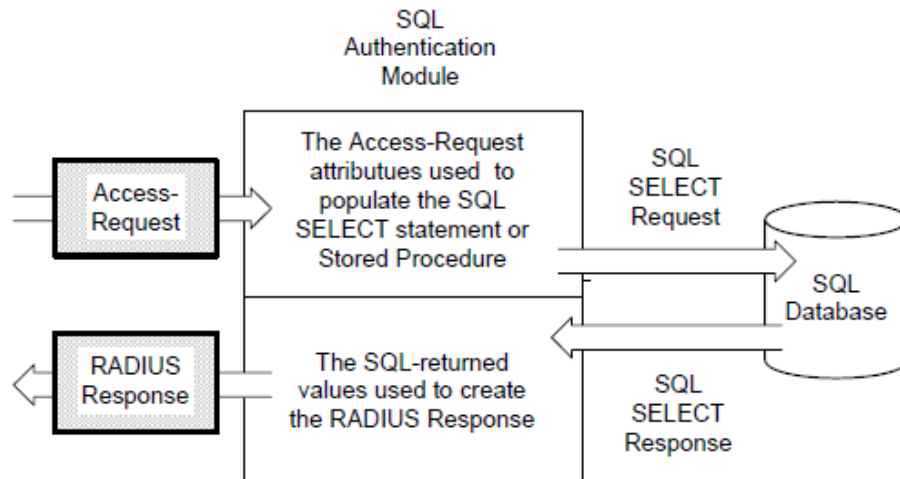
- The SQL statement is completely user-specified, allowing support of existing tables with existing field names and formats.
- The SQL statement supports a wide range of arithmetic and string expressions as part of the statement.
- The SQL statement is parameterized, so it is compiled once, and each execution uses variable data without need for recompilation.
- Multiple authentications may be overlapped at the same time.
- The SQL authentication method, which appears in the Authentication Policies panel in SBR Administrator, can be activated/deactivated and ordered with respect to other authentication methods.
- Multiple instances of the SQL authentication module can operate simultaneously, allowing authentication to multiple databases.
- If the database connection drops, it is automatically reestablished after a configurable timeout without Steel-Belted Radius being restarted.
- Data from the database can be returned as attributes in the Access-Accept message.

 **Note:** While Steel-Belted Radius does its best to provide uniformity in the operation of databases from different vendors, differences occur, particularly in the way SQL statements are interpreted. The capabilities of the SQL authentication module depend on the capabilities of the underlying databases and their clients; things that work with one database may not work with another.

SQL Authentication Process

Any RADIUS attribute (or Steel-Belted Radius request variable) from the request can be used in an SQL SELECT statement. Any return list attribute (that is, a Steel-Belted Radius response variable) can be retrieved from a SQL database and returned in a RADIUS access response message.

Figure 198: QL Authentication Process



Stored Procedures

A stored procedure is a sequence of SQL statements that form a logical unit and perform a particular task. You can use stored procedures to encapsulate a set of queries or operations that can be executed repeatedly on a database server. For example, you can code operations on an employee database, such as password lookup, as stored procedures that can be executed by application code.

Stored procedures can be compiled and executed with different parameters and results. Stored procedures can use any combination of input parameters (the values passed to the stored procedure at execution time) and output parameters (the values set or returned by the stored procedure to the calling application or environment).

You can write stored procedures for SQL that communicate with Steel-Belted Radius via input and output parameters to implement custom functions. Stored procedures let you use server-side processing on the SQL server to manipulate the information specified by variables. How you use these stored procedures depends on details specific to the implementation of SQL that you are using.

Note: Do not configure a stored procedure to call the same attribute more than once. Doing so may cause Steel-Belted Radius to fail.

For information on using stored procedures with the Oracle SQL database, see [“Working with Stored Procedures in Oracle”](#). For information on using stored procedures with the Microsoft SQL database, see [“Working with Stored Procedures in MS-SQL”](#).

Connectivity Issues

Steel-Belted Radius may encounter serious problems if the connection between Oracle and Steel-Belted Radius becomes unstable. The most common reasons for a connection becoming unstable are:

- Slow or unreliable network response times
- Interruptions in connectivity caused by intervening network devices, such as a firewall timing out the connection

To prevent connectivity problems, consider implementation of one of the following solutions:

- To minimize problems caused by intervening firewalls, configure your firewall to pass traffic on the Oracle communications ports between the Steel-Belted Radius server and the Oracle server without restriction.
- To minimize network latency and firewall-related problems, move the Steel-Belted Radius server to the same network segment as the Oracle server.
- If moving your Steel-Belted Radius server is not feasible, locate a second Steel-Belted Radius server on the same network segment as your Oracle server, and configure your current Steel-Belted Radius server to proxy all authentication requests to this new device. This configuration will allow you to open RADIUS ports on the firewall only for the Steel-Belted Radius server (instead of opening RADIUS ports for all network access devices). Because proxy functions in Steel-Belted Radius do not require an uninterrupted connection to process requests, this solution allows you to retain your current firewall timeout settings.

Configuring SQL Authentication

You must configure both Steel-Belted Radius and the SQL database to support SQL authentication. The configuration procedure must be tailored to the database that you use. However, all procedures must give the following results:

- The required transport must be in place between SQL client software and the SQL server.
- The SQL server must be configured via a plug-in to coordinate with SQL client software.
- The Steel-Belted Radius server must be configured to communicate with the SQL client software to interact with the back-end SQL server to perform stored procedures or SQL queries.

Files

The following files establish settings for configuring SQL authentication in Steel-Belted Radius. For more information about these files, refer to the *Steel-Belted Radius Reference Guide*.

Table 42: SQL Authentication Files

File Name	Function
sqlauth.aut	Configures settings for SQL authentication (Windows).
radsqldb.aut	Configures settings for SQL authentication using JDBC (Linux).

Using the SQL Authentication Header File

To configure SQL authentication, you must edit the authentication header files, radsqldb.aut (Linux with JDBC), or sqlauth.aut (Windows/ODBC), which are located in the same directory that contains the Steel-Belted Radius service or daemon. Most of these options may be left at their original settings; however, you must modify certain options to accommodate your own database.

After you complete your changes to the authentication header files and restart Steel-Belted Radius, the InitializationString value that you entered in the [Bootstrap] section of the header file appears in the Authentication Methods tab in the Authentication Policies panel. You can then enable, disable, or prioritize your

SQL database like any other authentication method in the list.

Using Multiple SQL Authentication Methods

You can configure Steel-Belted Radius to authenticate users against more than one SQL database. Each database that you set up in this way becomes a separate selection in the Authentication Methods tab in the Authentication Policies panel.

To add an additional database, create a new header file with extension `.aut` in the same directory as `radsqldb.aut` (Linux with JDBC), or `sqlauth.aut` (Windows/ODBC). You can give this file any name you like, provided its extension is `.aut`. At startup, Steel-Belted Radius enumerates all `.aut` files to create its list of authentication methods.

When creating the new file, start by copying the original `.aut` file. Be sure to change its `InitializationString` entry to a unique authentication method name; otherwise, Steel-Belted Radius has no way of distinguishing between the different methods in the authentication methods list.

Connecting to the SQL Database


Upon startup, the SQL authentication module connects to the database, using settings specified by a connect string specified in the header file. The connect string contains information such as the name and location of the database, and the password required to connect.


The connect string is passed to the database client to establish the connection. While a sample connect string is provided in the original header file, you must configure the `Connect` entry of the header file with a connect string appropriate to your database.

The password for database access must be provided as part of the connect string. If it is not:

- Linux: The connection fails.
- Windows: A pop-up window prompts you to enter the password before making the connection at startup and each time a reconnect is required. If the initial attempt to connect to the database fails, or if a processing error occurs that the SQL authentication module interprets as a database connection failure, the SQL authentication module drops the connection and attempts to establish a new connection after a period of time. In the interim, all authentication requests are ignored.

The SQL authentication module uses an exponential back-off strategy in determining how long to wait before attempting a new connection, as well as how frequently this attempt should be made. After the first dropped connection, it waits a certain amount of time before attempting to reconnect. If this attempt to reconnect also fails, it waits for twice the amount of time before trying again; and so on, up to some maximum wait time. The initial and maximum wait times are configurable.

 **Note:** "PWD" (password for DB) value of "Connect" string will be overwritten by their encrypted equivalents after restart.

 **Note:** (Linux only): Detailed error information may not be available if there is an error processing the database logon at connect time. A numeric result code is displayed in the log. You may need to refer to product-specific documentation to decode this result code.

SQL Statement Construction

The authentication transaction is based on an SQL query that returns a password (and possibly other information) based on the name entered by the user attempting to log in.

While a sample SQL query is provided in the original header file, you must configure the SQL entry of the header file with a query appropriate to your database. The query you enter must be either a SQL SELECT or SQL EXECUTE statement that contains additional syntax elements which are preprocessed by the SQL authentication module.

The SQL authentication module executes SQL statements in parameterized form. This means that the SQL statement is compiled once, with parameter markers (usually question marks) as placeholders for data items that vary from one execution to the next. Only upon execution of the statement are the actual data values supplied.

The SQL statement you compose must not include parameter markers directly. Instead, the names of the parameters should be included where parameter markers would appear, in a format described below. The SQL authentication module translates the SQL statement provided, replacing parameter names with parameter markers prior to passing the SQL statement to the database engine.

The SQL statement can be very simple. Basically, all that is required is to look up a password and possibly some optional information based on a username. The SQL statement can also be quite complex; it can include inner joins, and it can contain expressions. The underlying database engine is responsible for handling the SQL statement; the SQL authentication module performs no interpretation of the SQL statement other than to translate parameter names to parameter markers.

Example:

```
SELECT password, profile, fullname FROM usertable WHERE username = %name/63s
```

As shown in this example, a parameter consists of a percent sign (%), the name of the parameter and a format specifier. **Table 43** lists SQL statement parameter names.

Table 43: SQL Statement Parameters

Item	Meaning for SQL Authentication
%OriginalUserName	The original full identification of the user, prior to any processing (that is, user@realm).
%User	The user portion of OriginalUserName (the section before '@').
%UserName	The full user identification (user and realm strings) after all stripping and processing has been performed.
%Name	Synonym for UserName.
%EffectiveUser	The name of the user (the section before '@') as presented to the authentication method. This may be a modified version of the original user name.
%Realm	The realm portion of the original user identification (the section after '@') as presented to the authentication method. This may be a modified version of the original realm name.
%EffectiveRealm	The realm portion of the user identification as presented to the method. This may be a modified version of the original realm name.

Item	Meaning for SQL Authentication
%NASName	The name of the network access device that originated the request. This may be the name of the RADIUS clients entry in the database or the value of the NAS-Identifier or NAS-IP-Address attribute.
%NASAddress	The address of the network access device, in dotted notation.
%NASModel	The make/model of the network access device, as specified in the Steel-Belted Radius database.
%Password	The PAP password.
%AllowedAccessHours	The times that the user is allowed to be logged in.
%RADIUSClientName	The name of the network access device, as specified in a RADIUS clients entry in the Steel-Belted Radius database.


Along with these parameters, any RADIUS attribute received in the Access-Request can be referred to by using an at-sign ('@') followed by the name of the attribute. If you need to specify a literal at-sign character in an SQL statement, such as in a UserName, you must use two at-signs in a row. For example:

```
SELECT foo FROM bar WHERE field = 'abc@@xyz'
```

Likewise, if you need to specify a literal percent character ('%') in an SQL statement you must use a two percent characters in a row.

The format specifier should describe the database storage format of the column that corresponds to the parameter. It consists of a slash ('/'), a length, and a type, which for SQL authentication is always 's' for string. For example, if the user's name is stored in the database as a string of up to 63 bytes, you would enter:

```
%name/63s
```

 **Note:** Be sure to specify a length no greater than the actual field size in the database. The compilation of the SQL statement may fail if a parameter size greater than the actual field size is specified.

Password Parameters

Normally, the only parameter you'd include in the SQL statement is %name. The %password parameter is available to support databases containing non-unique usernames. For example, your database might allow two people named "George"; one with password "swordfish", and the other with password "martha". You can authenticate them correctly with the following query:

```
SELECT password, profile, fullname FROM usertable
WHERE username = %name/63s and password = %password/63s
```

You must return the password as the first column of the result to perform authentication. If the password is not returned in a password column or as an output parameter, no password authentication is performed.

In the following statement, %name is an input parameter used to look up a record.

```
SELECT profile FROM database WHERE username = %name
```

Since there's no password output parameter, no password authentication is performed. The [Results] section of the .aut file should look something like the following to work with the above SELECT statement:

```
[Results]
```

```
Password=0
```

```
Profile=1/50
```

```
Alias=0
```

If the record cannot be found in the database, the authentication attempt fails.


 **Note:** If you are not using password checking for authentication, the Password parameter must be set to 0 in the [Results] section.

Overlapped Execution of SQL Statements

The SQL authentication module is multi-threaded. SQL authentication can be configured with a maximum number of simultaneous executions of any SQL statement, using the MaxConcurrent entry in the .aut file's [Settings] section.

If MaxConcurrent is set to 1, SQL execution occurs serially, and the SQL execution for each authentication request must complete before execution for the next request may begin.

By increasing MaxConcurrent, it may be possible to increase throughput by overlapping operations, especially if the database server is remote and a large part of the time to complete a statement execution is taken up by network latency. If the database server is local, the point of diminishing returns may be reached at a small value of MaxConcurrent, possibly even at 1 or 2. The optimum value is a matter of experiment.

 **Note:** A setting of MaxConcurrent = 1 should be sufficient for all but the most demanding environments. Increase this value only slowly and conservatively.

You might expect that databases that are licensed by number of connections would debit a single connection regardless of how many SQL statements are active. This is not necessarily the case; some databases count each open compiled SQL statement against the licensed number of connections. So another factor that determines how MaxConcurrent should be set might be the database license.

%result Parameter

The %result parameter is a string value that can be returned as a column or stored procedure output parameter. The %result parameter can be used with or without password authentication.

The value expected to be returned in this parameter when authenticating a user can be specified in the SuccessResult entry of the [Settings] section. For example, if a user is successfully authenticated by the SQL authentication method, the result signifying success is the text string "okay". This can be automatically checked by the following setting.

```
[Settings]
```

```
SuccessResult = okay
```

 **Note:** The string comparison is case insensitive.

If the SQL statement succeeds but the `SuccessResult` value does not match the expected value returned from the database, Steel-Belted Radius issues a reject response, which can include any attributes and values configured in the `[FailedSuccessResultAttributes]` section of the `*.aut` file.

If `PerformSuccessResultCheckAfterPasswordCheck=1` is specified and the SQL statement performs a password check that fails, Steel-Belted Radius does not process the `SuccessResult` and does not return the attributes from the `[FailedSuccessResultAttributes]` section in the reject response. If `PerformSuccessResultCheckAfterPasswordCheck=1` is specified and the SQL statement performs a password check that succeeds but the `SuccessResult` value does not match the value returned from the database, Steel-Belted Radius issues a reject response that contains the attributes from the `[FailedSuccessResultAttributes]` section.

In the following statement, `%password` is passed to a stored procedure, which returns a `%result` of either “okay” or something else (that signifies a rejection):

```
BEGIN CheckUser(%name, %password, %result!o); END;
```

Another example might be a database of usernames, passwords, and account status. The administrator can enable a user by setting the user’s account status to “okay” or disable the user by setting the account status to some other value, without having to delete the record. In the following statement, both password and result columns are checked:

```
SELECT password, result FROM database WHERE username = %name
```

```
[Results]
```

```
Password=1/50
```

```
%Result=2/50
```

```
Profile=0
```

```
Alias=0
```

SQL Authentication and Password Format


Steel-Belted Radius supports the authentication of users residing in a SQL database, in which password values for the users are stored in one of the following formats: clear text, UNIXcrypt, Secured Hash Algorithm (SHA1+Base64 hash), MD4 hash, or enc-md5 reversibly-encoded password.

Hashed Passwords

Values in the Password column include a prefix that indicates how the password has been processed. The prefix is in clear text between curly braces { } and is immediately followed by a hash value computed from the password. If no prefix is present in the value retrieved from the table Password column, the entire password is assumed to be in clear text format. In summary:

- PasswordText indicates clear text format (no encryption)
- {crypt}HashHash indicates UNIXcrypt format
- {SHA}HashHashHash indicates SHA1+Base64 hash
- {SSHA}HashHashHashSalt indicates salted SHA1+Base64 hash
- {md4}HashHash indicates MD4 hash of the Unicode form of password
- {enc-md5}EncryptedEncrypted indicates a reversibly encrypted password

 **Note:** Refer to RFC 2759 for details about how MS-CHAP-V2 produces an MD4 hash value.

 **Note:** Although Steel-Belted Radius reads passwords encoded in enc-md5 format, you must purchase the Software Developer's Kit to convert clear-text passwords to this format.


UNIXcrypt is the standard hash algorithm that is used for the `/etc/passwd` file on Linux systems. This may be necessary if, for example, the standard user database on a Linux machine (the `/etc/passwd` file) is migrated to a SQL database, so that the values in the Password column of the SQL table are processed with UNIXcrypt.

Steel-Belted Radius may be configured to expect that the values retrieved from the SQL table Password column during authentication have been run through UNIXcrypt by adding the following entry into the [Settings] section of the SQL authentication header file:

```
PasswordFormat=3
```

Automatic Parsing

If PasswordFormat is set to 0, Steel-Belted Radius attempts to determine the password format automatically by parsing it. This is the recommended setting. Automatic parsing expects the password to be stored in one of the formats described in this section.

 **Note:** The setting for automatic password parsing in older versions of Steel-Belted Radius (`auto`) has been deprecated.

Working with Stored Procedures in Oracle

The following notes discuss some considerations specific to Oracle, which uses the term *package and package body* when referring to stored procedures.

Assume you have a SELECT statement that extracts a user's name, password, and profile from the table `usertable` when it receives the user's name as an input parameter:

```
SELECT fullname, password, profile FROM usertable WHERE username =  
%name/63s
```

To write a package called `myPack1` that performs the equivalent function, you would enter the following sequence of commands:

```
Package myPack1  
is  
PROCEDURE myProc  
(  
  name IN VARCHAR2,  
  passOUTVARCHAR2,  
  prof OUTVARCHAR2,  
  fName OUT VARCHAR2
```

```
);  
End myPack1;
```

When referencing the package from sqlauth.aut, you would point to the package name myPack1 (not the procedure name myProc):

```
Package Body myPack1  
is  
PROCEDURE myProc  
(  
  name IN VARCHAR2,  
  pass OUT VARCHAR2,  
  prof OUT VARCHAR2,  
  fName OUT VARCHAR2  
)  
IS  
BEGIN  
  SELECT fullname INTO fName, password INTO pass, profile INTO prof FROM  
  usertable WHERE username = name;  
END myProc;  
End myPack1;
```

When you invoke the stored procedure, you would delineate each parameter as an input (!i), output (!o), or input/output (!io) variable. The presence of a !io or !o keyword indicates that the value returned from the database is to be included in the Access-Accept response as if it had been coded in the [Results] section. If a r value is included in the suffix (for example, !ir, !r, or !or), the parameter is expected to be an output parameter, and the attribute is to be treated as if it were included in the [FailedSuccessResultAttributes] section. Variables that are not specifically marked are considered input parameters by default.



Note: Do not configure a stored procedure to call the same attribute more than once. Doing so may cause Steel-Belted Radius to fail.

Correct: SQL= {call joeproc2 (@class!o)}

Incorrect: SQL= {call joeproc2 (@class!o, @class!o)}

You could replace the SELECT statement by invoking myProc as follows:

```
SQL=BEGIN myPack1.myProc(%name!i, %password!o, %profile!o, %fullname!o ); END;
```

When using input-output parameters with Oracle, you must set the DefaultResults setting to 0. Any other variables that need to be returned (such as Reply-Message) must be identified by the “!o” marker within the SQL statement.

Working with Stored Procedures in MS-SQL

A simple example of a stored procedure returns a result set in the same way as a Select statement. For example, assume you have a table with the following fields: username, password, Alias, and active, where all fields have the datatype varchar. You want a stored procedure that will return a password and alias when the username and password received in the request match entries in the database, provided that active field has a value of 'yes'.

Example 1

To create a simple stored procedure, run the following command sequence from MS Query Analyzer to create a stored procedure called rsp_getpword.

```
CREATE PROCEDURE rsp_getpword
@Uname varchar(21),
@pword varchar(21)
AS
SELECT password, alias FROM authentication WHERE username = @Uname
AND password = @pword AND active = 'yes'
GO
```

This stored procedure can then be executed from a *.aut file as follows:

```
SQL= Execute rsp_getpword %username, %password
[results]
Password=1
Alias=2
```

Example 2

More complex stored procedures take input and output parameters in a manner similar to that used by Oracle. For example, assume you have a table with the following fields: username, password, profile, and active, where all fields have a datatype of varchar. You want a stored procedure that returns a password and profile when the username and password received in the request match a username and password in the database, provided that the active field has a value of yes.

First, to create the stored procedure, run the following command from MS query analyzer:

```
CREATE PROCEDURE rsp_authuser
@uname as varchar(20),
@pword as varchar(21) OUTPUT,
@profile as varchar(21)OUTPUT
AS
SELECT @pword =password,@profile=profile FROM authentication WHERE
username = @uname AND active = 'yes'
GO
```

This stored procedure can then be executed from a *.aut file as follows:

```
SQL= {call rsp_authuser (%username!i, %password!o, %profile!o)}
```

```
[results]
```

; No entries should be specified in results, everything but the header should be commented out.

Chapter 27

Configuring SQL Accounting

This chapter presents an overview of SQL accounting and describes how to configure SQL accounting in Steel-Belted Radius.


About SQL Accounting

Steel-Belted Radius can write RADIUS accounting information to an external SQL database, independently of the Steel-Belted Radius accounting log.

To set up an external database for use as a repository for RADIUS accounting data, you must place an .acc database configuration file in the same directory that contains the Steel-Belted Radius service (normally C:\RADIUS\Service) or daemon. This file must be modified to contain specialized information about your enterprise database.

Steel-Belted Radius offers the SQL accounting feature as a plug-in software module. Key features of the SQL plug-in include:

- The SQL statement is completely user-specified, allowing support of existing tables with existing field names and formats.
- The SQL statement can include a wide variety of arithmetic and string expressions.
- The SQL statement is parameterized, so it is compiled once, and each execution uses variable data without need for recompilation.
- Attribute and other data from the accounting request can be mapped to any parameter of the SQL statement (and hence to any field in the table) by means of a simple syntax.
- Different request types can be mapped to different SQL statements that may operate against distinct tables within the database.
- Multiple instances of a SQL statement can be overlapped for simultaneous execution.
- Multiple instances of the SQL accounting module can operate simultaneously, allowing logging to multiple databases.
- If the database connection drops, it is automatically reestablished after a configurable timeout without restarting Steel-Belted Radius.
- SQL accounting responses can return information.
- Stored procedures invoked by SQL accounting can make use of input parameters, record results, and return output parameters.

 **Note:** While Steel-Belted Radius tries to provide uniformity in the operation of databases from different vendors, differences exist, particularly in the way SQL statements are interpreted. The capabilities of the SQL Authentication module depend on the capabilities of the underlying databases and their clients; things that work with one database may not work with another.

Stored Procedures

A stored procedure is a sequence of SQL statements that form a logical unit and perform a particular task. You can use stored procedures to encapsulate a set of queries or operations that can be executed repeatedly on a database server. For example, you can code operations on an employee database, such as password lookup, as stored procedures that can be executed by application code.

Stored procedures can be compiled and executed with different parameters and results. Stored procedures can use any combination of input parameters (the values passed to the stored procedure at execution time) and output parameters (the values set or returned by the stored procedure to the calling application or environment).

You can write stored procedures for SQL that communicate with Steel-Belted Radius via input and output parameters to implement custom functions. Stored procedures let you use server-side processing on the SQL server to manipulate the information specified by variables. How you use these stored procedures depends on details specific to the implementation of SQL that you are using.

For information on using stored procedures with the Oracle SQL database, see [“Working with Stored Procedures in Oracle”](#). For information on using stored procedures with the Microsoft SQL database, see [“Working with Stored Procedures in MS-SQL”](#).

Connectivity Issues

Steel-Belted Radius may encounter serious problems if the connection between Oracle and Steel-Belted Radius becomes unstable. The most common reasons for a connection becoming unstable are:

- Slow or unreliable network response times
- Interruptions in connectivity caused by intervening network devices, such as a firewall timing out the connection

To prevent connectivity problems, consider implementation of one of the following solutions:

- To minimize problems caused by intervening firewalls, configure your firewall to pass traffic on the Oracle communications ports between the Steel-Belted Radius server and the Oracle server without restriction.
- To minimize network latency and firewall-related problems, move the Steel-Belted Radius server to the same network segment as the Oracle server.
- If moving your Steel-Belted Radius server is not feasible, locate a second Steel-Belted Radius server on the same network segment as your Oracle server, and configure your current Steel-Belted Radius server to proxy all authentication requests to this new device. This configuration will allow you to open RADIUS ports on the firewall only for the Steel-Belted Radius server (instead of opening RADIUS ports for all network access devices). Because proxy functions in Steel-Belted Radius do not require an uninterrupted connection to process requests, this solution allows you to retain your current firewall timeout settings.

Configuring SQL Accounting

You must configure both Steel-Belted Radius and the SQL database to support SQL accounting. The configuration procedure must be tailored to the database that you use. However, all procedures must give the following results:

- The SQL server must be configured to be listening for client requests. Note that for SQL purposes, the Steel-Belted Radius server must be a client of the SQL server.

- The Steel-Belted Radius server must know the machine where the SQL server software runs, and it must know the protocol and port used in communicating with that machine.
- The required transport must be in place between SQL client and server.

Files

The following files establish settings for configuring SQL accounting in Steel-Belted Radius. For more information about these files, refer to the Steel-Belted Radius Reference Guide.

Table 44: SQL Accounting Files

File Name	Function
radsqljdbc.acc	Configures settings for SQL accounting (Linux and JDBC).
sqlacct.acc	Configures settings for SQL accounting (Windows/ODBC).

Using the SQL Accounting Header File


To configure SQL accounting, you must edit the accounting header file `radsqljdbc.acc` (Linux and JDBC) or `sqlacct.acc` (Windows/ODBC), located in the same directory that contains the Steel-Belted Radius service (normally `C:\RADIUS\Service`) or daemon.

You must modify certain options in the accounting header file to accommodate your own database. After you update your accounting header file and restart Steel-Belted Radius, accounting proceeds as you have configured it.

Using Multiple SQL Databases

You can configure Steel-Belted Radius to log accounting transactions against more than one SQL database.

To add an additional database, create a new header file with extension `.acc` in the same directory as `radsqljdbc.acc` (Linux and JDBC), or `sqlacct.acc` (Windows/ODBC). You can give this file any name you like, provided its extension is `.acc`. At startup, Steel-Belted Radius enumerates all `.acc` files to create its list of accounting modules.

 **Note:** When creating the new file, start by duplicating the original `.acc` file, then make whatever modifications are necessary.

Connecting to the SQL Database

Upon startup, the SQL accounting module connects to the database, based on a connect string specified in your accounting header file. The connect string contains information such as the name and location of the database, and the password required to connect.

The connect password will be overwritten by their encrypted value in accounting header file.

The connect string is passed to the database client to establish the connection. While a sample connect string is provided in the original header file, you must configure the Connect entry of the header file with a connect string appropriate to your database.

The password for database access must be provided as part of the connect string or the following results occur:

- Linux: The connection fails.

- Windows: A pop-up window prompts the user to enter a password before making the connection at startup and each time a reconnect is required.

If the initial attempt to connect to the database fails, or if a processing error occurs that the SQL accounting module interprets as a database connection failure, the SQL accounting module drops the connection and attempts to establish a new connection after a period of time. In the interim, all authentication requests are ignored.

The SQL accounting module uses an exponential back-off strategy in determining how long to wait before attempting a new connection, as well as how frequently this attempt should be made. After the first dropped connection, it waits a certain amount of time before attempting to reconnect. If this attempt to reconnect also fails, it waits for twice the amount of time before trying again; and so on, up to some maximum wait time. The initial and maximum wait times are configurable.



Note: Linux: Detailed error information may not be available if there is an error processing the database logon at connect time. A numeric result code appears in the log. You may need to refer to product-specific documentation to decode this result code.

SQL Statement Construction

For each accounting request whose Acct-Status-Type is mapped to a SQL statement, that accounting request is logged to the backend database by executing the associated SQL statement.

While a sample SQL statement is provided in the original header file, you must configure one or more SQL entries of the header file with a statement appropriate to your database. Each SQL statement is typically an INSERT INTO statement and may contain additional syntax elements that are preprocessed by the SQL accounting module.

The SQL accounting module executes SQL statements in parameterized form. This means that the SQL statement is compiled once, with parameter markers (usually question marks) as placeholders for data items that vary from one execution to the next. Only upon execution of the statement are the actual data values supplied.

The SQL statement you compose must not include parameter markers directly. Instead, the names of the parameters should be included where parameter markers would appear, in a format described below. The SQL authentication module translates the SQL statement provided, replacing parameter names with parameter markers prior to passing the SQL statement to the database engine.

A SQL statement can be very simple. Basically, all that is required is to set fields of the database record with values from the request. The SQL statement can also be quite complex; it can include inner joins, and it can contain expressions. The underlying database engine is responsible for handling the SQL statement; The SQL accounting module performs no interpretation of the SQL statement other than to translate parameter names to parameter markers.

INSERT Statement and VALUES Section



The following is an example of a SQL INSERT statement that might be found in a Steel-Belted Radius .acc file.

Figure 199: INSERT Statement Example

```
INSERT INTO usagelog (Time, NASAddress, SessionID, Type, Name, BytesIn,
BytesOut) VALUES (%TransactionTime/t, %NASAddress, @Acct-Session-Id,
@Acct-Status-Type, %FullName/40s, @Acct-Input-Octets, @Acct-Output-Octets)
```

In the VALUES section, the names (between parentheses) represent the values inserted into the SQL table columns. To support the SQL accounting module, each item in the VALUES section must be prefixed with a @ sign or a % sign.

- @ indicates a RADIUS accounting attribute. The attribute name must also be listed in the account.ini file. This remains true even if the account.ini file is disabled.
- % indicates an item associated with the INSERT request that is not a RADIUS accounting attribute.
- **Table 45** lists the Steel-Belted Radius items that may be provided.
- **Table 45: Insert Statement Syntax**

Item	Data Type	Meaning
%TransactionTime	Time	The date/time that the event occurred that is the subject of the request.  Note: You should include the /t (timestamp) data type qualifier with the %TransactionTime argument in SQL statements. If you do not, the %TransactionTime output is formatted as character, with differing results on JDBC and Oracle.
%Time	Time	The date/time when the request is being processed. (This is later than %TransactionTime if the request is a retry.)  Note: You should include the /t (timestamp) data type qualifier with the %Time argument in SQL statements. If you do not, the %Time output is formatted as character, with differing results on JDBC and Oracle.
%Type	String	The RADIUS accounting request type.
%NASAddress	IP address	The IP address of the requesting RAS.
%NASName	String	The name of the network access device that originated the request. This may be the name of the RADIUS client entry in the database or the value of the NAS-Identifier or NAS-IP-Address attribute.
%NASModel	String	The RAS make/model.
%FullName	String	The full name of the logged in user.
%AuthType	String	The method by which the user was authenticated.
%RADIUSClientName	String	The name of the network access device, as specified in a RADIUS client entry in the Steel-Belted Radius database.

A format specifier may appear immediately following each parameter. The format specifier should describe the database storage format of the column that corresponds to the parameter. It consists of a slash ("/"), possibly a length, and a data type. **Table 46** lists the available data types.

Table 46: Data Types

Format Specifier	Meaning
/xs	A text string of length x. /s indicates a string with the default length of 256.
/xb	A binary data string of length x. A binary string is different from a text string in that it is not NULL-terminated and is not restricted to ASCII characters. /b indicates a binary data string with the default length of 256.
/n	32-bit integer
/n8	8-bit integer
/n16	16-bit integer
/n32	32-bit integer (same as /n)
/nxx	Integer xx bits in length. For example, /n64 indicates a number with a length of 64 bits.
/t	Timestamp

Note: Steel-Belted Radius supports integers larger than 32 bits by manipulating them as binary data strings. The Oracle 8 plug-ins are able to convert binary data strings between Oracle VARRAW types (/xb) and Oracle NUMBER types (/n). Oracle types must be declared with enough precision to avoid truncation when inserting into the database, and care must also be taken to avoid truncation when retrieving from the database. In particular, avoid retrieving Oracle VARRAW types larger than 256 bytes. Other database/operating-system combinations may not allow for integers larger than 32 bits.

If a format specifier is not present in the SQL statement syntax, Steel-Belted Radius automatically defaults to an appropriate specifier based on the actual parameter type. For example, @Acct-Input-Octets is a number, and defaults to /n.

Note: For strings, always include a format specifier, and be sure to specify a length no greater than the actual field size in the database. The compilation of the SQL statement may fail if a length greater than the actual field size is specified. If no format specifier is present, the length defaults to 256 characters, which may cause the compilation to fail.

Steel-Belted Radius automatically attempts to convert between the internal format of a parameter and its format in the database, as described by the format specifier. In most cases, the formats are equivalent; if not, Steel-Belted Radius performs reasonable conversions.

Table 47 lists the internal formats and their compatible database formats:

Table 47: Internal Formats and Compatible Database Formats

Internal Format	Compatible Database Formats
Binary data string	/b, /xb, /n, /n8, /n16, /n32
Number	/n, /n8, /n16, /n32, /xs, /s
String	/xs, /s

Internal Format	Compatible Database Formats
Time (seconds since 1/1/70)	/t, /n, /n32, /xs, /s
IP address	/n, /n32, /xs, /s

As you write the INSERT statement for your SQL accounting header file (.acc), we recommend the following syntax checklist:

- The column names and their corresponding attributes in the VALUES section are order-dependent. In the example shown in
- Figure 199, the %TransactionTime/t value would be inserted into the Time column (and formatted as a timestamp), the %NASAddress value would be inserted into the NASAddress column, and so forth. The ordering of these settings is critical to proper RADIUS accounting data insertion, since each column in the SQL table may be a specific data type, such as varchar or int.
- The use of left and right parentheses (' '), the backslash '\', the forward slash '/' and even blank spaces are all extremely important and must be exact. You can add as many columns and attributes as you want for your RADIUS accounting needs; however, be sure to model your INSERT statement syntax on the example shown in
- Figure 199.
- An attribute listed incorrectly in the VALUES section, such as @Acct_Session-Id rather than @Acct-Session-Id, causes the SQL statement to fail during a RADIUS accounting transaction. The attribute's syntax must match its corresponding attribute name in the account.ini file, which in turn matches the attribute's name in the appropriate dictionary file, which allows Steel-Belted Radius to process the attribute correctly when it is received from the RAS (the RADIUS client).
- An attribute listed in the VALUES section that is missing its prefix of '@' or '%' causes the SQL statement to fail during a RADIUS accounting transaction.
- If a carriage return is present within the INSERT statement without the backslash '\' to indicate the end of the line, the SQL statement fails during a RADIUS accounting transaction.
- Do not make the lines in the .acc file too long. There is a line length limit of 255 characters. Use the backslash '\' to indicate the end of the line before that limit is reached. If a line exceeds this limit, the SQL statement fails during a RADIUS accounting transaction.

Using Multiple SQL Statements

The most common use of accounting is to track user sessions. However, accounting requests are generated when the RAS starts up and shuts down; and, vendor-specific uses of accounting are used to track other RAS phenomena. Clearly, it might be advisable to log different types of accounting events to different tables.


The Acct-Status-Type attribute of an accounting request indicates the request type. You may, if you like, create multiple SQL statements, and map each Acct-Status-Type to one of these SQL statements. The different statements may update different tables in the database, but they all share the single database connection.

Overlapped Execution of SQL Statements

The SQL accounting module is multi-threaded. SQL accounting can be configured with a maximum number of simultaneous executions of any SQL statement, using the MaxConcurrent entry in the .acc file's [Settings] section.

If MaxConcurrent is set to 1, SQL execution occurs serially, and the SQL execution for each accounting request must complete before execution for the next request may begin.

By increasing MaxConcurrent, it may be possible to increase throughput by overlapping operations, especially if the database server is remote and a large part of the time to complete a statement execution is taken up by network latency. If the database server is local, the point of diminishing returns may be reached at a small value of MaxConcurrent, possibly even at 1 or 2. You can find the optimum value for your system by experimentation.

 **Note:** A setting of MaxConcurrent = 1 should be sufficient for all but the most demanding environments. Increase this value slowly and conservatively.

MaxConcurrent determines the maximum overlap for executing any single SQL statement. Multiple SQL statements for different request types are not interdependent, and executions of one statement do not affect executions of a different statement.

You might expect that databases that are licensed by number of connections would debit a single connection regardless of how many SQL statements are active. This is not necessarily the case; some databases count each open compiled SQL statement against the licensed number of connections. The database license may also have an influence on the optimum setting for MaxConcurrent.

SQL Accounting Return Values

SQL accounting statements can return information in RADIUS attributes in an accounting response. This is useful only if you are using a client that expects and supports attributes embedded in a RADIUS accounting response message.

Stored procedures can also return output parameters. The way in which these stored procedures are called depends on your operating system:

- To call an Oracle stored procedure in a Windows environment:

```
call(storedProcedure(parameters...))
```

Accounting Stored Procedure Example

A simple stored procedure can return a result set in the same way as a Select statement. For example, assume you have a table with the following fields: username, password, Alias, and active, where all fields have the datatype varchar. You want a stored procedure that will return a password and alias when the username and password received in the request match entries in the database, provided that active field has a value of yes'.

The following example executes a stored procedure to update an accounting table in Steel-Belted Radius.

1. Create an accounting table by executing the following command:

```
create table accounting
( TransactionDate varchar(20), Username varchar(21), SessionID varchar(12),
  NASIPAddr varchar(15), NASPort varchar(5), UserIPAddr varchar(15), CallingNum
  varchar(12), CalledNum varchar(12),
  type varchar(4), Sessiontime varchar(14), Disconnect varchar(12))
```

2. Create a rsp_account stored procedure that can be called by a *.acc file.

```

create procedure rsp_account
@transactiontime varchar(21),
@username varchar(21),
@AcctSessionID varchar(21),
@NASIPAddress varchar(21),
@NASPORTTYPE varchar(21),
@FRAMEDIPADDRESS varchar(21),
@callingstationid varchar(21),
@calledstationid varchar(21),
@TYPE varchar(21),
@ACCTSESSIONTIME varchar(21),
@ACCTTERMINATIONCAUSE varchar(21)
AS
INSERT INTO Accounting (TransactionDate, username, SessionID, NASIPAddr,
NASPort, UserIPAddr, CallingNum, CalledNum, type, Sessiontime, Disconnect)
VALUES (@transactiontime, @username, @AcctSessionID, @NASIPAddress,
@NASPORTTYPE, @FRAMEDIPADDRESS, @callingstationid, @calledstationid,
@TYPE, @ACCTSESSIONTIME, @ACCTTERMINATIONCAUSE)

```

3. Create the mysqlacct.acc file to call the rsp_account stored procedure.

Note that the mysqlacct.acc file uses an SQL=EXECUTE procedure_name value1,...valueN statement instead of an SQL=INSERT into table (column1, ...columnN) Values (value1,...valueN), since the stored procedure will do the INSERT action. You would configure the CONNECT statement to reflect your operating environment.

[Bootstrap]

LibraryName=sqlacct.dll

Enable=1

InitializationString=

[Settings]

Connect=DSN=<dsn_name_here>;UID=<username_for_dB>;PWD=<password_for_dB>

ConnectTimeout=25

WaitReconnect=2
MaxWaitReconnect=360
ParameterMarker=?
loglevel=2
[Type]
1=User
2=User
3=User
[Type/User]
SQL=Execute rsp_account %transactiontime/t, \
 @user-name/21s, \
 @Acct-Session-ID/12s, \
 @NAS-IP-Address/15s, \
 @NAS-PORT-TYPE/5s, \
 @FRAMED-IP-ADDRESS/15s, \
 @calling-station-id/12s, \
 @called-station-id/12s, \
 %TYPE/4s, \
 @ACCT-SESSION-TIME/14s, \
 @ACCT-TERMINATION-CAUSE/12s
ConcurrentTimeout=30
MaxConcurrent=2

Chapter 28

Configuring LDAP Authentication

This chapter presents an overview of LDAP authentication and describes how to configure LDAP authentication in Steel-Belted Radius.

About LDAP Authentication

Steel-Belted Radius can authenticate against records stored in an external LDAP database. Any attribute(s), such as username and password, can be used to query the database.

External database authentication is typically used when an organization has a large amount of user information stored in an LDAP database, and wants to authenticate these users using RADIUS. Authentication against an existing LDAP database extends authentication services to user accounts without requiring an administrator to enter user information into the Steel-Belted Radius database.

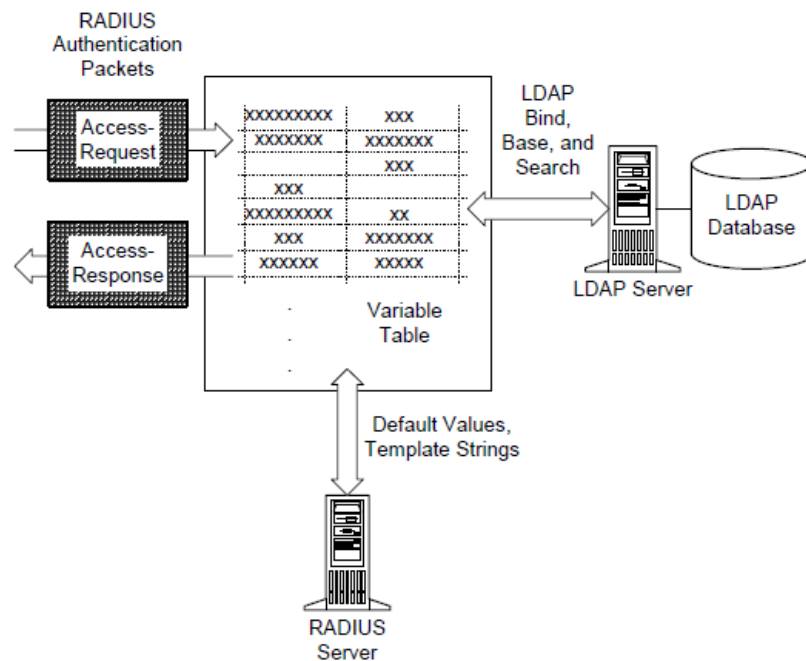
Steel-Belted Radius offers LDAP authentication as a plug-in software module. Key features of the LDAP plug-in include the following:

- LDAP Version 3 is supported.
- SSL/TLS is supported on Linux platform.
- TLS is supported on Windows platform.
- You can authenticate via LDAP Bind or via a password returned from an LDAP Search request (BindName).
- A single Search request or a sequence of Search requests can be specified.
- Bind, Base, and Search strings can include variables.
- New Bind parameters can be specified during a sequence of searches.
- Other authentication credentials can be specified in a string that can include variable values.
- Variables may be set from the RADIUS request packet and from LDAP Search results.
- Variables may be used to specify RADIUS response attributes and other response information.
- The RADIUS response can include RADIUS attributes found in the LDAP database, or it can reference a Steel-Belted Radius profile or user entry.
- Several features similar to SQL authentication are supported, such as round-robin load balancing, the "server of last resort," and activation targets.
- Decorated usernames can be parsed into two variables within the variable table. For example, simon@xyz.com would be parsed into simon and xyz.com for use later in the authentication process.
- The variable table allows both attributes and %Profile in the [Response] section.
- Conditional search logic is supported by branching using the OnFound and OnNotFound fields.

LDAP Variable Table

The LDAP Variable Table lets you translate a RADIUS request into an LDAP lookup. At the beginning of each LDAP authentication request, Steel-Belted Radius creates a Variable Table. Attributes and other information from the RADIUS request are entered in the Variable Table for use in LDAP Bind, Base, and Search strings. When attributes are returned by LDAP requests, they too are entered in the Variable Table. Finally, selected information from the Variable Table is returned to the RADIUS client in the RADIUS response packet.

Figure 200: Role of the Variable Table in LDAP Authentication



Types of LDAP Authentication

To design an LDAP authentication method, consider how you want to validate the username and password.

The LDAP plug-in offers two techniques for validating the username and password. Each header file that you write to control LDAP authentication must employ Bind or BindName. The differences between the two techniques have to do with how Steel-Belted Radius connects to the LDAP server and whether the username/password validation is performed by the LDAP server or by Steel-Belted Radius.

BindName Authentication

When you use BindName authentication, your LDAP header file provides Steel-Belted Radius with the username and password of an account on the LDAP server. This must be an account that has privileges to access all of the information that you require to authenticate users. In the LDAP header file, you provide the username in the BindName parameter, and the password in the BindPassword parameter.

BindPassword parameter will be encrypted and overwritten in the LDAP header file after restart.

After you complete the LDAP header file, each time Steel-Belted Radius starts up, it executes a Bind request to the LDAP server using the BindName and BindPassword parameters as its credentials. If the LDAP server can validate these credentials, a connection is established between the two servers. This connection remains “up” all the time. It is disconnected only if the Steel-Belted Radius server or the LDAP server goes down, and it’s re-established as soon as possible after the “down” server comes back up. The LDAP header file offers a number of connection and re-connection timeouts and other parameters that regulate this relationship.

Any time authentication via LDAP is required, Steel-Belted Radius consults the corresponding LDAP header file. When you use BindName authentication, this file must contain a Search command that maps the username from the Access-Request to a password attribute in the LDAP database. The Search may retrieve other LDAP attributes as well. When the Search returns its results, Steel-Belted Radius compares the value of the password returned from the LDAP database with the password from the incoming Access-Request. If the two values are the same, the password is considered validated.

When the connection to the LDAP server is established using BindName, multiple authentications can be performed at the same time over the same connection.

Bind Authentication

When you use Bind authentication, Steel-Belted Radius authenticates connection requests by attempting to Bind to the LDAP server using the username and password from the incoming Access-Request or from a configured username and password. If this Bind request succeeds, the password is validated. This is essentially “pass-through” authentication; Steel-Belted Radius presents an LDAP user’s credentials to the LDAP server and asks to have them validated.

In the simplest case, a single connection is established for each Access-Request and is kept open only long enough for the LDAP server to validate the password and respond to any Search requests. Then Steel-Belted Radius closes the connection and completes any processing that remains to generate an Access-Response.

A more sophisticated search technique can take advantage of flexible Bind, which allows you to allocate a sequence of connections for each Access-Request. Each in turn is kept open only long enough for the server to process each search criterion. Then Steel-Belted Radius closes the connection and completes any processing that remains to generate an Access-Response.

Attributes and LDAP Authentication

A username and password may be all the information that you require to authenticate users. However, the LDAP plug-in offers a number of techniques for working with checklist and/or return list attributes, should you need them.

Configuring LDAP Authentication

To configure an LDAP authentication method, you must edit the header file that controls the LDAP authentication sequence.

Table 46 summarizes the process of configuring an LDAP authentication method for Steel-Belted Radius. It lists the sections that you must edit in the header file to accomplish each step. No step may be omitted. You must at least consider the entries that you want to put in each section of the header file, even if you decide to leave most of that section blank.

Table 46: LDAP Authentication Header File Topics

Step	LDAP Configuration Task	.aut File Sections
1	Decide how you want Steel-Belted Radius to validate RADIUS access requests. Two major areas of choice are described above: (1) Bind or BindName; and (2) Profile, Alias, or attribute list.	All sections
2	Determine which incoming RADIUS attributes are required to perform the LDAP search.	[Response]

Step	LDAP Configuration Task	.aut File Sections
3	Determine which LDAP attributes support are required to perform the LDAP search.	[Attribute/name]
4	Design Search template(s) that can find the necessary data in your LDAP database schema.	[Search/name]
5	Extract the data from the incoming RADIUS packet that Steel-Belted Radius will use to perform the LDAP Bind and Search requests.	[Request]
6	Select defaults that you want Steel-Belted Radius to use when corresponding values are not provided.	[Defaults]
7	Enable connections between the Steel-Belted Radius server and LDAP server(s).	[Server] [Server/name] [Settings] [Failure]
8	Enable the LDAP plug-in and name the authentication method.	[Bootstrap]

The order in which you should edit header file sections is the reverse order in which Steel-Belted Radius processes them. The processing sequence is described in “Configuring LDAP Authentication”.

Supporting Secure Sockets Layer/Transport Layer Security

Linux platform:

1. Set SSL in the [Settings] (or [Server/name]) section to 1.
2. Set the Certificates field in the [Settings] section to the path where the SHA1 and SHA2 certificate files are located. The certificate should be in .cer format. The name of the file should be included. For example: Certificates=/- 3. Set the Host[server] section in the URI format.
 - a. If SSL, the Host should be in URI format like ldaps://<LDAP Server IP>:<SSL Port of the LDAP server>
 - b. If TLS, the host should be in URI format like ldap://<LDAP Server IP>:<TLS Port of the LDAP server>
- 4. While TLS/SSL support, Disable Port [server] Section in ldapauth.aut file. "

Windows platform:

1. Set SSL in the [Settings] (or [Server/name]) section to 1.
2. Certificate related configurations:
 - a. If the certificate of the server is trusted, i.e. signed by a Trusted Certificate Authority (example: Verisign), then there is no configuration needed.
 - b. If the certificate of the server is untrusted, then the certificate has to be installed as trusted in the store of Computer account option present in Microsoft Management Console. Go to MMC → File → add or remove snap-in. Select the certificates option and click **Add**. Then select Computer Account option and click **Finish**. Expand Certificates tree and expand Trusted CA / any other option according to the requirement. Right click Certificates and select All Tasks -> Import. Import the certificate which has to be trusted.

- Set the port in the [Server] section to the TLS port of the LDAP server.

Files

The following file establishes settings for LDAP authentication. For more information about this file, refer to the *Steel-Belted Radius Reference Guide*.

Table 48: LDAP Authentication Files

File Name	Function
ldapauth.aut	Specifies settings for LDAP authentication in Steel-Belted Radius.

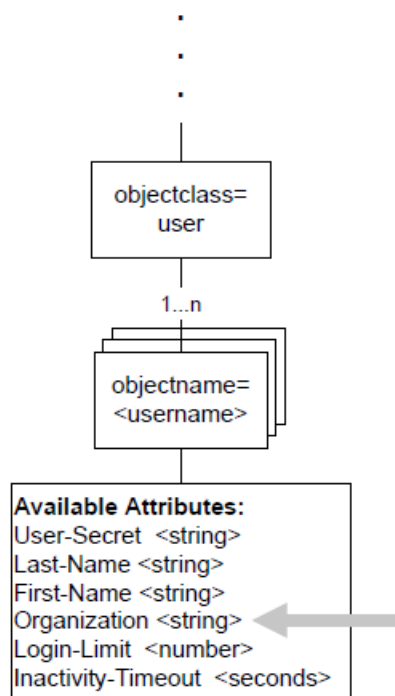
LDAP Database Schema

The most important factor in the success of your LDAP authentication methods is the design of your LDAP database schema. It's assumed that you already have a schema in place.

Often, you can use the LDAP plug-in without changing the LDAP database schema at all. In **Figure 201**, the user record already provides an LDAP attribute called Organization. If you intend to grant connection privileges according to the organization to which each user belongs, you can create profiles in the Steel-Belted Radius database whose names match the strings you are already using for the Organization attribute. You can then create an LDAP authentication header file that retrieves the value of the Organization attribute from the LDAP database and returns it to Steel-Belted Radius as the name of the profile to use.

Note: If you are using BindName authentication, you need to be able to identify which LDAP attribute contains the user's password. In the schema below, this attribute is called User-Secret.

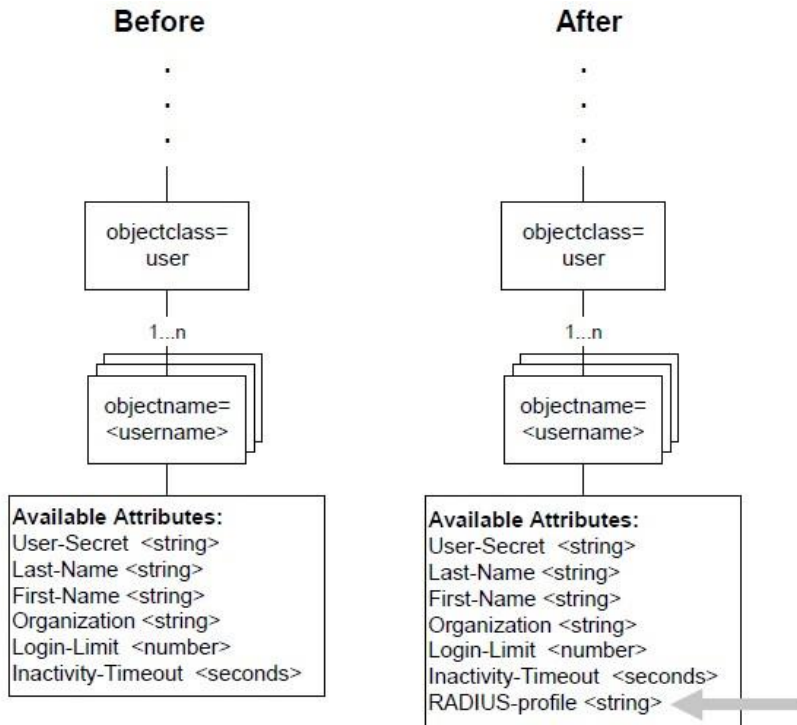
Figure 201: Capitalizing on an Existing Schema for LDAP Authentication



When the authentication strategy you have chosen requires data that is not currently in the schema, you might need to modify the schema.

The name of a Steel-Belted Radius profile is a typical example. Consider the example shown in Figure 201. If you want to assign connection privileges to users in some way other than by Organization, and no other LDAP attribute seems appropriate, you can add an LDAP attribute that names a profile. In Figure 202, this attribute is called RADIUS-Profile. This attribute contains a string value that can be set to the name of a profile defined in the Steel-Belted Radius database.

Figure 202: Modifying a Schema to Enhance LDAP Authentication



Note: LDAP concepts and the details of your own LDAP schema are entirely outside the scope of this chapter. The instructions in this chapter are provided to help you to make the LDAP plug-in work with an existing LDAP database or databases to provide a Steel-Belted Radius authentication method. The instructions assume that you already have a working knowledge of LDAP syntax and conventions. For details about LDAP, please refer to your usual LDAP information source.

LDAP Authentication and Password Format

Steel-Belted Radius supports authentication of users whose records reside in an LDAP table in which password values are stored in one of the following formats: clear text, UNIXcrypt, Secured Hash Algorithm (SHA1+Base64 hash), MD4 hash, or enc-md5 reversibly-encoded password.

Hashed Passwords

Encoded values include a prefix that indicates how the password has been processed. The prefix is in clear text between curly braces '{' '}' and is immediately followed by a hash value computed from the password. If no prefix is present in the value retrieved, the entire password is assumed to be in clear text format. In summary:

- PasswordText indicates clear text format (no encryption)
- {crypt}HashHash indicates UNIXcrypt format
- {SHA}HashHashHash indicates SHA1+Base64 hash
- {SSHA}HashHashHashSalt indicates salted SHA1+Base64 hash
- {md4}HashHash indicates MD4 hash of the Unicode form of password
- {enc-md5}EncryptedEncrypted indicates a reversibly encrypted password. (Note that, although Steel-Belted Radius reads passwords encoded in this format, you must purchase the Software Developer's Kit to convert clear-text passwords to this format.)

You can configure Steel-Belted Radius to expect that the values retrieved from a table have been run through UNIXcrypt by adding the following entry into the [Settings] section of the LDAP authentication header file:

```
PasswordFormat=3
```

Automatic Parsing

If PasswordFormat is set to 0, Steel-Belted Radius attempts to determine the password format automatically by parsing it. This is the recommended setting. Automatic parsing expects the password to be stored in one of the formats described in this chapter.

This technique is useful if clear text passwords are available to Steel-Belted Radius (that is, if PAP is used). If you set PasswordFormat to 0, the stored password can be returned to Steel-Belted Radius still encrypted, and the comparison with the password received from the RADIUS client can be done on the Steel-Belted Radius side.

 **Note:** The setting for automatic password parsing in previous versions of Steel-Belted Radius (auto) has been deprecated.

LDAP Authentication Sequence

The sequence of an LDAP authentication transaction is controlled by the LDAP authentication header file as follows:

1. The Variable Table is initialized to default values as specified in the [Defaults] section. All variables that are not listed in the [Defaults] section are initialized to null values.
2. The values of RADIUS attributes in the Access-Request are copied to the Variable Table, as specified in the [Request] section.
3. If a Bind entry was specified in the [Settings] section, authentication via LDAP Bind is now performed. The Bind entry is used as a template to construct a bind string, using replacement values from the Variable Table. An LDAP Bind is then performed to authenticate the user.
4. An LDAP Search request is performed for each [Search/name] section specified. You may specify zero or more separate Search requests. For each Search request, LDAP Base and Filter strings are constructed from templates, using replacement values from the Variable Table. These Base and Filter strings are then transmitted to the LDAP server in a Search request. Each attribute/value pair returned by the LDAP Search is used to set the value of the corresponding entry in the Variable Table. Also, the DN returned by the search may be used to set a variable.
5. If a %Password entry appears in the [Response] section, authentication is now performed. The

password entered by the user is validated against the value that appears in the %Password variable, and the user is rejected if the passwords don't match.

6. If a %Profile entry appears in the [Response] section, the value of the %Profile variable is used to look up a Profile entry in the Steel-Belted Radius database. The checklist and return list attributes in that Profile are used to validate the request and return an appropriate response.
7. If a %Alias entry appears in the [Response] section, the value of the %Alias variable is used to look up a Native User entry in the Steel-Belted Radius database. The current transaction is treated as if it came from the "alias" user; that is, the checklist and return list attributes of the alias user are used to validate the request and return an appropriate response.
8. If neither a %Profile nor a %Alias entry appears in the [Response] section, then RADIUS attributes for the response packet are created from the Variable Table, based on attribute entries in the [Response] section.

LDAP Authentication Examples

This topic provides examples of LDAP authentication header file syntax. The examples illustrate how you might:

- Authenticate passwords (Bind or BindName).
- Specify checklist and return list attributes (list the attributes or name a profile entry in the Steel-Belted Radius database).

Bind Authentication with Default Profile

The following example is a simple LDAP authentication header file. Every user is authenticated using a Bind request to the LDAP database. The same Steel-Belted Radius attribute profile is applied to every Access-Request.

```
[Settings]
MaxConcurrent=1
Timeout=20
ConnectTimeout=25
QueryTimeout=10
WaitReconnect=2
MaxWaitReconnect=360
Bind=uid=<User-Name>,ou=Special Users,o=bigco.com
LogLevel = 2
UpperCaseName = 0
PasswordCase=original
SSL = 0

[Server]
s1=

[Server/s1]
Host=199.185.162.147
```

```

Port = 389

[Defaults]

TheUserProfile = Sample

[Request]

%User-Name = User-Name

[Response]

%Profile = TheUserProfile

[Search/DoLdapSearch]

Base = ou=Special Users,o=bigco.com

Scope = 2

Filter = uid=<dialup>

Attributes = AttrList

Timeout = 20

%DN = dn

[Attributes/AttrList]

```

If the [Response] section was empty, Steel-Belted Radius would pass the Bind results (accept or reject) directly to its client and no additional RADIUS attributes would be returned in the Access-Response.

BindName Authentication with Callback Number Returned

In the following example, requests are authenticated using Search. BindName and BindPassword values are supplied to permit a connection to the LDAP database. Return list attributes for authentication are listed in the [Response] section. In this example, the network access device needs a callback number to complete the connection. The value of the incoming DNIS attribute Calling-Station-ID is used to ensure that the callback number is the number from which the user's request originated.



Note: This example is incomplete; it omits the [Bootstrap] and [Settings] sections to save space.

```

[Server]

s1=

[Server/s1]

Host = 67.186.4.3

Port = 389

BindName=uid=admin,ou=Administrators,ou=TopologyManagement,
o=NetscapeRoot

BindPassword=ourlittlesecret

Search = DoLdapSearch

[Defaults]

```

```

SendThis = DidLDAPAuthSearch
[Request]
%UserName = dialup
Calling-Station-ID = thenumbertocall
[Search/DoLdapSearch]
Base = ou=Special Users, o=bigco.com
Scope = 2
Filter = uid=<dialup>
Attributes = AttrList
Timeout = 20
%DN = dn
[Attributes/AttrList]
dialuppassword
[Response]
%Password = dialuppassword
Reply-Message = SendThis
Ascend-Callback-No = thenumbertocall

```

LDAP Bind with Profile Based on Network Access Device

In the following example, requests are authenticated using Bind. Checklist and return list attributes for authentication are provided by referencing a profile entry in the Steel-Belted Radius database. The profile to be used depends on the specific network access device from which the user's request originates. Steel-Belted Radius retrieves the profile name by the LDAP database for an IP address that matches the address of the requesting RAS. If this search fails, a profile called limited is used. If a profile name is successfully retrieved from the LDAP database, but no profile by that name can be found in the Steel-Belted Radius database, authentication fails due to "lack of resources" and the user is rejected.



Note: This example is incomplete; it omits the [Bootstrap] section and many [Settings] entries to save space.

```

[Settings]
Bind=uid=<loginID>, ou=Special Users, o=bigco.com
Search = DoLdapSearch
[Server]
s1=
[Server/s1]
Host = 67.186.4.3
Port = 389

```

[Request]

%UserName = loginID

%NASAddress = deviceIP

[Defaults]

%Profile = limited

[Search/DoLdapSearch]

Base = ou=CommServers,o=bigco.com

Scope = 1

Filter = ipaddr=<deviceIP>

Attributes = AttrList

Timeout = 20

%DN = dn

[Attributes/AttrList]

profile

[Response]

%Profile = profile

Chapter 29

Displaying Statistics via SBR Administrator

The Statistics panel lets you display summary statistics for authentication, accounting, and proxy forwarding transactions. You can also use the Statistics panel to see how long Steel-Belted Radius has been running and to display a list of the users currently connected through a RAS or tunnel via SBR Administrator.

Note: Only the standard IETF RADIUS statistics are available from the Statistics panel. To access Steel-Belted Radius extended statistics, you must use other utilities. See “Statistics Variables”.

Displaying Authentication Statistics

Authentication statistics (Figure 203) summarize the number of authentication acceptances and rejections, with summary totals for each type of rejection or retry.

To display authentication statistics, open the Statistics panel, click the System tab, pull down the View list, and choose Authentication.

Figure 203: Statistics Panel: Authentication Statistics

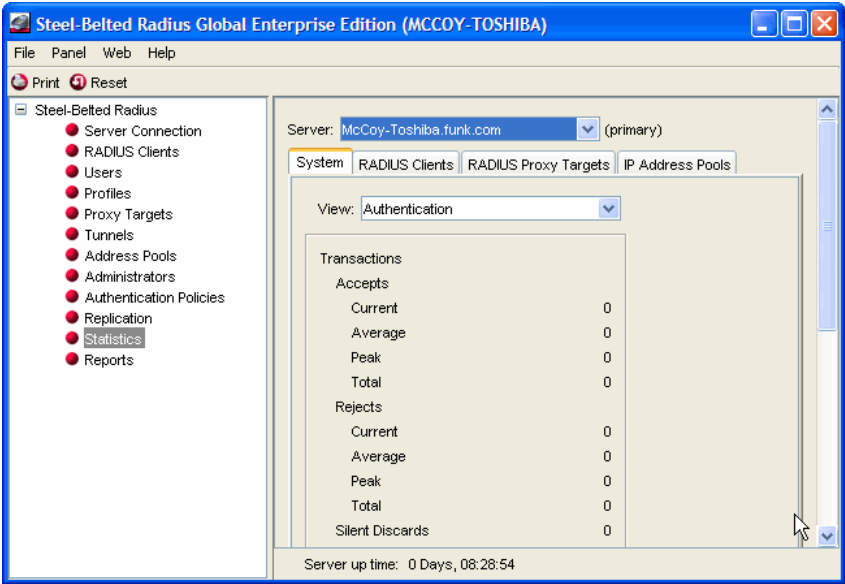


Table 49 explains the authentication statistics fields and describes possible causes for authentication rejections.

Table 49: Authentication Statistics

Authentication Statistic	Meaning
Transactions	
Accepts	The current, average, and peak number of RADIUS transactions that resulted in an accept response.

Authentication Statistic	Meaning
Rejects	The current, average, and peak number of RADIUS transactions that resulted in a reject response. These are detailed in the Reject Details section.
Silent Discards	The number of requests in which the client could not be identified. This might occur if a RADIUS client entry cannot be found for a device with the name and/or IP address of a device requesting authentication services.
Total Transactions	The sum of the accept, reject, and silent discard totals.
Reject Details	
Dropped Packet	The number of RADIUS authentication packets dropped by Steel-Belted Radius because the server was flooded with more packets than it could handle.
Invalid Request	The number of invalid RADIUS requests made. A device is sending incorrectly formed packets to Steel-Belted Radius; either there is a configuration error or the device does not conform to the RADIUS standard.
Failed Authentication	The number of failed authentication requests, where the failure is due to invalid username or password. If all transactions are failing authentication, the problem might be that the shared secret entered into Steel-Belted Radius does not match the shared secret entered on the client device.
Failed on Checklist	The number of requests that were authenticated but failed to meet the checklist requirements.
Insufficient Resources	The number of rejects due to a server resource problem.
Proxy Failure Rejected by Proxy	The number of rejects that had to be issued because Proxy forwarding to another RADIUS server failed. The number of rejects due to receiving a reject response from a proxy RADIUS target server.
Retires Received	
Transactions Retried	The number of requests for which one or more duplicates was received.
Total Retry Packets	The number of duplicate packets received.
Challenges	The number of challenges received.

Displaying Accounting Statistics

Accounting statistics provide information such as the number of transactions starts and stops and the reasons

for rejecting attempted transactions. The start and stop numbers rarely match, as many transactions can be in progress at any given time.

To display authentication statistics, open the Statistics panel, click the System tab, pull down the View list, and choose Accounting.

Figure 204: Statistics Panel: Accounting Statistics

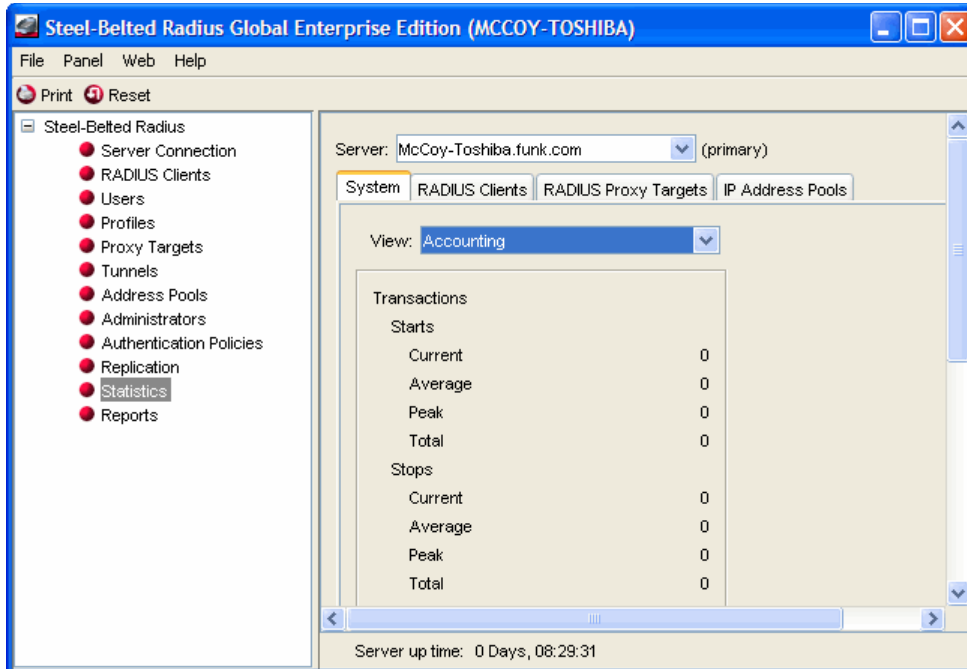


Table 50 describes the accounting statistics and describes possible causes for accounting errors.

Table 50: Accounting Statistics

Statistic	Meaning
Transactions	
Starts	The current, average, and peak number of transactions in which a dial-in connection was started following a successful authentication.
Stops	The current, average, and peak number of transactions in which a dial-in connection was terminated.
Ons	The number of Accounting-On messages received, indicating that a RADIUS client has restarted.
Offs	The number of Accounting-Off messages received, indicating that a RADIUS client has shut down.
Total	The sum of the start, stop, on and off totals.
Failure Details	

Statistic	Meaning
Dropped Packet	The number of RADIUS accounting packets dropped by Steel-Belted Radius because the server was flooded with more packets than it could handle.
Invalid Request	The number of invalid RADIUS requests made. A device is sending incorrectly formed packets to Steel-Belted Radius; either there is a configuration error or the device does not conform to the RADIUS standard.
Invalid Client	The number of requests in which the RADIUS client could not be identified. A device might be configured to use Steel-Belted Radius but no RADIUS client entry has been created with the name and/or IP address of the client; or the RADIUS client entry might be configured with an incorrect name or IP address; or some rogue device is attempting to compromise RADIUS security.
Invalid Shared Secret	The number of packets for which an incorrect digital signature was received. The shared secret does not match between Steel-Belted Radius and the client device; or some rogue device is attempting to compromise RADIUS security.
Insufficient Resources	The number of rejects due to a server resource problem.
Proxy Failure	The number of times that proxy RADIUS forwarding failed.
Retries Received	
Transactions Retried	The number of requests for which one or more duplicates was received.
Total Retry Packets	The number of duplicate packets received.
Interim Requests	The number of interim accounting packets received.

Displaying Proxied Request Statistics

Proxied request statistics provide information such as the number of proxy authentication or accounting requests and the reasons for any transaction failures that occur.

To display proxied request statistics, open the Statistics panel, click the **System** tab, pull down the **View** list, and choose **Proxied Requests**.

Figure 205: Statistics Panel: Proxied Request Statistics

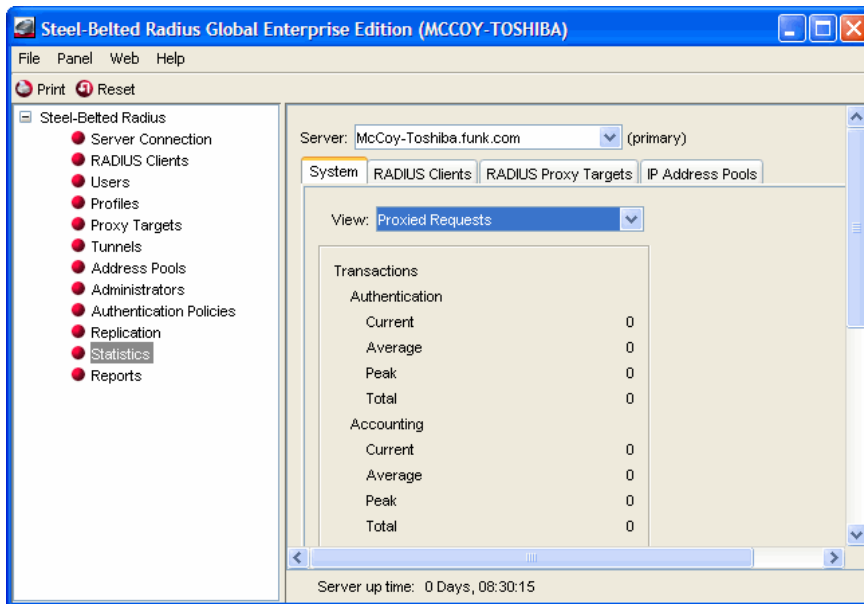


Table 51 describes the proxy request statistics, with possible interpretations in *italics*.

Table 51: Proxy Statistics

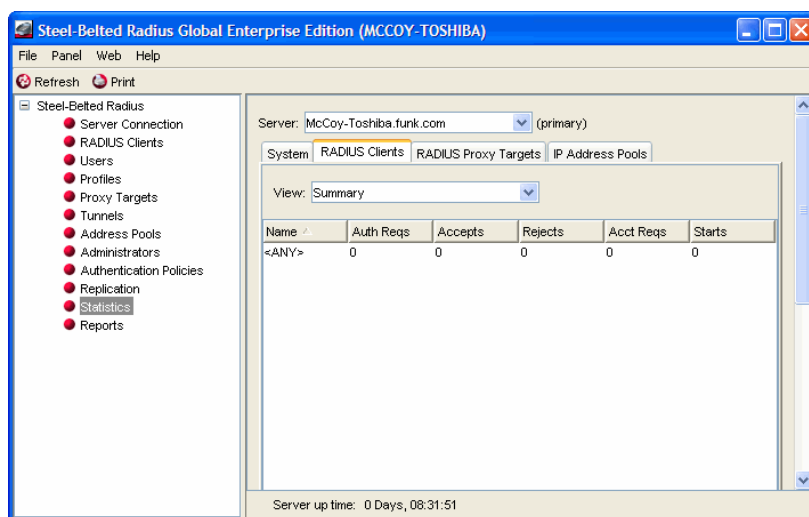
Proxy Statistic	Meaning
Transactions	
Authentication	The number of authentication transactions between the proxy and target RADIUS servers.
Accounting	The number of accounting transactions between the proxy and target RADIUS servers.
Total Transactions	The sum of the authentication and accounting transaction totals.
Failure Details	
Timed Out	The number of RADIUS transactions that timed out. This means that after all retry attempts were made, the transaction still timed out.
Invalid Response	The number of invalid RADIUS responses received. A target is sending incorrectly formed packets to Steel-Belted Radius; there is a configuration error, the target RADIUS server does not conform to the RADIUS standard, or Steel-Belted Radius did not receive a proxy state echo in the received packet.
Invalid Shared Secret	The number of packets for which an incorrect digital signature was received. The shared secret does not match between Steel-Belted Radius and the target; or some unauthorized rogue device is attempting to compromise RADIUS security.
Insufficient Resources	The number of rejects due to a server resource problem.

Proxy Statistic	Meaning
Retries Sent	
Transactions Retried	The number of requests for which one or more retried transmissions was performed.
Total Retry Packets	The number of duplicate packets received.

Displaying RADIUS Client Statistics

RADIUS client statistics provide information about the number of authentication and accounting requests by client.

Figure 206: Statistics Panel: RADIUS Clients Tab



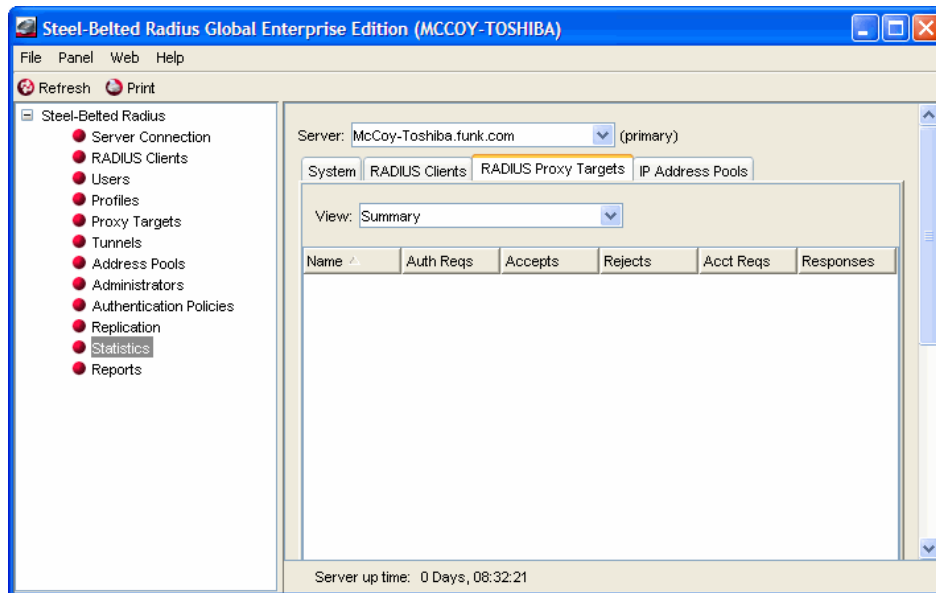
To display statistics for RADIUS clients:

1. Open the Statistics panel and click the **RADIUS Clients** tab.
2. Use the **View** list to display the type of statistics you want to display.
 - **Summary**—Displays the number of authentication requests, Access-Accepts, and Accept-Reject messages and the total number of accounting requests, starts, and stops for each RADIUS client.
 - **Authentication Request Details**—Displays the number of duplicate messages, challenges, messages containing invalid authentication information, bad authentication requests, bad types, and dropped requests for each RADIUS client.
 - **Accounting Request Types**—Displays the number of accounting start messages, accounting stop messages, interim messages, Accounting-On messages, Accounting-Off messages, and acknowledgement messages sent for each RADIUS client.
 - **Accounting Request Diagnostics**—Displays the number of duplicate messages, messages with invalid secrets, malformed messages, messages with incorrect types, ignored messages, and dropped requests for each RADIUS client.
3. Optionally, sort the messages by clicking a column header.

Displaying RADIUS Proxy Targets Statistics

RADIUS proxy target statistics provide information about the number of authentication and accounting transactions associated with each proxy target.

Figure 207: Statistics Tab: RADIUS Proxy Targets Tab



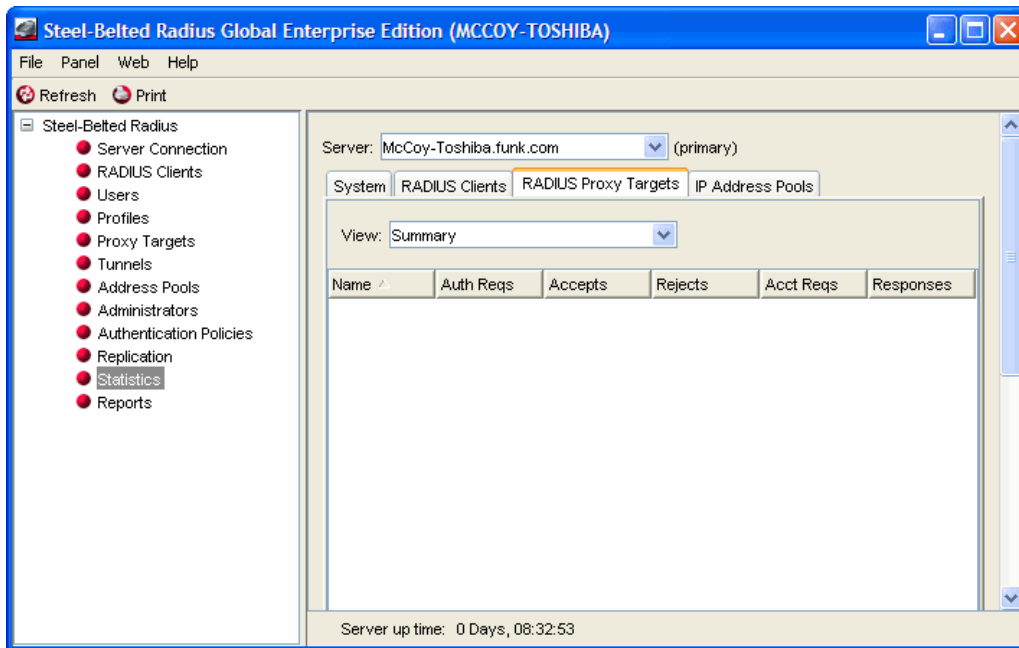
To display statistics for RADIUS proxy targets:

1. Open the Statistics panel and click the RADIUS Proxy Targets tab.
2. Use the View list to display the type of statistics you want to display.
 - **Summary**—Displays the number of authentication requests, accepts and reject messages, and the number of accounting requests and responses for each RADIUS proxy target.
 - **Authentication Request Details**—Displays the number of outstanding messages, retransmitted messages, and challenges, along with the most recent response time for the proxy target.
 - **Authentication Request Diagnostics**—Displays the number of timeouts, invalid secrets, incorrect requests, requests with invalid types, and dropped messages for each proxy target.
 - **Accounting Request Types**—Displays the number of outstanding messages and retransmitted messages, along with the most recent response time for the proxy target.
 - **Accounting Request Diagnostics**—Displays the number of timeouts, invalid secrets, incorrect requests, requests with invalid types, and dropped messages for each proxy target.
3. Optionally, sort the messages by clicking a column header.

Displaying IP Address Pool Statistics

IP address pool statistics provide a summary of the number of addresses allocated from each IPv4 address pool and how many addresses remain available.

Figure 208: Statistics Panel: IP Address Pools Tab



Chapter 30

Displaying Statistics via WebGUI

The Statistics page lets you display summary statistics for authentication, accounting, and proxy forwarding transactions. You can also use the Statistics page to see how long Steel-Belted Radius has been running and to display a list of the users currently connected through a RAS or tunnel via WebGUI.



Note: Only the standard IETF RADIUS statistics are available from the Statistics page. To access Steel-Belted Radius extended statistics, you must use other utilities. See [“Statistics Variables”](#).

Displaying Authentication Statistics

Authentication statistics (Figure 203) summarize the number of authentication acceptances and rejections, with summary totals for each type of rejection or retry.

To display authentication statistics, choose **System > Statistics > System**, pull down the View list, and choose **Authentication**.

Figure 209: Statistics Page: Authentication Statistics

Type	Value
Transactions	
----- Accepts	
----- Current	0
----- Average	0
----- Peak	0
----- Total	0
----- Rejects	
----- Current	0
----- Average	0
----- Peak	0
----- Total	0
----- Silent Discards	0
----- Total Transactions	0
Reject Details	
----- Dropped Packet	0
----- Invalid Request	0
----- Failed Authentication	0
----- Failed On Check List	0
----- Insufficient Resources	0
----- Proxy Failure	0
----- Rejected by Proxy	0
Retries Sent	
----- Transactions Retried	0

Table 55**Table 49** explains the authentication statistics fields and describes possible causes for authentication rejections.

Table 52: Authentication Statistics

Authentication Statistic	Meaning
Transactions	
Accepts	The current, average, and peak number of RADIUS transactions that resulted in an accept response.
Rejects	The current, average, and peak number of RADIUS transactions that resulted in a reject response. These are detailed in the Reject Details section.
Silent Discards	The number of requests in which the client could not be identified. This might occur if a RADIUS client entry cannot be found for a device with the name and/or IP address of a device requesting authentication services.
Total Transactions	The sum of the accept, reject, and silent discard totals.
Reject Details	
Dropped Packet	The number of RADIUS authentication packets dropped by Steel-Belted Radius because the server was flooded with more packets than it could handle.
Invalid Request	<p>The number of invalid RADIUS requests made.</p> <p>A device is sending incorrectly formed packets to Steel-Belted Radius; either there is a configuration error or the device does not conform to the RADIUS standard.</p>
Failed Authentication	<p>The number of failed authentication requests, where the failure is due to invalid username or password.</p> <p>If all transactions are failing authentication, the problem might be that the shared secret entered into Steel-Belted Radius does not match the shared secret entered on the client device.</p>
Failed on Checklist	The number of requests that were authenticated but failed to meet the checklist requirements.
Insufficient Resources	The number of rejects due to a server resource problem.
Proxy Failure Rejected by Proxy	<p>The number of rejects that had to be issued because Proxy forwarding to another RADIUS server failed.</p> <p>The number of rejects due to receiving a reject response from a proxy RADIUS target server.</p>
Retires Received	
Transactions Retried	The number of requests for which one or more duplicates was received.
Total Retry Packets	The number of duplicate packets received.

Authentication Statistic	Meaning
Challenges	The number of challenges received.

Displaying Accounting Statistics

Accounting statistics provide information such as the number of transaction starts and stops and the reasons for rejecting attempted transactions. The start and stop numbers rarely match, as many transactions can be in progress at any given time.

To display accounting statistics, choose **System > Statistics > System**, pull down the View list, and choose Accounting.

Figure 210: Statistics Page: Accounting Statistics

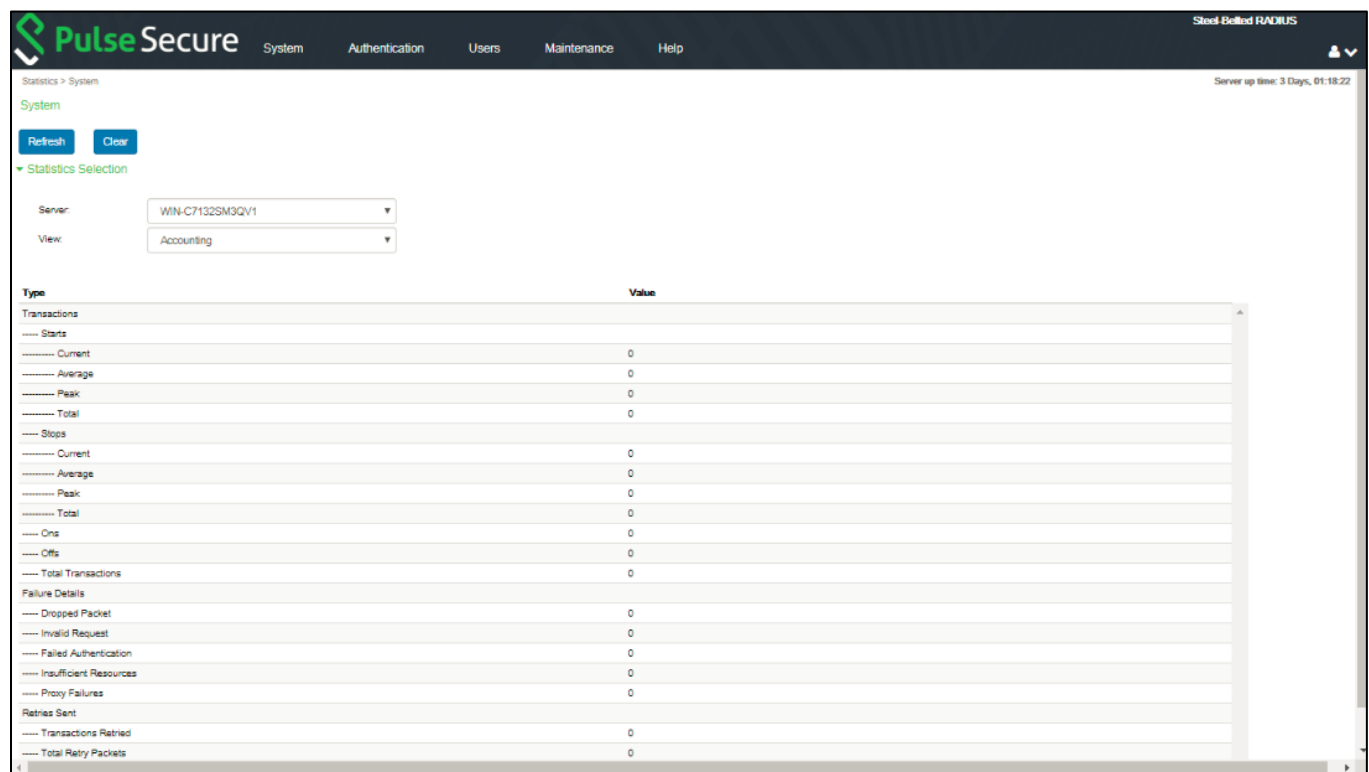


Table 56**Table 50** describes the accounting statistics and describes possible causes for accounting errors.

Table 53: Accounting Statistics

Statistic	Meaning
Transactions	
Starts	The current, average, and peak number of transactions in which a dial-in connection was started following a successful authentication.

Statistic	Meaning
Stops	The current, average, and peak number of transactions in which a dial-in connection was terminated.
Ons	The number of Accounting-On messages received, indicating that a RADIUS client has restarted.
Offs	The number of Accounting-Off messages received, indicating that a RADIUS client has shut down.
Total	The sum of the start, stop, on and off totals.
Failure Details	
Dropped Packet	The number of RADIUS accounting packets dropped by Steel-Belted Radius because the server was flooded with more packets than it could handle.
Invalid Request	<p>The number of invalid RADIUS requests made.</p> <p>A device is sending incorrectly formed packets to Steel-Belted Radius; either there is a configuration error or the device does not conform to the RADIUS standard.</p>
Invalid Client	<p>The number of requests in which the RADIUS client could not be identified.</p> <p>A device might be configured to use Steel-Belted Radius but no RADIUS client entry has been created with the name and/or IP address of the client; or the RADIUS client entry might be configured with an incorrect name or IP address; or some rogue device is attempting to compromise RADIUS security.</p>
Invalid Shared Secret	<p>The number of packets for which an incorrect digital signature was received.</p> <p>The shared secret does not match between Steel-Belted Radius and the client device; or some rogue device is attempting to compromise RADIUS security.</p>
Insufficient Resources	The number of rejects due to a server resource problem.
Proxy Failure	The number of times that proxy RADIUS forwarding failed.
Retries Received	
Transactions Retried	The number of requests for which one or more duplicates was received.
Total Retry Packets	The number of duplicate packets received.
Interim Requests	The number of interim accounting packets received.

Displaying Proxied Request Statistics

Proxied request statistics provide information such as the number of proxy authentication or accounting requests and the reasons for any transaction failures that occur.

To display proxied request statistics, choose **System > Statistics > System**, pull down the **View** list, and choose **Proxied Requests**.

Figure 211: Statistics Page: Proxied Request Statistics

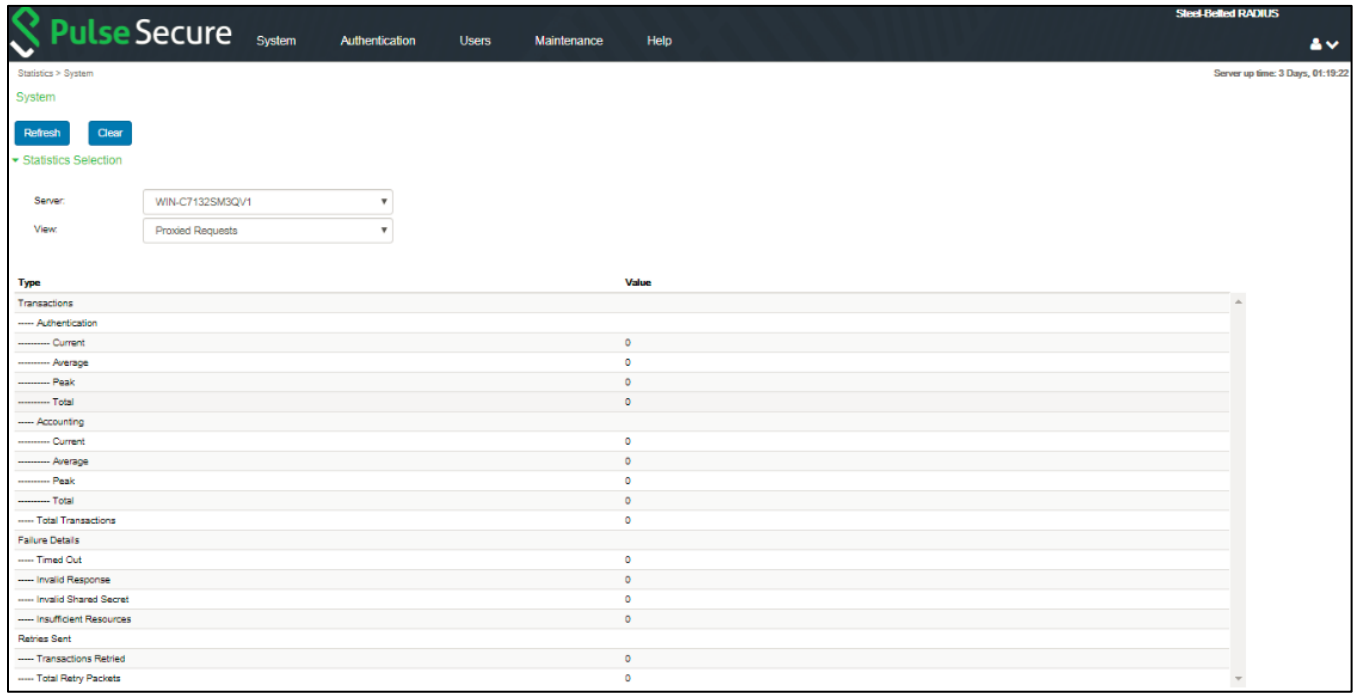


Table 57 describes the proxy request statistics, with possible interpretations in italics.

Table 54: Proxy Statistics

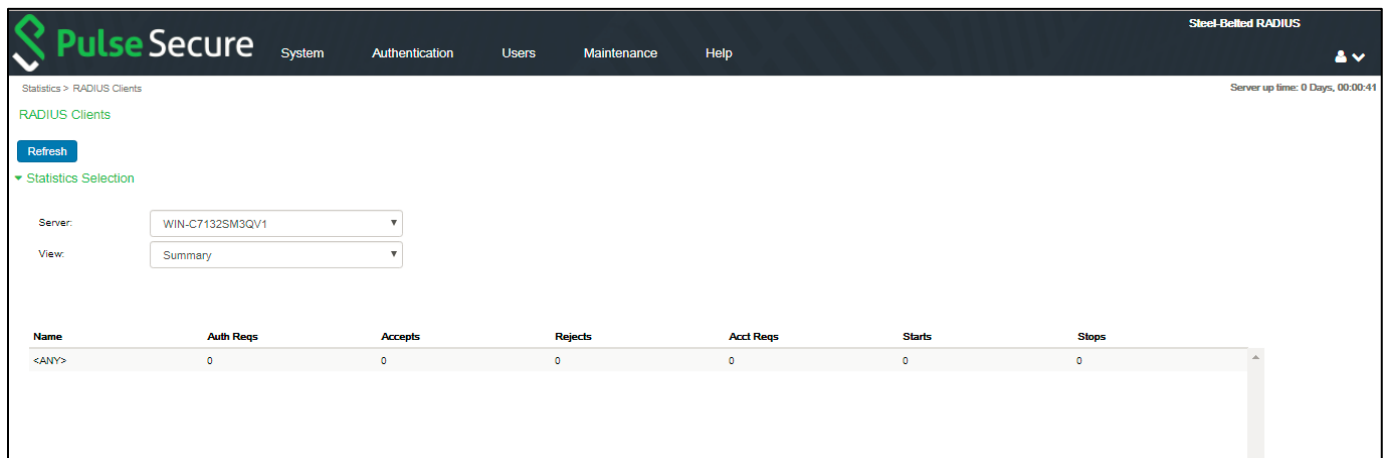
Proxy Statistic	Meaning
Transactions	
Authentication	The number of authentication transactions between the proxy and target RADIUS servers.
Accounting	The number of accounting transactions between the proxy and target RADIUS servers.
Total Transactions	The sum of the authentication and accounting transaction totals.
Failure Details	
Timed Out	The number of RADIUS transactions that timed out. This means that after all retry attempts were made, the transaction still timed out.

Proxy Statistic	Meaning
Invalid Response	The number of invalid RADIUS responses received. A target is sending incorrectly formed packets to Steel-Belted Radius; there is a configuration error, the target RADIUS server does not conform to the RADIUS standard, or Steel-Belted Radius did not receive a proxy state echo in the received packet.
Invalid Shared Secret	The number of packets for which an incorrect digital signature was received. The shared secret does not match between Steel-Belted Radius and the target; or some unauthorized rogue device is attempting to compromise RADIUS security.
Insufficient Resources	The number of rejects due to a server resource problem.
Retries Sent	
Transactions Retried	The number of requests for which one or more retried transmissions was performed.
Total Retry Packets	The number of duplicate packets received.

Displaying RADIUS Client Statistics

RADIUS client statistics provide information about the number of authentication and accounting requests by client.

Figure 212: Statistics Page: RADIUS Clients Tab



To display statistics for RADIUS clients:

1. Open the Statistics page by choosing **System > Statistics > RADIUS Clients**.
2. Use the **View** list to display the type of statistics you want to display.
 - **Summary**—Displays the number of authentication requests, Access-Accepts, and Accept-Reject messages and the total number of accounting requests, starts, and stops for each RADIUS client.
 - **Authentication Request Details**—Displays the number of duplicate messages, challenges,

messages containing invalid authentication information, bad authentication requests, bad types, and dropped requests for each RADIUS client.

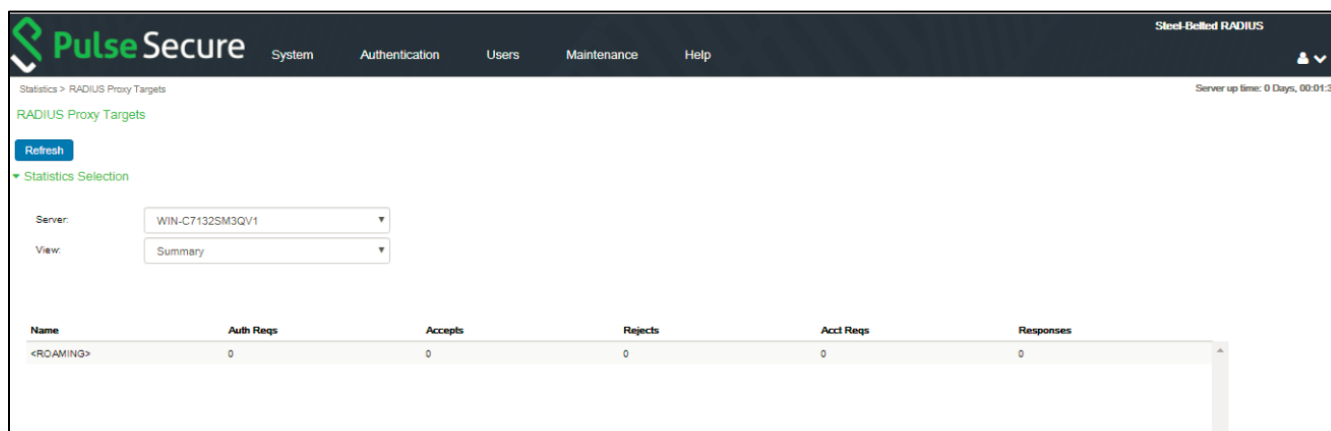
- **Accounting Request Types**—Displays the number of accounting start messages, accounting stop messages, interim messages, Accounting-On messages, Accounting-Off messages, and acknowledgement messages sent for each RADIUS client.
- **Accounting Request Diagnostics**—Displays the number of duplicate messages, messages with invalid secrets, malformed messages, messages with incorrect types, ignored messages, and dropped requests for each RADIUS client.

3. Optionally, sort the messages by clicking a column header.

Displaying RADIUS Proxy Targets Statistics

RADIUS proxy target statistics provide information about the number of authentication and accounting transactions associated with each proxy target.

Figure 213: Statistics Tab: RADIUS Proxy Targets Tab



To display statistics for RADIUS proxy targets:

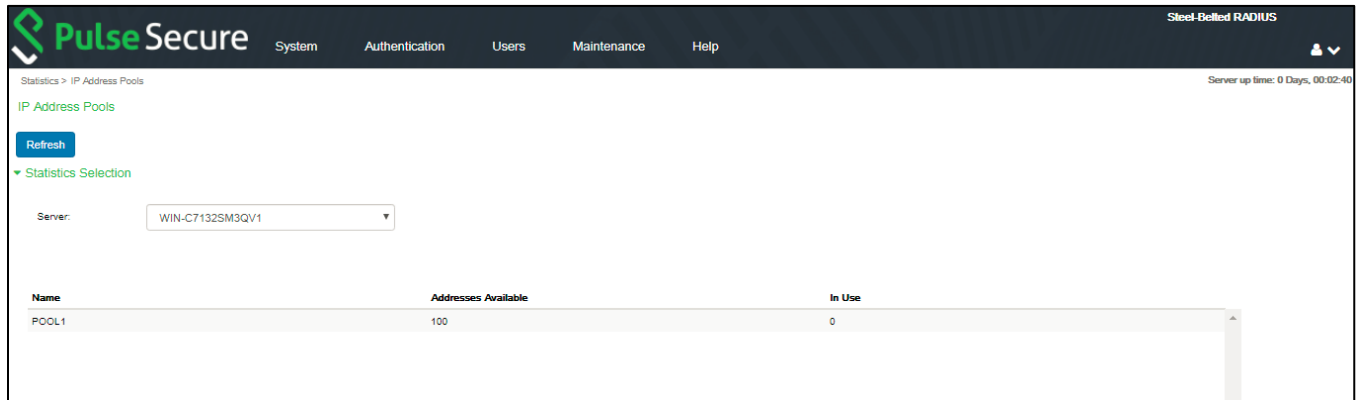
1. Open the Statistics page by choosing **System > Statistics > RADIUS Proxy Targets**.
2. Use the View list to display the type of statistics you want to display.
 - **Summary**—Displays the number of authentication requests, accepts and reject messages, and the number of accounting requests and responses for each RADIUS proxy target.
 - **Authentication Request Details**—Displays the number of outstanding messages, retransmitted messages, and challenges, along with the most recent response time for the proxy target.
 - **Authentication Request Diagnostics**—Displays the number of timeouts, invalid secrets, incorrect requests, requests with invalid types, and dropped messages for each proxy target.
 - **Accounting Request Types**—Displays the number of outstanding messages and retransmitted messages, along with the most recent response time for the proxy target.
 - **Accounting Request Diagnostics**—Displays the number of timeouts, invalid secrets, incorrect requests, requests with invalid types, and dropped messages for each proxy target.

3. Optionally, sort the messages by clicking a column header.

Displaying IP Address Pool Statistics

IP address pool statistics provide a summary of the number of addresses allocated from each IPv4 address pool and how many addresses remain available.

Figure 214: Statistics Page: IP Address Pools Tab



Chapter 31

Logging and Reporting via Legacy SBR Administrator

This chapter describes how to set up and use logging and reporting functions in Steel-Belted Radius via legacy SBR Administrator.

Logging Files

The following files establish settings for logging and reporting. For more information about these files, refer to the *Steel-Belted Radius Reference Guide*.

Table 55: Logging and Reporting Files

File Name	Function
account.ini	Controls how RADIUS accounting attributes are logged.
authlog.ini	Controls how RADIUS authentication requests are logged by Steel-Belted Radius.
authReport.ini	Controls what authentication logs Steel-Belted Radius generates.
authReportAccept.ini	Controls options for the acceptance authentication log file.
authReportBadSharedSecret.ini	Controls options for the invalid shared secret authentication log file.
authReportReject.ini	Controls options for the rejection authentication log file.
authReportUnknownClient.ini	Controls options for the unknown client authentication log file.
events.ini	Controls dilutions and thresholds for Steel-Belted Radius events used to communicate failures, warnings, and other information.
radius.inic	Controls (among other things) the types of messages Steel-Belted Radius records in the server log file and the location of the log directory.

Displaying the Current Sessions List

Steel-Belted Radius tracks the status of the user connections that it authenticates. To obtain a real-time snapshot of currently active connections, display the Current Sessions list. Because the Current Sessions list is based on RADIUS accounting data, the list is accurate only if all of your network access devices are configured to support RADIUS accounting.

Each server has its own Current Sessions display. Therefore, when you view this display, it typically reflects only the activity on the Steel-Belted Radius server to which you are connected. The Current Users display on a specific server reflects the activity across your entire RADIUS configuration only if (1) all clients in your

configuration support RADIUS accounting, and (2) all clients are configured to send accounting messages to the server you are viewing.

Note: Steel-Belted Radius maintains the Current User list on disk. The information is preserved if you unload and reload the server.

To display the Current Sessions list (Figure 215), open the Reports panel and click the Current Sessions tab.

Figure 215: Reports Panel: Current Sessions List

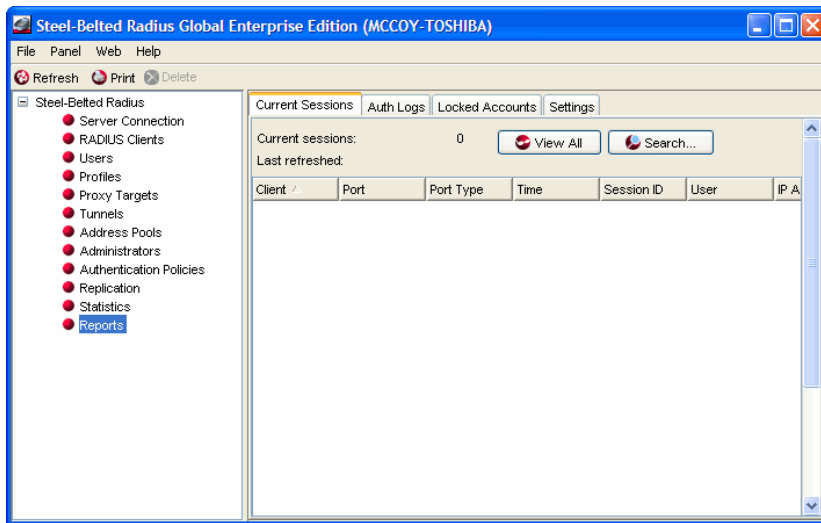


Table 56 describes the fields for each active session in the Current Sessions list.

Table 56: Sessions List Fields

Field	Meaning
Client	Client The identifier for the RADIUS client, which is typically the name or IP address of the device.
Port	The UDP port number on the RADIUS client that has been assigned to the connection. To determine slot number of the physical port on the RADIUS client, consult the device documentation.
Port Type	Describes how the port is used or configured.
Time	Identifies the date and time at which the connection was opened.
Session ID	Identifies the session key, which is a number generated by the RADIUS client.
User Name	Displays the name of the authenticated user. <ul style="list-style-type: none"> If the user is local (native), the field shows only the username, in the form username. If the user is non-local, the field shows the remote system name as well as the username, in the form \\systemname\username. If the user is associated with a specific tunnel, the field shows the tunnel name as well as the username, in the form \\tunnelname\username.
IP Address	Identifies the IP address that was assigned to the user from an IP address pool. This field will be blank

if a static IP address was assigned.

Note: For tunnel connections, if Steel-Belted Radius was used to authenticate both the user and the tunnel, then two entries are displayed in the Current Sessions panel: one entry for the authenticated user, and one for the authenticated tunnel.

Searching the Current Sessions List

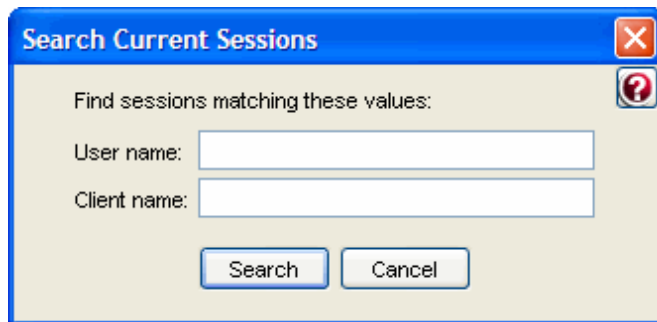
You can search the Current Sessions list to display only those sessions that match user name or client name criteria.

To search the Current Sessions list:

1. Open the Reports panel and click the Current Sessions tab.
2. Click the Search button.

The Search Current Sessions dialog opens.

Figure 216: Search Current Sessions Dialog



3. Enter the search criteria you want to use.
 - To search for a specific username, enter it in the User name field.
 - To search for a specific RADIUS client, enter a client name in the Client name field.
4. Click Search.

Deleting Entries from the Sessions List

Normally, the system maintains the information in the Sessions list based on accounting information received from the RADIUS client. However, a user who has logged off may still be identified as active in the Current Sessions list if communications between the RADIUS client and Steel-Belted Radius fail or if either the RADIUS client or Steel-Belted Radius is taken down for a period of time.

In most cases, Steel-Belted Radius can correct such anomalies itself. For example, if a new user dials in to the same port on the same RADIUS client, Steel-Belted Radius infers that the previous user must have disconnected and removes the entry.

You can manually correct the Sessions list by highlighting any entry and clicking Delete. This removes the user from the list and decrements the user's connection count (if it is being tracked) by one. Any pooled IP or IPX address assigned to the deleted user is returned to the appropriate pool.

Displaying the Authentication Log Files

The Auth Logs tab (Figure 217) on the Reports panel lets you enable and display the following authentication log files:

- Successful request authentication log file—The successful request authentication log file identifies the authentication requests that were approved by Steel-Belted Radius.
- Invalid shared secrets authentication log file—The invalid shared secrets authentication log file identifies the authentication requests that failed because a known RADIUS client supplied an incorrect shared secret. This condition is detectable only if the authentication request contains a Message-Authenticator attribute, which is required if credentials are of an EAP type but optional if credentials are PAP, CHAP, or MS-CHAP.
- Failed request authentication log file—The failed request authentication log file identifies the authentication requests that were rejected because the user supplied incorrect credentials.
- Unknown client request authentication log file—The unknown client request authentication log file identifies authentication requests received from unknown RADIUS clients.

File Permissions for Log Files (Linux)

When you run Steel-Belted Radius on a Linux server, you can specify the users who are authorized to read or edit important files, such as authentication and accounting log files. For example, you can specify that system administrators who install and configure Steel-Belted Radius have read/write access for system log files and that network operators who monitor Steel-Belted Radius have read-only (or no) access for system log files.

Security Groups and Permissions

Each file and directory on a Linux server has three security groups associated with it:

- The Owner identifies the person who created or owns the file.
- The Group security group identifies the set of users who are members of the group or groups to which the file Owner belongs. Group members can exercise special privileges with respect to that file. A user can belong to more than one group.
- The Other security group consists of the set of all users who do not belong to Owner or Group.

Each security group has three flags that control what privileges that group can exercise with respect to the file or directory:

- The Read flag (r) determines whether the file can be read. The Read flag has an octal value of 4.
- The Write flag (w) determines whether the security group can create, modify, or delete the file. The Write flag has an octal value of 2.
- The Execute flag (x) determines whether the security group can run a script or executable file. The Execute flag has an octal value of 1.

For example, a file owner might have rwx permission for a file, which indicates the file owner has read/write/execute access to the file. Similarly, Other might have r-- permission (where - indicates no permission), which means that the user can read but not edit or execute the file.

You can add the octal values for permission flags to generate a numeric representation of the file permissions for Owner, Group, and Other:

- 1 = execute only

- 2 = write only
- 3 = write and execute (1+2)
- 4 = read only
- 5 = read and execute (4+1)
- 6 = read and write (4+2)
- 7 = read and write and execute (4+2+1)

The security permissions exercised by Owner/Group/Other are typically expressed as string or a three-digit number. **Table 57** provides examples of different file permissions.

Table 57: File Permissions

Permission	Octal value	What It Means
-rwxrwxrwx	777	Read, write, and executable for Owner/Group/Other
-rw-rw-r--	664	Read and write for Owner/Group; read access for Other
-rw-rw----	660	Read and write for Owner/Group; no access for Other
-rwx-----	700	Read, write, and executable for owner only
-rw-rw-rw	666	Read and write for owner, group, and all others

The UNIX `chown` command lets you change the owner or group (or both) associated with a file or directory. The UNIX `chmod` command lets you change the permissions of files and directories.

Using the User File Creation Mode Mask

The user file mode creation mode mask (often abbreviated as `umask`) determines the default file system mode for newly created files of the current process. Linux hosts typically have a hierarchy of `umask` values: a server-level `umask` value, which can be overridden by a user-, shell-, or application-level `umask` value. The result is an ambient `umask` value, which determines what file permissions are used when files are created by any given process.

The `umask` value is a three-digit octal number. The first digit sets the mask for Owner, the second for Group, and the third for Other. The `umask` value identifies the permissions that are withheld when a file is created: the `umask` value is subtracted from the full access mode value (777) to determine the access permissions for a new file. For example, if the `umask` value for a process is set to 022, the Write permission for Group and Other are withheld from the full access mode value (777), resulting in a file permission of 755 (`rwxr-xr-x`). Similarly, if the `umask` value of 177 is configured for a process (explicitly or by virtue of the ambient `umask`), files created by the process have a file permission of 600 (`rw-----`). **Table 58** summarizes the result of using different octal numbers in a `umask` value.

Table 58: Summary of `umask` Permissions

Octal Number	Access	Permission Resulting From <code>umask</code> Value
--------------	--------	----------------------------------------------------

0	rwX	Read, Write, Execute
1	rw-	Read, Write
2	r-x	Read, Execute only
3	r--	Read only
4	-wX	Write, Execute only
5	-w-	Write only
6	--X	Execute only
7	---	No permissions

The umask value affects a file's access permissions only when the file is created. If you change the umask value, access permissions for existing files are not affected. Similarly, you can use the `chown` and `chmod` commands to change a file's access permissions after the file has been created.


Implementing Default File Permissions in Steel-Belted Radius

The `RADIUSMASK` parameter in the `sbrd.conf` file specifies the application-level umask value used to establish access permissions for all files created by Steel-Belted Radius. Refer to the Steel-Belted Radius Reference Guide for information on configuring the `sbrd.conf` file.

If you do not specify a value for the `RADIUSMASK` parameter, Steel-Belted Radius uses the ambient umask value established by the server-, user- or shell-level umask value to determine the access permissions for files it creates.

Some log files have explicit controls that let you override the umask value established by the `RADIUSMASK` parameter or the ambient umask value. See [Implementing Override File Permissions in Steel-Belted Radius](#) for more information on overriding the application-level default umask value.

As previously noted, the umask value affects a file's access permissions only when the file is created. If you change the `RADIUSMASK` setting, new files created by Steel-Belted Radius are assigned the access permission specified by the new setting. This includes files that roll over periodically; the existing file would retain the access file permission it received when it was created, and the new file would be assigned the access permission specified by the new `RADIUSMASK` value.

 **Note:** The Execute file permission value for files created by Steel-Belted Radius is always set to None for Owner, Group, and Other. Thus, a umask value of 0 (no restrictions) is equivalent to a umask value of 1 (read/write permission) for files created by Steel-Belted Radius.

Implementing Override File Permissions in Steel-Belted Radius

To override file permissions established by the Steel-Belted Radius `RADIUSMASK` or the ambient umask for specific log files, you must modify the `LogFilePermissions` parameter in the applicable initialization (.ini) file.

Table 59 identifies the configuration file you must modify to configure non-default file permissions for Steel-Belted Radius log files.


Table 59: Configuration Files for Setting Log File Permissions

Controlled Files	Configuration File
Server Diagnostics log (RADIUS log)	radius.ini
Authentication Reporting Library accepts log	authReportAccept.ini
Authentication Reporting Library bad shared secret log	authReportBadSharedSecret.ini
Authentication Reporting Library rejects log	authReportReject.ini
Authentication Reporting Library unknown client log	authReportUnknownClient.ini
Authentication Logging Library logs and header check-point logs	authlog.ini
Accounting Library logs and header check-point logs	account.ini
Server Statistics logs and header check-point logs	statlog.ini

The syntax for the LogFilePermissions parameter is:

LogfilePermissions = owner:group mode

- Specify the owner and group settings by entering character strings or decimal integers, as used for arguments to the UNIX chown(1) command. For example, ralphw:proj, ralphw:120, or 1007:120.
- Specify the mode setting as a character string or an octal integer. When permissions are specified as a character string, they follow the format that is used by the UNIX ls(1) command; for example, rw-rw-rw-. When permissions are specified as an octal integer, they follow the format used for arguments to the UNIX chmod(1) command; for example, 666.

 **Note:** You can specify only read/write permissions for a Steel-Belted Radius file. You cannot specify execute permissions for Steel-Belted Radius files.

The value of each LogFilePermissions parameter is read when the Steel-Belted Radius server is started or restarted. The value of the LogFilePermissions parameter in the radius.ini file is also read when you issue a HUP command to the Steel-Belted Radius server.

- If you enter a valid value for a LogfilePermissions parameter, the ownership and permissions of the controlled log file are set as specified whenever the file is opened or created.
- If you do not enter a value for a LogfilePermissions parameter, the ownership and permissions of the controlled file are not changed. The controlled file is created using the ownership of the account that is executing the server and the permissions that are derived from the default RADIUSMASK value or from the ambient umask setting. If the file already exists, new information is appended without changing the existing ownership and permissions of the controlled file.
- If you enter an invalid value for a LogfilePermissions setting, then the ownership of the controlled log file defaults to the effective user/group ID of the server process (normally root:root on Linux), and the permissions for the controlled file default to 0600 (-rw-----). This ensures that the affected log file can always be opened without any escalation of file access privileges. Messages similar to the

following are logged whenever an explicit file access control is misconfigured:

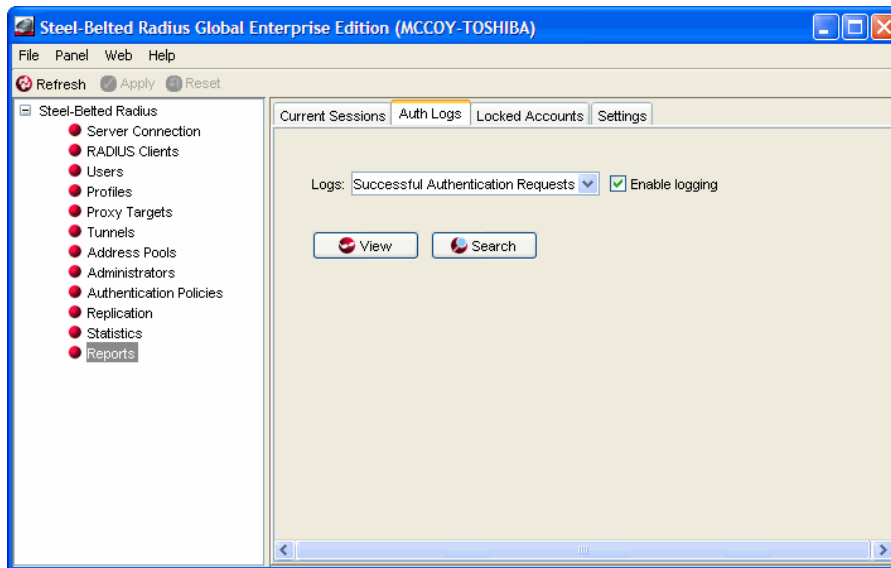
```
Invalid LogfilePermissions specified in radius.ini [Configuration]: -rwx-----
Server log file permissions defaulted to 0:0 0600
```

Enabling and Disabling the Authentication Log Files

To enable an authentication log file:

1. Open the Reports panel and click the **Auth Logs** tab.

Figure 217: Reports Panel: Auth Logs Tab



2. Use the Logs list to select the authentication log file you want to enable or disable.
3. Click the **Enable logging** check box to enable the specified authentication log.

Unclick the Enable logging check box to disable the specified authentication log.

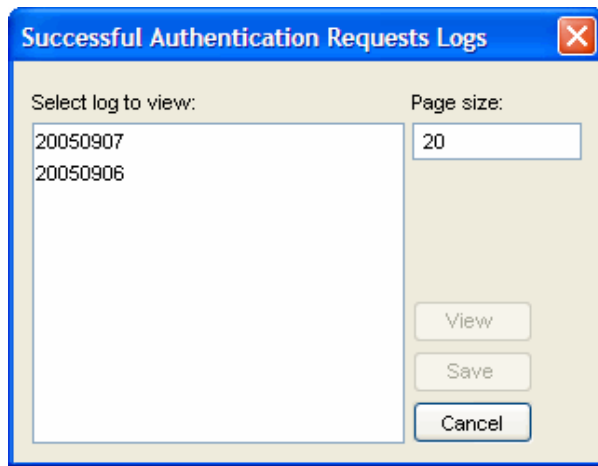
Viewing the Authentication Log Files

To display an authentication log file:

1. Open the Reports panel and click the **Auth Logs** tab.
2. Use the **Logs** list to select the log file you want to display.
3. Click the **View** button.

The Log List dialog opens.

Figure 218: Log List Dialog



4. Select the log you want to display and click **View**.

By default, SBR Administrator displays the authentication log file 20 lines at a time. To change the number of lines displayed, enter a different number in the **Page size** field before you click **View**.

5. When the authentication log file dialog opens, click the **Up** and **Down** arrows to page through the log file.

To sort the authentication log file, click the appropriate column header.

To print the authentication log file, click the **Print** button.

To refresh the authentication log file display, click the **Refresh** button.

6. When you are finished, click **Close**.

Saving the Log Files

To save an authentication log file to a text file:

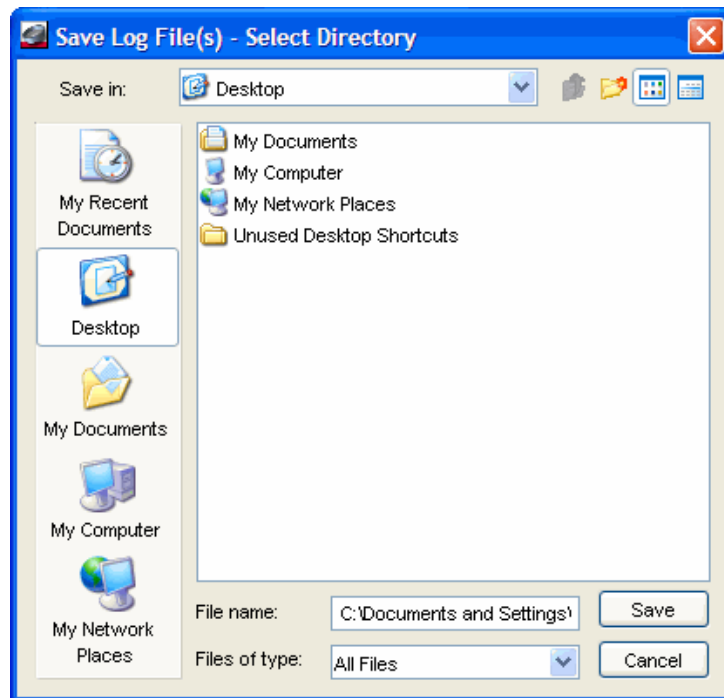
1. Open the Reports panel and click the **Auth Logs** tab.
2. Use the **Logs** list to select the authentication log file you want to save.
3. Click the **View** button.

The Log List dialog (Figure 219) opens.

4. Select the log you want to save and click **Save**.

The Save Log File As dialog opens.

Figure 219: Save Log File As Dialog



5. Specify the name and destination for the log file and click **Save**.

Searching the Log Files

You can search the Steel-Belted Radius authentication log files to display messages within a specified time range, messages relating to a specific client, or messages relating to a specific user.

To search the authentication log files:

1. Open the Reports panel and click the **Auth Logs** tab.
2. Use the **Logs** list to select the type of authentication log file you want to search.
3. Click the **Search** button.

The Search Logs dialog (Figure 220) opens.

Figure 220: Search Logs Dialog

Search Successful Authentication Requests Logs

From

☒ Now

☐ Specific date: Jan [] YYYY -H:MM:SS

To

☒ No limit

☐ Specific date: Jan [] YYYY -H:MM:SS

Filter by

☐ RADIUS client: []

☐ User name: []

Maximum returns: 200

OK Cancel

4. If you want to search the authentication log file for messages within a specified time range:
 - a. Specify the starting date/time in the range by clicking the **Now** radio button or by clicking the **From: Specific date** radio button.
 - b. Specify the ending date/time in the range by clicking the **No limit** radio button or by clicking the **To: Specified date** radio button and entering a date and time.
5. If you want to filter message so that you see only those relating to a specified RADIUS client, click the **RADIUS client** check box and enter the name of the **RADIUS client** in the RADIUS client text field.
6. If you want to filter message so that you see only those relating to a specified user, click the **User name** check box and enter the name of the user in the User name text field.
7. If you want to limit the number of messages you want SBR Administrator to display, enter a number in the **Maximum returns** field.
8. Click **OK**.

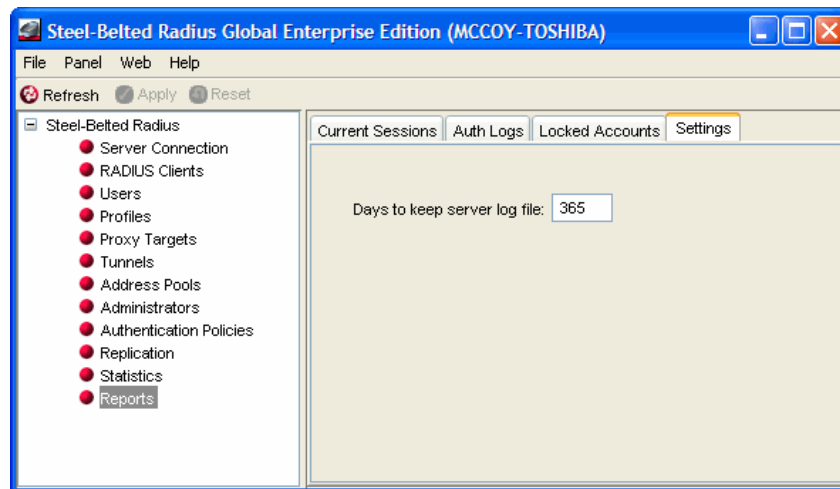
Configuring the Log Retention Period

Each day at midnight, the previous day's log files are completed, and new log files are created for the new day's transactions. To prevent the log files from filling up available disk space, you can configure Steel-Belted Radius to discard the log files after a specified number of days.

To configure the log retention period:

1. Open the Reports panel and click the **Settings** tab.
2. When the Settings tab opens, enter the number of days you want Steel-Belted Radius to retain log file in the **Days to keep server log file** field.

Figure 221: Reports Panel: Settings Tab



Using the Server Log File

The server log file records RADIUS events, such as server startup or shutdown or user authentication or rejection, as a series of messages in an ASCII text file. Each line of the server log file identifies the date and time of the RADIUS event, followed by event details. You can open the current log file while Steel-Belted Radius is running.

Server log files are kept for the number of days specified in the Settings tab in the Reports panel (described in “Configuring the Log Retention Period”) and then deleted to conserve disk space.

Optionally, you can specify a maximum size for a server log file by entering a non-zero value for the LogfileMaxMBytes setting in the [Configuration] section of the radius.ini file.

- If a maximum file size is set, the server log filename identifies the date and time it was opened (YYYYMMDD_HHMM.log). When the current server log file approaches the specified number of megabytes (1024 x 1024 bytes), the current log file is closed and a new one is opened. The closed file will be slightly smaller than the specified maximum file size.
- If the maximum file size is set to 0 (or if the LogfileMaxMBytes setting is absent), the server log file size is ignored and log file names are datestamped to identify when they were opened (YYYYMMDD.log).

Note: The size of the log file is checked once per minute, and the log file cannot roll over more than once a minute. The log file may exceed the specified maximum file size temporarily (for less than a minute) after it passes the LogfileMaxMBytes threshold between size checks.

By default, server log files are located in the RADIUS database directory. You can specify an alternate destination directory in the [Configuration] section of the radius.ini file.

Level of Logging Detail

You can control the level of detail recorded in server log files by use of the LogLevel, LogAccept, and LogReject settings.

The LogLevel setting determines the level of detail given in the server log file. The LogLevel can be the number 0, 1, or 2, where 0 is the least amount of information, 1 is intermediate, and 2 is the most verbose. The LogLevel setting is specified in the [Configuration] section of radius.ini and in the [Settings] sections of .aut files.

The LogAccept and LogReject flags allow you to turn on or off the logging of Access-Accept and Access-Reject messages in the server log file. These flags are set in the [Configuration] section of radius.ini: a value of 1 causes these messages to be logged, and a value of 0 causes the messages to be omitted. An Accept or Reject is logged only if LogAccept or LogReject, respectively, is enabled and the LogLevel is “verbose” enough for the message to be recorded.

The TraceLevel setting specifies whether packets should be logged when they are received and being processed, and what level of detail should be recorded in the log.

If you alter the LogLevel or TraceLevel settings, you can have them take effect without restarting the server by issuing the following command:

- Linux: Enter the kill -HUP pid command.
- Windows: Issue the radhup command.

Using the Authentication Log File

The authentication log file records each RADIUS authentication request received by Steel-Belted Radius. Authentication log files are Comma Separated Value (CSV) ASCII text files that can be imported into a spreadsheet or database program.

Authentication log files are located in the RADIUS database directory area by default, although you can specify an alternate destination directory in the [Configuration] section of authlog.ini. Authentication log files are named yyyyymmdd.authlog, where yyyy is the 4-digit year, mm is the month, and dd is the day on which the log file was created.

Authentication log files are kept for the number of days specified in the Settings tab of the Reports panel, and are deleted after that.

The current log file can be opened while Steel-Belted Radius is running.

Authentication Log File Format

The first five fields in every authentication log entry are required by Steel-Belted Radius:

- **Date**—The date when the event occurred
- **Time**—The time when the event occurred
- **RAS-Client**—The name or IP address of the RADIUS client sending the authentication request
- **Full-Name**—The fully distinguished name of the user, based on the authentication performed by the RADIUS server
- **ACC/REJ**—The result of the authentication request (ACCEPT or REJECT)

The RADIUS attributes specified in the authlog.ini file appear next. Attributes in the authlog.ini file beginning with a semicolon (;), are commented out, and their values are not recorded in the authentication log file.


User-Name

NAS-IP-Address

NAS-Port

Service-Type

Framed-Protocol
 Framed-IP-Address
 Framed-IP-Netmask
 Framed-Compression
 Login-IP-Host
 Callback-Number
 State
 Called-Station-Id=
 Calling-Station-Id=
 NAS-Identifier=
 Proxy-State=
 Login-LAT-Service
 Login-LAT-Node
 Login-LAT-Group
 Event-Timestamp
 NAS-Port-Type
 Port-Limit
 Login-LAT-Port

 **Note:** If the User-Password attribute is included in the authlog.ini file, it is ignored during processing to prevent exposing users' cleartext passwords in the log file.

You can include vendor-specific attributes if the device sending the authentication packet supports them. For more information, see ["Vendor-Specific Attributes"](#).

You can edit the authlog.ini file to add, remove, or reorder the standard RADIUS or vendor-specific attributes that are logged. For information on authlog.ini, refer to the *Steel-Belted Radius Reference Guide*.

First Line Headings

The first line of the authentication log file lists the names of all the attributes that have been enabled for logging, in the order in which they are logged. This first line serves as a complete set of column headings for the remaining entries in the file.

The content of the first line depends on the attributes specified in the authlog.ini file. The following example shows the heading line and an authentication log file entry consisting of the required attributes.

```

    "Date","Time","RAS-Client","Full-Name","ACC/REJ"

    "7/3/2003","12:11:55","RRAS","EdisonCarter","ACCEPT",
  
```

Comma Placeholders

Log entries may not include every attribute listed in the first line of the authentication log file. When Steel-Belted Radius records the event in the authentication log file, it uses a comma "placeholder" to mark empty entries, so

that all entries remain aligned with their headings.

For example, the following log entries indicate that Bob's authentication request was rejected but Alice's authentication request was accepted. The reported fields include Called-Station-Id, Calling-Station-Id, and Port-Limit. Note that the attributes listed in the log heading that were not returned for the authentication events are separated with commas.

```
"Date","Time","RAS-Client","Full-Name","Acc/Rej",
"User-Name","NAS-IP-Address","NAS-Port","Service-Type",
"Framed-Protocol","Framed-IP-Address",    "Framed-IP-Netmask","Framed-Compression",
>Login-IP-Host","Callback-Number","State",    "Called-Station-Id","Calling-Station-Id",
"NAS-Identifier","Proxy-State", "Event-Timestamp","NAS-Port-Type","Port-Limit",
>Login-LAT-Port""07/14/2003","13:39:10","192.168.2.42",
"BOB","REJECT",,,,,,,,,"Alice's Office","Bob's
Office",,,,,"5","07/14/2003","13:43:26","192.168.2.42",
"ALICE","ACCEPT",,,,,,,,,"Bob's Office","Alice's Office",,,,,"5",
```

Using the Accounting Log File

RADIUS accounting events are recorded in the accounting log file. Accounting events include START messages, which indicate the beginning of a connection; STOP messages, which indicate the termination of a connection; and INTERIM messages, which indicate a connection is ongoing.

Accounting log files use comma-delimited, ASCII format, and are intended for import into a spreadsheet or database program. Accounting log files are located in the RADIUS database directory area by default, although you can specify an alternate destination directory in the [Configuration] section of the account.ini file. Accounting log files are named yyyyymmdd.ACT, where yyyy is the 4-digit year, mm is the month, and dd is the day on which the log file was created.

Accounting log files are kept for the number of days specified in the Settings tab of the Reports panel, and are deleted after that to conserve disk space.

The current log file can be opened while Steel-Belted Radius is running.

Accounting Log File Format

The first six fields in every accounting log entry are provided by Steel-Belted Radius for your convenience in reading and sorting the file:

- Date—The date when the event occurred
- Time—The time when the event occurred
- RAS-Client—The name or IP address of the RADIUS client sending the accounting record
- Record-Type—START, STOP, INTERIM, ON, or OFF, the standard RADIUS accounting packet types
- Full-Name—The fully distinguished name of the user, based on the authentication performed by the RADIUS server

- Auth-Type—A number that indicates the class of authentication performed:

0—Native

10—SecurID User 11—

SecurID Prefix 12—

SecurID Suffix 13—

TACACS+ User

16—TACACS+ Prefix 17—

TACACS+ Suffix 100—Tunnel

User 200—External

Database (other)—Proxy

By default, the standard RADIUS attributes follow the Auth-Type identifier. See [“Standard RADIUS Accounting Attributes”](#).

You can include vendor-specific attributes if the device sending the accounting packet supports them. For more information, see [“Vendor-Specific Attributes”](#).

You can edit the account.ini initialization file to add, remove or reorder the standard RADIUS or vendor-specific attributes that are logged. For information on account.ini, refer to the *Steel-Belted Radius Reference Guide*.

First Line Headings

The first line of the accounting log file is a file header that lists the attributes that have been enabled for logging in the order in which they are logged. The following example of a first line shows required headings in bold italic, standard RADIUS headings in bold, and vendor-specific headings in regular text:

“Date”, “Time”, “RAS-Client”, “Record-Type”, “Full-Name”, “Auth-Type”, “User-Name”,

“NAS-Port”, “Acct-Status-Type”, “Acct-Delay-Time”, “Acct-Input-Octets”,

“Acct-Output-Octets”, “Acct-Session-Id”, “Acct-Authentic”, “Acct-Session-Time”,

“Acct-Input-Packets”, “Acct-Output-Packets”, “Acct-Termination-Cause”,

“Acct-Multi-Session-Id”, “Acct-Link-Count”, “Acc-Err-Message”,

“Nautica-Acct-SessionId”, “Nautica-Acct-Direction”,

“Nautica-Acct-CauseProtocol”, “Nautica-Acct-CauseSource”,

“Telebit-Accounting-Info”, “Last-Number-Dialed-Out”,

“Last-Number-Dialed-In-DNIS”, “Last-Callers-Number-ANI”,

“Channel”, “Event-Id”, “Event-Date-Time”, “Call-Start-Date-Time”, “Call-End-Date-Time”,

“Default-DTE-Data-Rate”, “Initial-Rx-Link-Data-Rate”,

“Final-Rx-Link-Data-Rate”, “Initial-Tx-Link-Data-Rate”,

“Final-Tx-Link-Data-Rate”, “Sync-Async-Mode”,

“Originate-Answer-Mode”, “Modulation-Type”,

"Equalization-Type","Fallback-Enabled","Characters-Sent",
 "Characters-Received","Blocks-Sent","Blocks-Received",
 "Blocks-Resent","Retrains-Requested","Retrains-Granted",
 "Line-Reversals","Number-Of-Characters-Lost",
 "Number-of-Blers","Number-of-Link-Timeouts",
 "Number-of-Fallbacks","Number-of-Upshifts",
 "Number-of-Link-NAKs","Back-Channel-Data-Rate",
 "Simplified-MNP-Levels","Simplified-V42bis-Usage", "PW_VPN_ID"

Comma Placeholders

Steel-Belted Radius writes accounting events to the accounting log file. If an event recorded in the accounting log file does not have data for every attribute, a comma "placeholder" marks the empty entry, so that all entries remain correctly aligned with their headings. For example, based on the "first line" of headings described above, the following is a valid accounting log entry, in which the value of the Acct-Status-Type attribute is 7:

```

"12/23/1997","12:11:55","RRAS","Accounting-On",
,,,7,,,,,,,,,,,,,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
  
```

Standard RADIUS Accounting Attributes

Table 60 lists the standard RADIUS accounting attributes defined in RFC 2866, "RADIUS Accounting."

Table 60: Standard RADIUS Accounting Attributes

User-Name	The name of the user as received by the client.
NAS-Port	The port number on the client device.
Acct-Status-Type	A number that indicates the beginning or ending of the user service: 1—Start 2—Stop 3— Interim-Acct 7— Accounting-On 8— Accounting-Off
Acct-Delay-Time	Indicates how many seconds the client has been trying to send this record, which can be subtracted from the time of arrival on the server to find the approximate time of the event generating this request.
Acct-Input-Octets	Number of octets (bytes) received by the port over the connection; present only in STOP records.
Acct-Output-Octets	Number of octets (bytes) sent by the port over the connection; present only in STOP records.

Acct-Session-Id	Identifier used to match START and STOP records in a log file.
Acct-Authentic	Indicates how the user was authenticated by RADIUS, the network access device (local), or another remote authentication protocol: 1—RADIUS 2—Local 3—Remote
Acct-Session-Time	Elapsed time of connection in seconds; present only in STOP records.
Acct-Input-Packets	Number of packets received by the port over the connection; present only in STOP records.
Acct-Output-Packets	Number of packets sent by the port over the connection; present only in STOP records.
Acct-Termination-Cause	Number that indicates how the session was terminated; present only in STOP records: 1—User Request 2—Lost Carrier 3—Lost Service 4—Idle Timeout 5—Session Timeout 6—Admin Reset 7—Admin Reboot 8—Port Error 9—NAS Error 10—NAS Request 11—NAS Reboot 12—Port Unneeded 13—Port Preempted 14—Port Suspended 15—Service Unavailable 16—Callback 17—User Error 18—Host Request
Acct-Multi-Session-Id	Unique accounting identifier to make it easy to link together multiple related sessions in a log file.
Acct-Link-Count	The count of links that are known to have been in a given multi-link session at the time the accounting record is generated.

Chapter 32

Logging and Reporting via WebGUI

This chapter describes how to set up and use logging and reporting functions in Steel-Belted Radius via WebGUI.

Logging Files

The following files establish settings for logging and reporting. For more information about these files, refer to the *Steel-Belted Radius Reference Guide*.

Table 61: Logging and Reporting Files

File Name	Function
account.ini	Controls how RADIUS accounting attributes are logged.
authlog.ini	Controls how RADIUS authentication requests are logged by Steel-Belted Radius.
authReport.ini	Controls what authentication logs Steel-Belted Radius generates.
authReportAccept.ini	Controls options for the acceptance authentication log file.
authReportBadSharedSecret.ini	Controls options for the invalid shared secret authentication log file.
authReportReject.ini	Controls options for the rejection authentication log file.
authReportUnknownClient.ini	Controls options for the unknown client authentication log file.
events.ini	Controls dilutions and thresholds for Steel-Belted Radius events used to communicate failures, warnings, and other information.
radius.inic	Controls (among other things) the types of messages Steel-Belted Radius records in the server log file and the location of the log directory.

Displaying the Current Sessions List

Steel-Belted Radius tracks the status of the user connections that it authenticates. To obtain a real-time snapshot of currently active connections, display the Current Sessions list. Because the Current Sessions list is based on RADIUS accounting data, the list is accurate only if all of your network access devices are configured to support RADIUS accounting.

Each server has its own Current Sessions display. Therefore, when you view this display, it typically reflects only the activity on the Steel-Belted Radius server to which you are connected. The Current Users display on a specific server reflects the activity across your entire RADIUS configuration only if (1) all clients in your configuration support RADIUS accounting, and (2) all clients are configured to send accounting messages

to the server you are viewing.

Note: Steel-Belted Radius maintains the Current User list on disk. The information is preserved if you unload and reload the server.

To display the Current Sessions list (**Figure 222: Reports Page: Current Sessions List**), choose **System > Reports > Current Sessions**.

Figure 222: Reports Page: Current Sessions List

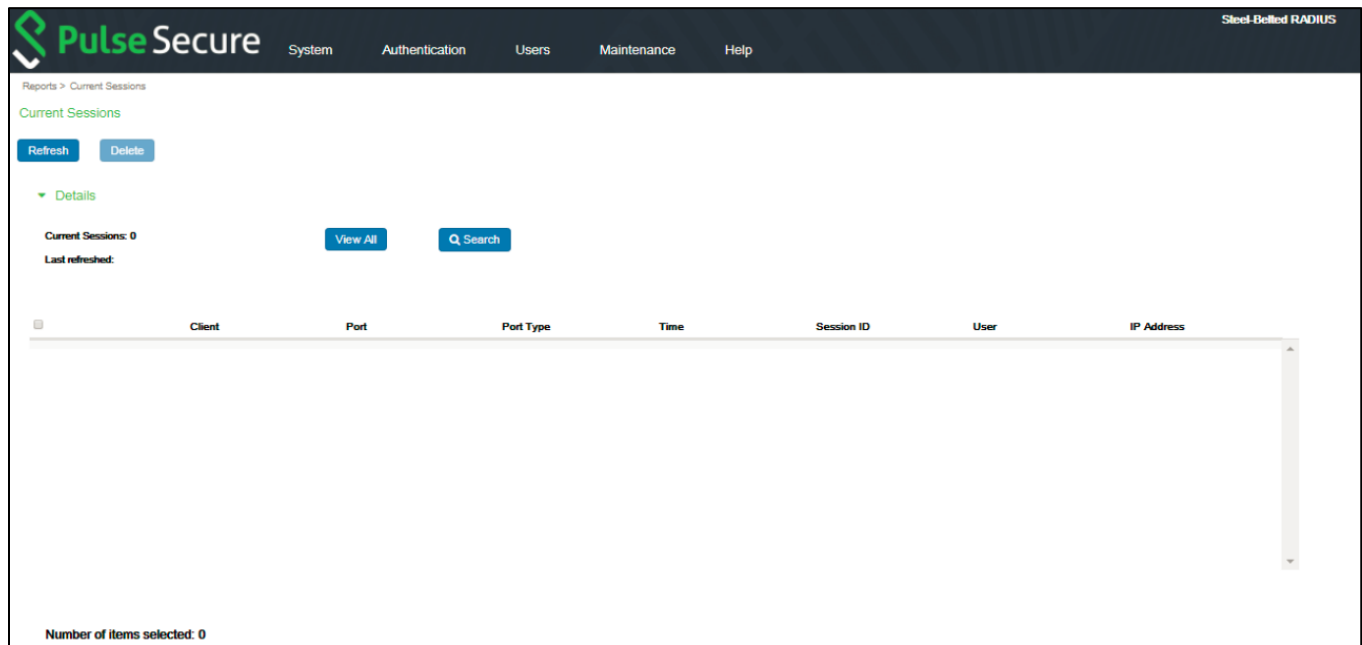


Table 65**Table 56** describes the fields for each active session in the Current Sessions list.

Table 62: Sessions List Fields

Field	Meaning
Client	Client The identifier for the RADIUS client, which is typically the name or IP address of the device.
Port	The UDP port number on the RADIUS client that has been assigned to the connection. To determine slot number of the physical port on the RADIUS client, consult the device documentation.
Port Type	Describes how the port is used or configured.
Time	Identifies the date and time at which the connection was opened.
Session ID	Identifies the session key, which is a number generated by the RADIUS client.
User Name	Displays the name of the authenticated user. <ul style="list-style-type: none"> If the user is local (native), the field shows only the username, in the form username. If the user is non-local, the field shows the remote system name as well as the username, in the form \\systemname\username. If the user is associated with a specific tunnel, the field shows the tunnel name as well as the username, in the form \\tunnelname\username.

IP Address

Identifies the IP address that was assigned to the user from an IP address pool. This field will be blank if a static IP address was assigned.

Note: For tunnel connections, if Steel-Belted Radius was used to authenticate both the user and the tunnel, then two entries are displayed in the Current Sessions page: one entry for the authenticated user, and one for the authenticated tunnel.

Searching the Current Sessions List

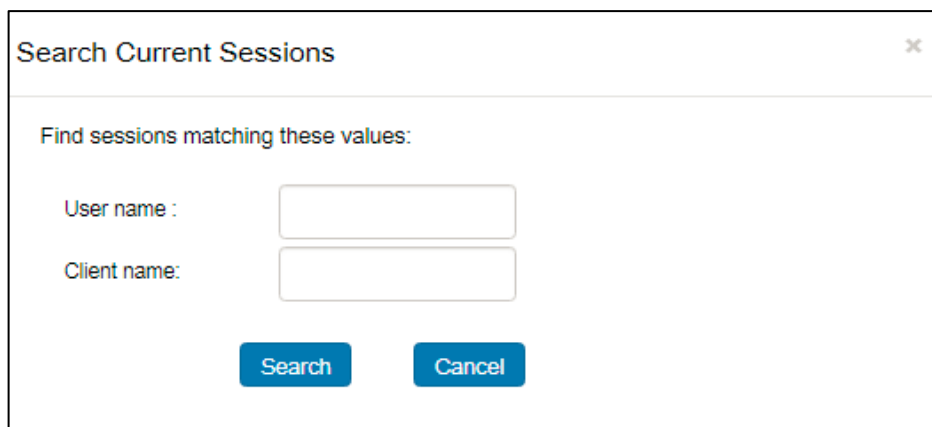
You can search the Current Sessions list to display only those sessions that match user name or client name criteria.

To search the Current Sessions list:

1. Choose **System > Reports > Current Sessions**.
2. Click the Search button.

The Search Current Sessions page opens.

Figure 223: Search Current Sessions Page



Search Current Sessions

Find sessions matching these values:

User name :

Client name:

Search **Cancel**

3. Enter the search criteria you want to use.
 - To search for a specific username, enter it in the User name field.
 - To search for a specific RADIUS client, enter a client name in the Client name field.
4. Click Search.

Deleting Entries from the Sessions List

Normally, the system maintains the information in the Sessions list based on accounting information received from the RADIUS client. However, a user who has logged off may still be identified as active in the Current Sessions list if communications between the RADIUS client and Steel-Belted Radius fail or if either the RADIUS client or Steel-Belted Radius is taken down for a period of time.

In most cases, Steel-Belted Radius can correct such anomalies itself. For example, if a new user dials in to the same port on the same RADIUS client, Steel-Belted Radius infers that the previous user must have disconnected and removes the entry.

You can manually correct the Sessions list by highlighting any entry and clicking Delete. This removes the user

from the list and decrements the user's connection count (if it is being tracked) by one. Any pooled IP or IPX address assigned to the deleted user is returned to the appropriate pool.

Displaying the Authentication Log Files

The Auth Logs tab (Figure 217) on the Reports page lets you enable and display the following authentication log files:

- Successful request authentication log file—The successful request authentication log file identifies the authentication requests that were approved by Steel-Belted Radius.
- Invalid shared secrets authentication log file—The invalid shared secrets authentication log file identifies the authentication requests that failed because a known RADIUS client supplied an incorrect shared secret. This condition is detectable only if the authentication request contains a Message-Authenticator attribute, which is required if credentials are of an EAP type but optional if credentials are PAP, CHAP, or MS-CHAP.
- Failed request authentication log file—The failed request authentication log file identifies the authentication requests that were rejected because the user supplied incorrect credentials.
- Unknown client request authentication log file—The unknown client request authentication log file identifies authentication requests received from unknown RADIUS clients.

File Permissions for Log Files (Linux)

When you run Steel-Belted Radius on a Linux server, you can specify the users who are authorized to read or edit important files, such as authentication and accounting log files. For example, you can specify that system administrators who install and configure Steel-Belted Radius have read/write access for system log files and that network operators who monitor Steel-Belted Radius have read-only (or no) access for system log files.

Security Groups and Permissions

Each file and directory on a Linux server has three security groups associated with it:

- The Owner identifies the person who created or owns the file.
- The Group security group identifies the set of users who are members of the group or groups to which the file Owner belongs. Group members can exercise special privileges with respect to that file. A user can belong to more than one group.
- The Other security group consists of the set of all users who do not belong to Owner or Group.

Each security group has three flags that control what privileges that group can exercise with respect to the file or directory:

- The Read flag (r) determines whether the file can be read. The Read flag has an octal value of 4.
- The Write flag (w) determines whether the security group can create, modify, or delete the file. The Write flag has an octal value of 2.
- The Execute flag (x) determines whether the security group can run a script or executable file. The Execute flag has an octal value of 1.

For example, a file owner might have `rw`x permission for a file, which indicates the file owner has read/write/execute access to the file. Similarly, Other might have `r--` permission (where - indicates no permission), which means that the user can read but not edit or execute the file.

You can add the octal values for permission flags to generate a numeric representation of the file permissions for Owner, Group, and Other:

- 1 = execute only
- 2 = write only
- 3 = write and execute (1+2)
- 4 = read only
- 5 = read and execute (4+1)
- 6 = read and write (4+2)
- 7 = read and write and execute (4+2+1)

The security permissions exercised by Owner/Group/Other are typically expressed as string or a three-digit number. Table 66**Table 57** provides examples of different file permissions.

Table 63: File Permissions

Permission	Octal value	What It Means
-rwxrwxrwx	777	Read, write, and executable for Owner/Group/Other
-rw-rw-r--	664	Read and write for Owner/Group; read access for Other
-rw-rw----	660	Read and write for Owner/Group; no access for Other
-rwx-----	700	Read, write, and executable for owner only
-rw-rw-rw	666	Read and write for owner, group, and all others

The UNIX `chown` command lets you change the owner or group (or both) associated with a file or directory. The UNIX `chmod` command lets you change the permissions of files and directories.

Using the User File Creation Mode Mask

The user file mode creation mode mask (often abbreviated as `umask`) determines the default file system mode for newly created files of the current process. Linux hosts typically have a hierarchy of `umask` values: a server-level `umask` value, which can be overridden by a user-, shell-, or application-level `umask` value. The result is an ambient `umask` value, which determines what file permissions are used when files are created by any given process.

The `umask` value is a three-digit octal number. The first digit sets the mask for Owner, the second for Group, and the third for Other. The `umask` value identifies the permissions that are withheld when a file is created: the `umask` value is subtracted from the full access mode value (777) to determine the access permissions for a new file. For example, if the `umask` value for a process is set to 022, the Write permission for Group and Other are withheld from the full access mode value (777), resulting in a file permission of 755 (`rwxr-xr-x`). Similarly, if the `umask` value of 177 is configured for a process (explicitly or by virtue of the ambient `umask`), files created by the process have a file permission of 600 (`rw-----`). **Table 58** summarizes the result of using different octal numbers in a `umask` value.

Table 64: Summary of umask Permissions

Octal Number	Access	Permission Resulting From umask Value
0	rwX	Read, Write, Execute
1	rw-	Read, Write
2	r-X	Read, Execute only
3	r--	Read only
4	-wX	Write, Execute only
5	-w-	Write only
6	--X	Execute only
7	---	No permissions

The umask value affects a file's access permissions only when the file is created. If you change the umask value, access permissions for existing files are not affected. Similarly, you can use the `chown` and `chmod` commands to change a file's access permissions after the file has been created.


Implementing Default File Permissions in Steel-Belted Radius

The `RADIUSMASK` parameter in the `sbrd.conf` file specifies the application-level umask value used to establish access permissions for all files created by Steel-Belted Radius. Refer to the Steel-Belted Radius Reference Guide for information on configuring the `sbrd.conf` file.

If you do not specify a value for the `RADIUSMASK` parameter, Steel-Belted Radius uses the ambient umask value established by the server-, user- or shell-level umask value to determine the access permissions for files it creates.

Some log files have explicit controls that let you override the umask value established by the `RADIUSMASK` parameter or the ambient umask value. See [Implementing Override File Permissions in Steel-Belted Radius](#) for more information on overriding the application-level default umask value.

As previously noted, the umask value affects a file's access permissions only when the file is created. If you change the `RADIUSMASK` setting, new files created by Steel-Belted Radius are assigned the access permission specified by the new setting. This includes files that roll over periodically; the existing file would retain the access file permission it received when it was created, and the new file would be assigned the access permission specified by the new `RADIUSMASK` value.

 **Note:** The Execute file permission value for files created by Steel-Belted Radius is always set to None for Owner, Group, and Other. Thus, a umask value of 0 (no restrictions) is equivalent to a umask value of 1 (read/write permission) for files created by Steel-Belted Radius.

Implementing Override File Permissions in Steel-Belted Radius

To override file permissions established by the Steel-Belted Radius RADIUSMASK or the ambient umask for specific log files, you must modify the LogFilePermissions parameter in the applicable initialization (.ini) file.

Table 59 identifies the configuration file you must modify to configure non-default file permissions for Steel-Belted Radius log files.

Table 65: Configuration Files for Setting Log File Permissions

Controlled Files	Configuration File
Server Diagnostics log (RADIUS log)	radius.ini
Authentication Reporting Library accepts log	authReportAccept.ini
Authentication Reporting Library bad shared secret log	authReportBadSharedSecret.ini
Authentication Reporting Library rejects log	authReportReject.ini
Authentication Reporting Library unknown client log	authReportUnknownClient.ini
Authentication Logging Library logs and header check-point logs	authlog.ini
Accounting Library logs and header check-point logs	account.ini
Server Statistics logs and header check-point logs	statlog.ini

The syntax for the LogFilePermissions parameter is:

LogfilePermissions = owner:group mode

- Specify the owner and group settings by entering character strings or decimal integers, as used for arguments to the UNIX chown(1) command. For example, ralphw:proj, ralphw:120, or 1007:120.
- Specify the mode setting as a character string or an octal integer. When permissions are specified as a character string, they follow the format that is used by the UNIX ls(1) command; for example, rw-rw-rw-. When permissions are specified as an octal integer, they follow the format used for arguments to the UNIX chmod(1) command; for example, 666.



Note: You can specify only read/write permissions for a Steel-Belted Radius file. You cannot specify execute permissions for Steel-Belted Radius files.

The value of each LogFilePermissions parameter is read when the Steel-Belted Radius server is started or restarted. The value of the LogFilePermissions parameter in the radius.ini file is also read when you issue a HUP command to the Steel-Belted Radius server.

- If you enter a valid value for a LogfilePermissions parameter, the ownership and permissions of the controlled log file are set as specified whenever the file is opened or created.
- If you do not enter a value for a LogfilePermissions parameter, the ownership and permissions of the controlled file are not changed. The controlled file is created using the ownership of the account that is executing the server and the permissions that are derived from the default RADIUSMASK value or from the ambient umask setting. If the file already exists, new information is appended without changing the existing ownership and permissions of the controlled file.

- If you enter an invalid value for a LogfilePermissions setting, then the ownership of the controlled log file defaults to the effective user/group ID of the server process (normally root:root on Linux), and the permissions for the controlled file default to 0600 (-rw-----). This ensures that the affected log file can always be opened without any escalation of file access privileges. Messages similar to the following are logged whenever an explicit file access control is misconfigured:

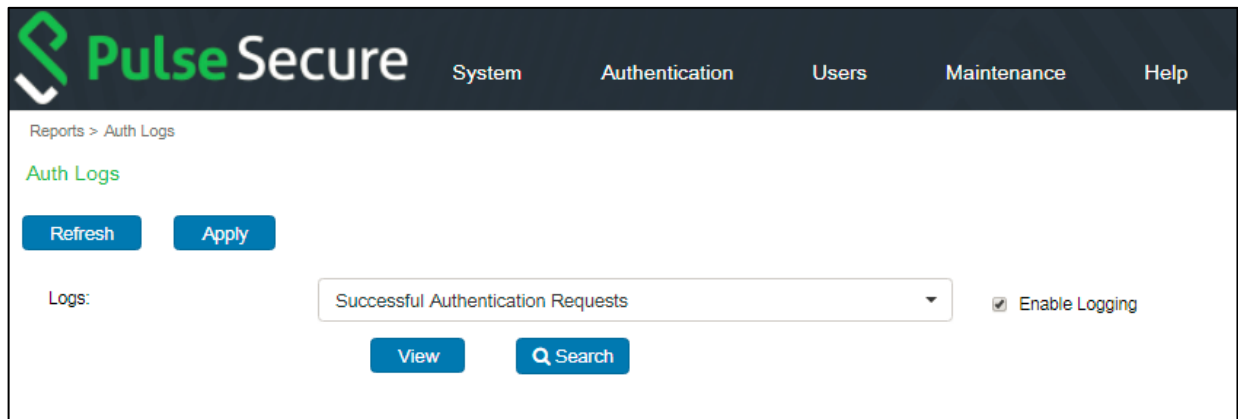
Invalid LogfilePermissions specified in radius.ini [Configuration]: -rwx-----
Server log file permissions defaulted to 0:0 0600

Enabling and Disabling the Authentication Log Files

To enable an authentication log file:

1. Choose **System > Reports > Auth Logs**.

Figure 224: Reports Page Auth Logs Tab



2. Use the Logs list to select the authentication log file you want to enable or disable.
3. Click the **Enable logging** check box to enable the specified authentication log.

Unclick the Enable logging check box to disable the specified authentication log.

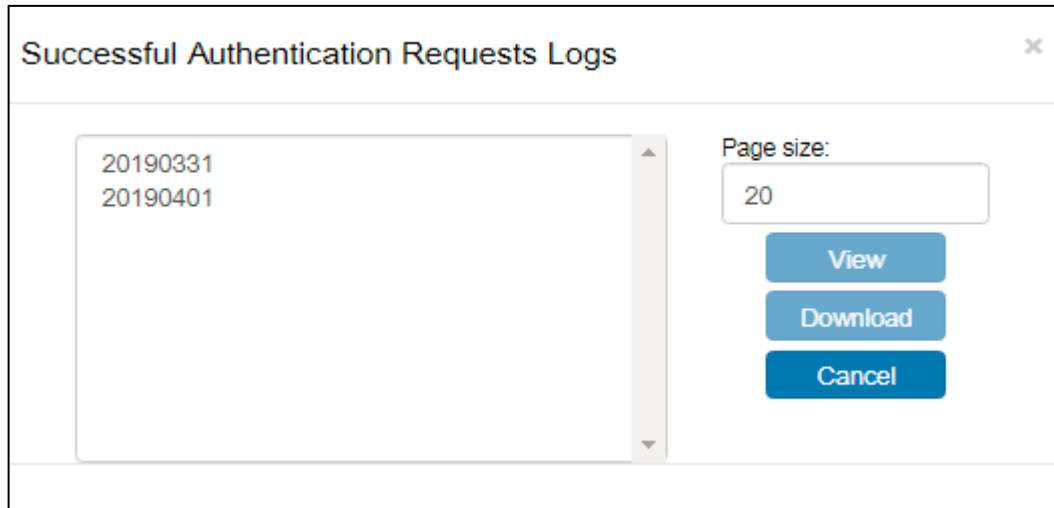
Viewing the Authentication Log Files

To display an authentication log file:

1. Choose Open the Reports panel and click the **System > Reports > Auth Logs**.
2. Use the **Logs** list to select the log file you want to display.
3. Click the **View** button.

The Log List page opens.

Figure 225: Log List Page



4. Select the log you want to display and click **View**.

By default, SBR Administrator displays the authentication log file 20 lines at a time. To change the number of lines displayed, enter a different number in the **Page size** field before you click **View**.

5. When the authentication log file dialog opens, click the **Up** and **Down** arrows to page through the log file.

To sort the authentication log file, click the appropriate column header.

To refresh the authentication log file display, click the **Refresh** button.

6. When you are finished, click **Close**.

Downloading the Log Files

To save an authentication log file to a text file:

1. Choose **System > Reports > Auth Logs**.
2. Use the **Logs** list to select the authentication log file you want to save.
3. Click the **Download** button. The log file will be automatically downloaded.

The Log List dialog (Figure 219) opens.

Searching the Log Files

You can search the Steel-Belted Radius authentication log files to display messages within a specified time range, messages relating to a specific client, or messages relating to a specific user.

To search the authentication log files:

1. Choose **System > Reports > Auth Logs**.
2. Use the **Logs** list to select the type of authentication log file you want to search.
3. Click the **Search** button.

The Search Logs page (Figure 220) opens.

Figure 226: Search Logs Page

Search Successful Authentication Requests Logs [X]

▼ From

☒ **Now**
☐ **Specific date:**

Jan ▼ 1 ▼ (MM) (HH.MM.SS)

▼ To

☒ **No limit**
☐ **Specific date:**

Jan ▼ 1 ▼ (MM) (HH.MM.SS)

▼ Filter by

☐ **Radius client:**
☐ **User name**

Maximum returns:

4. If you want to search the authentication log file for messages within a specified time range:
 - a. Specify the starting date/time in the range by clicking the **Now** radio button or by clicking the **From: Specific date** radio button.
 - b. Specify the ending date/time in the range by clicking the **No limit** radio button or by clicking the **To: Specified date** radio button and entering a date and time.
5. If you want to filter message so that you see only those relating to a specified RADIUS client, click the **RADIUS client** check box and enter the name of the **RADIUS client** in the RADIUS client text field.
6. If you want to filter message so that you see only those relating to a specified user, click the **User name** check box and enter the name of the user in the User name text field.
7. If you want to limit the number of messages you want SBR Administrator to display, enter a number in the **Maximum returns** field.
8. Click **OK**.

Configuring the Log Retention Period

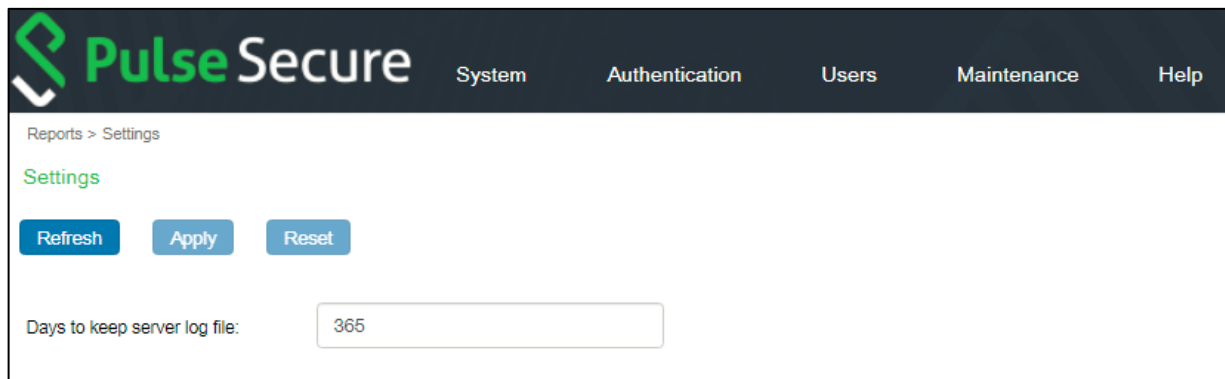
Each day at midnight, the previous day's log files are completed, and new log files are created for the new day's

transactions. To prevent the log files from filling up available disk space, you can configure Steel-Belted Radius to discard the log files after a specified number of days.

To configure the log retention period:

1. Choose **System > Reports > Settings**.
2. When the Settings tab opens, enter the number of days you want Steel-Belted Radius to retain log file in the **Days to keep server log file** field.

Figure 227: Reports Page: Settings Tab



Using the Server Log File

The server log file records RADIUS events, such as server startup or shutdown or user authentication or rejection, as a series of messages in an ASCII text file. Each line of the server log file identifies the date and time of the RADIUS event, followed by event details. You can open the current log file while Steel-Belted Radius is running.

Server log files are kept for the number of days specified in the Settings tab in the Reports panel (described in “Configuring the Log Retention Period”) and then deleted to conserve disk space.

Optionally, you can specify a maximum size for a server log file by entering a non-zero value for the LogfileMaxMBytes setting in the [Configuration] section of the radius.ini file.

- If a maximum file size is set, the server log filename identifies the date and time it was opened (YYYYMMDD_HHMM.log). When the current server log file approaches the specified number of megabytes (1024 x 1024 bytes), the current log file is closed and a new one is opened. The closed file will be slightly smaller than the specified maximum file size.
- If the maximum file size is set to 0 (or if the LogfileMaxMBytes setting is absent), the server log file size is ignored and log file names are datestamped to identify when they were opened (YYYYMMDD.log).

Note: The size of the log file is checked once per minute, and the log file cannot roll over more than once a minute. The log file may exceed the specified maximum file size temporarily (for less than a minute) after it passes the LogfileMaxMBytes threshold between size checks.

By default, server log files are located in the RADIUS database directory. You can specify an alternate destination directory in the [Configuration] section of the radius.ini file.

Level of Logging Detail

You can control the level of detail recorded in server log files by use of the LogLevel, LogAccept, and LogReject

settings.

The LogLevel setting determines the level of detail given in the server log file. The LogLevel can be the number 0, 1, or 2, where 0 is the least amount of information, 1 is intermediate, and 2 is the most verbose. The LogLevel setting is specified in the [Configuration] section of radius.ini and in the [Settings] sections of .aut files.

The LogAccept and LogReject flags allow you to turn on or off the logging of Access-Accept and Access-Reject messages in the server log file. These flags are set in the [Configuration] section of radius.ini: a value of 1 causes these messages to be logged, and a value of 0 causes the messages to be omitted. An Accept or Reject is logged only if LogAccept or LogReject, respectively, is enabled and the LogLevel is “verbose” enough for the message to be recorded.

The TraceLevel setting specifies whether packets should be logged when they are received and being processed, and what level of detail should be recorded in the log.

If you alter the LogLevel or TraceLevel settings, you can have them take effect without restarting the server by issuing the following command:

- Linux: Enter the kill -HUP pid command.
- Windows: Issue the radhup command.

Using the Authentication Log File

The authentication log file records each RADIUS authentication request received by Steel-Belted Radius. Authentication log files are Comma Separated Value (CSV) ASCII text files that can be imported into a spreadsheet or database program.

Authentication log files are located in the RADIUS database directory area by default, although you can specify an alternate destination directory in the [Configuration] section of authlog.ini. Authentication log files are named yyyymmdd.authlog, where yyyy is the 4-digit year, mm is the month, and dd is the day on which the log file was created.

Authentication log files are kept for the number of days specified in the Settings tab of the Reports panel, and are deleted after that.

The current log file can be opened while Steel-Belted Radius is running.

Authentication Log File Format


The first five fields in every authentication log entry are required by Steel-Belted Radius:

- **Date**—The date when the event occurred
- **Time**—The time when the event occurred
- **RAS-Client**—The name or IP address of the RADIUS client sending the authentication request
- **Full-Name**—The fully distinguished name of the user, based on the authentication performed by the RADIUS server
- **ACC/REJ**—The result of the authentication request (ACCEPT or REJECT)

The RADIUS attributes specified in the authlog.ini file appear next. Attributes in the authlog.ini file beginning with a semicolon (;), are commented out, and their values are not recorded in the authentication log file.

User-Name

NAS-IP-Address
 NAS-Port
 Service-Type
 Framed-Protocol
 Framed-IP-Address
 Framed-IP-Netmask
 Framed-Compression
 Login-IP-Host
 Callback-Number
 State
 Called-Station-Id=
 Calling-Station-Id=
 NAS-Identifier=
 Proxy-State=
 Login-LAT-Service
 Login-LAT-Node
 Login-LAT-Group
 Event-Timestamp
 NAS-Port-Type
 Port-Limit
 Login-LAT-Port

 **Note:** If the User-Password attribute is included in the authlog.ini file, it is ignored during processing to prevent exposing users' cleartext passwords in the log file.

You can include vendor-specific attributes if the device sending the authentication packet supports them. For more information, see [“Vendor-Specific Attributes”](#).

You can edit the authlog.ini file to add, remove, or reorder the standard RADIUS or vendor-specific attributes that are logged. For information on authlog.ini, refer to the *Steel-Belted Radius Reference Guide*.

First Line Headings

The first line of the authentication log file lists the names of all the attributes that have been enabled for logging, in the order in which they are logged. This first line serves as a complete set of column headings for the remaining entries in the file.

The content of the first line depends on the attributes specified in the authlog.ini file. The following example shows the heading line and an authentication log file entry consisting of the required attributes.

```
"Date","Time","RAS-Client","Full-Name","ACC/REJ"
```

```
"7/3/2003","12:11:55","RRAS","EdisonCarter","ACCEPT",
```

Comma Placeholders

Log entries may not include every attribute listed in the first line of the authentication log file. When Steel-Belted Radius records the event in the authentication log file, it uses a comma “placeholder” to mark empty entries, so that all entries remain aligned with their headings.

For example, the following log entries indicate that Bob’s authentication request was rejected but Alice’s authentication request was accepted. The reported fields include Called-Station-Id, Calling-Station-Id, and Port-Limit. Note that the attributes listed in the log heading that were not returned for the authentication events are separated with commas.

```
"Date","Time","RAS-Client","Full-Name","Acc/Rej",
"User-Name","NAS-IP-Address","NAS-Port","Service-Type",
"Framed-Protocol","Framed-IP-Address",    "Framed-IP-Netmask","Framed-Compression",
"Login-IP-Host","Callback-Number","State",    "Called-Station-Id","Calling-Station-Id",
"NAS-Identifier","Proxy-State", "Event-Timestamp","NAS-Port-Type","Port-Limit",
"Login-LAT-Port""07/14/2003","13:39:10","192.168.2.42",
"BOB","REJECT",,,,,,,,,"Alice's Office","Bob's
Office",,,,,"5","07/14/2003","13:43:26","192.168.2.42",
"ALICE","ACCEPT",,,,,,,,,"Bob's Office","Alice's Office",,,,,"5",
```

Using the Accounting Log File

RADIUS accounting events are recorded in the accounting log file. Accounting events include START messages, which indicate the beginning of a connection; STOP messages, which indicate the termination of a connection; and INTERIM messages, which indicate a connection is ongoing.

Accounting log files use comma-delimited, ASCII format, and are intended for import into a spreadsheet or database program. Accounting log files are located in the RADIUS database directory area by default, although you can specify an alternate destination directory in the [Configuration] section of the account.ini file. Accounting log files are named yyyyymmdd.ACT, where yyyy is the 4-digit year, mm is the month, and dd is the day on which the log file was created.

Accounting log files are kept for the number of days specified in the Settings tab of the Reports panel, and are deleted after that to conserve disk space.

The current log file can be opened while Steel-Belted Radius is running.

Accounting Log File Format

The first six fields in every accounting log entry are provided by Steel-Belted Radius for your convenience in reading and sorting the file:

- Date—The date when the event occurred
- Time—The time when the event occurred
- RAS-Client—The name or IP address of the RADIUS client sending the accounting record

- Record-Type—START, STOP, INTERIM, ON, or OFF, the standard RADIUS accounting packet types
- Full-Name—The fully distinguished name of the user, based on the authentication performed by the RADIUS server
- Auth-Type—A number that indicates the class of authentication performed:
 - 0—Native
 - 10—SecurID User 11—
 - SecurID Prefix 12—
 - SecurID Suffix 13—
 - TACACS+ User
 - 16—TACACS+ Prefix 17—
 - TACACS+ Suffix 100—Tunnel
 - User 200—External
 - Database (other)—Proxy

By default, the standard RADIUS attributes follow the Auth-Type identifier. See [“Standard RADIUS Accounting Attributes”](#).

You can include vendor-specific attributes if the device sending the accounting packet supports them. For more information, see [“Vendor-Specific Attributes”](#).

You can edit the account.ini initialization file to add, remove or reorder the standard RADIUS or vendor-specific attributes that are logged. For information on account.ini, refer to the *Steel-Belted Radius Reference Guide*.

First Line Headings

The first line of the accounting log file is a file header that lists the attributes that have been enabled for logging in the order in which they are logged. The following example of a first line shows required headings in bold italic, standard RADIUS headings in bold, and vendor-specific headings in regular text:

“Date”, “Time”, “RAS-Client”, “Record-Type”, “Full-Name”, “Auth-Type”, “User-Name”,
“NAS-Port”, “Acct-Status-Type”, “Acct-Delay-Time”, “Acct-Input-Octets”,
“Acct-Output-Octets”, “Acct-Session-Id”, “Acct-Authentic”, “Acct-Session-Time”,
“Acct-Input-Packets”, “Acct-Output-Packets”, “Acct-Termination-Cause”,
“Acct-Multi-Session-Id”, “Acct-Link-Count”, “Acc-Err-Message”,
“Nautica-Acct-SessionId”, “Nautica-Acct-Direction”,
“Nautica-Acct-CauseProtocol”, “Nautica-Acct-CauseSource”,
“Telebit-Accounting-Info”, “Last-Number-Dialed-Out”,
“Last-Number-Dialed-In-DNIS”, “Last-Callers-Number-ANI”,
“Channel”, “Event-Id”, “Event-Date-Time”, “Call-Start-Date-Time”, “Call-End-Date-Time”,
“Default-DTE-Data-Rate”, “Initial-Rx-Link-Data-Rate”,
“Final-Rx-Link-Data-Rate”, “Initial-Tx-Link-Data-Rate”,

"Final-Tx-Link-Data-Rate","Sync-Async-Mode",
 "Originate-Answer-Mode","Modulation-Type",
 "Equalization-Type","Fallback-Enabled","Characters-Sent",
 "Characters-Received","Blocks-Sent","Blocks-Received",
 "Blocks-Resent","Retrans-Requested","Retrans-Granted",
 "Line-Reversals","Number-Of-Characters-Lost",
 "Number-of-Blers","Number-of-Link-Timeouts",
 "Number-of-Fallbacks","Number-of-Upshifts",
 "Number-of-Link-NAKs","Back-Channel-Data-Rate",
 "Simplified-MNP-Levels","Simplified-V42bis-Usage", "PW_VPN_ID"

Comma Placeholders

Steel-Belted Radius writes accounting events to the accounting log file. If an event recorded in the accounting log file does not have data for every attribute, a comma "placeholder" marks the empty entry, so that all entries remain correctly aligned with their headings. For example, based on the "first line" of headings described above, the following is a valid accounting log entry, in which the value of the Acct-Status-Type attribute is 7:

"12/23/1997","12:11:55","RRAS","Accounting-On",

,,,7,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

Standard RADIUS Accounting Attributes

Table 60 lists the standard RADIUS accounting attributes defined in RFC 2866, "RADIUS Accounting."

Table 66: Standard RADIUS Accounting Attributes

User-Name	The name of the user as received by the client.
NAS-Port	The port number on the client device.
Acct-Status-Type	A number that indicates the beginning or ending of the user service: 1—Start 2—Stop 3— Interim-Acct 7— Accounting-On 8— Accounting-Off
Acct-Delay-Time	Indicates how many seconds the client has been trying to send this record, which can be subtracted from the time of arrival on the server to find the approximate time of the event generating this request.
Acct-Input-Octets	Number of octets (bytes) received by the port over the connection; present only in STOP records.

Acct-Output-Octets	Number of octets (bytes) sent by the port over the connection; present only in STOP records.
Acct-Session-Id	Identifier used to match START and STOP records in a log file.
Acct-Authentic	Indicates how the user was authenticated by RADIUS, the network access device (local), or another remote authentication protocol: 1—RADIUS 2—Local 3—Remote
Acct-Session-Time	Elapsed time of connection in seconds; present only in STOP records.
Acct-Input-Packets	Number of packets received by the port over the connection; present only in STOP records.
Acct-Output-Packets	Number of packets sent by the port over the connection; present only in STOP records.
Acct-Termination-Cause	Number that indicates how the session was terminated; present only in STOP records: 1—User Request 2— Lost Carrier 3—Lost Service 4—Idle Timeout 5—Session Timeout 6—Admin Reset 7—Admin Reboot 8—Port Error 9—NAS Error 10— NAS Request 11—NAS Reboot 12—Port Unneeded 13—Port Preempted 14—Port Suspended 15—Service Unavailable 16—Callback 17—User Error 18—Host Request
Acct-Multi-Session-Id	Unique accounting identifier to make it easy to link together multiple related sessions in a log file.
Acct-Link-Count	The count of links that are known to have been in a given multi-link session at the time the accounting record is generated.

Appendix A

Glossary

802.1X	The IEEE 802.1X standard defines a mechanism that allows a supplicant (client) to connect to a wireless access point or wired switch (authenticator) so that the supplicant can provide authentication credentials that can be verified by an authentication server.
AAA	Authentication, authorization, and accounting.
accounting	The process of recording and aggregating resource use statistics and log files for a user, connection session, or function for billing, system diagnosis, and usage planning.
agent	SNMP module on a managed device that responds to requests from a management station and sends traps to one or more recipients (trap sinks) to inform administrators of potential problems.
AP	Access Point. A device that serves as a communication hub to connect 802.1X wireless clients to a wired network.
attribute	RADIUS attributes carry the specific authentication, authorization, and accounting.
authentication	The process of verifying the identity of a person or file system and whether the person is allowed on a protected network.
authentication server	A back-end database server that verifies, from the credentials provided by an access client, whether the access client is authorized to use network resources.
authorization	The process of controlling the access settings, such as privileges and time limits, that the user can exercise on a protected network.
AVP	Attribute-value pair. An attribute and its corresponding value.; for example, User-Name = admin .
blacklist	A profile of checklist attributes that cause Steel-Belted Radius to reject an authentication request. For example, a blacklist profile might specify calling station phone numbers or IP addresses that are blocked by Steel-Belted Radius.
CA	Certificate authority. A trusted entity that registers the digital identity of a site or individual and issues a digital certificate that guarantees the binding between the identity and the data items in a certificate.
CCM	Centralized configuration management. The process by which information is shared between a primary RADIUS server and one or more replica RADIUS servers in a multi-server environment.
certificate	A digital file signed by a CA that guarantees the binding between an identity and the contents of the certificate.

CHAP	Challenge Handshake Authentication Protocol. An authentication protocol where a server sends a challenge to a requestor after a link has been established. The requestor responds with a value obtained by executing a hash function. The server verifies the response by calculating its own hash value: if the two hash values match, the authentication is acknowledged.
checklist	A list of attributes that must accompany a request for connection before the connection request can be authenticated.
CIDR	Classless Inter-Domain Routing. In CIDR notation, an IP address is represented as A.B.C.D/n, where /n identifies the IP prefix or network prefix). The IP prefix identifies the number of significant bits used to identify a network. For example, 192.168.1.22/18 means "use the first 18 bits to represent the network and the remaining 14 bits to identify hosts." Common prefixes are /8 (Class A network), /16 (Class B network), /24 (Class C network), and /32.
community	An SNMP community is a group of devices and management stations running SNMP. An SNMP device or agent may belong to more than one SNMP community.
communitystring	Character string included in SNMP messages to identify valid sources for SNMP requests and to limit access to authorized devices.
credentials	Data that is verified when presented to an authenticator, such as a password or a digital certificate.
CRL	Certificate Revocation List. A data structure that identifies the digital certificates that have been invalidated by the certificates' issuing CA prior to their expiration date.
daemon	A program on a Linux host that runs continuously to handle service requests.
dictionary	Text file that maps the attribute/value pairs supported by third-party RADIUS vendors.
DHCP	Dynamic Host Configuration Protocol. Protocol by which a server automatically assigns (leases) a network address and other configuration settings to a client temporarily or permanently.
DNIS	Dialed number identification service. A telephone service that identifies what number was dialed by a caller.
DNS	Domain Name Service. Internet protocol for mapping host names, domain names, and aliases to IP addresses.
EAP	Extensible Authentication Protocol. An industry-standard authentication protocol for network access that acts as a transport for multiple authentication methods or types. Defined by RFC 2284.
EAP-15	A simple one-time password EAP method.
EAP-32	See POTP.

EAP-TLS	Authentication method that uses EAP (Extensible Authentication Protocol) and TLS (Transport Layer Security).
EAP-TTLS	Authentication method that uses EAP (Extensible Authentication Protocol) and TTLS (Tunneled Transport Layer Security).
GTC	Generic Token Card.
IEEE	Institute of Electrical and Electronics Engineers.
IETF	Internet Engineering Task Force. Technical subdivision of the Internet Architecture Board that coordinates the development of Internet standards.
IPv4	Implementation of the TCP/IP suite that uses a 32-bit addressing structure.
IPv6	Implementation of the TCP/IP suite that uses a 128-bit addressing structure.
Java	Programming language designed for use in distributed environments such as the Internet.
JDBC	Java Database Connectivity. Application programming interface for accessing a database from programs written in Java.
LCI	LDAP configuration interface.
LDAP	Lightweight Directory Access Protocol. An IETF standard protocol for updating and searching directories over TCP/IP networks.
LDIF	LDAP Data Interchange Format. The format used to represent directory server entries in text form.
LEAP	Lightweight Extensible Authentication Protocol.
MAC	(1) Message Authentication Code. A MAC function takes a variable-length input and a key to produce a fixed-length output to carry authentication and integrity protection of data. (2) Media Access Control. The unique hardware address associated with a computer network interface.
managed device	A device that runs an SNMP agent.

management station	Host that monitors and controls managed devices running SNMP agents.
MIB	Management Information Base. A database of objects, such as alarm status or statistics counters, that can be monitored or overwritten by an SNMP management station.
MPPE	Microsoft Point-to-Point Encryption. A means of representing point-to-point packets in an RC4 encrypted format. Defined in RFC 3078.
MS-CHAP	Microsoft CHAP. Proprietary version of CHAP.
NAS	Network Access Server. Network device that accepts connection requests from remote users, authenticates users via RADIUS, and routes user onto the network. Identical in meaning to RAS.
NAT	Network Address Translation. Technique that allows an intranet to use IP addresses that are different from what the Internet recognizes
native user	A user authenticated by Steel-Belted Radius using its internal authentication database.
ODBC	Open Database Connectivity. Standard (open) application programming interface for accessing a database.
OTP token	One-time password token. Hardware or software module that generates one-time passwords that can be used to authenticate a user.
PAC	Protected Access Credential. A high-entropy secret that is known to both the RADIUS client and the RADIUS server to secure the TLS handshake.
PAP	Password Authentication Protocol. An authentication protocol where a requestor sends an identifier and password to a server after a link has been established. If the identifier and password match an entry in the server's database, the authentication is acknowledged.
PEAP	Protected Extensible Authentication Protocol. A two-phase authentication protocol where (1) an authentication server is authenticated to a supplicant using a digital certificate and a secure channel is established; and (2) the supplicant is authenticated to the authentication server via the secure channel.
POTP	Protected One-Time Password. EAP method that uses one-time password tokens for unilateral or mutual authentication.
PPP	Point-to-Point Protocol. Network protocol defined in RFC 1661 that provides a standard method for transporting multi-protocol datagrams over point-to-point links.
proxy RADIUS	Process of authenticating users whose profiles are on other RADIUS servers by forwarding access-request packets received from a RADIUS client to a remote RADIUS server (the proxy target), and then forwarding the response from the remote server back to the RADIUS client.
proxy target	The remote RADIUS server that actually performs authentication in a proxy RADIUS sequence.

RADIUS	Remote Authentication Dial In User Service. A client/server security administration standard that functions as an information clearinghouse, storing authentication information about users and administering multiple security systems across complex networks.
RAS	Remote Access Server. Network device that accepts connection requests from remote users, authenticates users via RADIUS, and routes user onto the network. Identical in meaning to NAS.
return list	A list of attributes that Steel-Belted Radius must return to a RADIUS client after authentication of a user succeeds. The return list usually provides additional parameters that the RADIUS client needs to complete the connection.
roaming	The ability to move from one Access Point coverage area to another without interruption of service or loss of connectivity.
RSA SecurID	Security token system that allows remote-access users to generate a pseudorandom value they can forward as part of an authentication sequence.
session ID	Session Identifier. A string of characters uniquely identifying the session.
SHA-1	Secure Hash Algorithm-1. A one-way cryptographic function that takes a message of any length and produces a 160-bit message digest.
shared secret	An encryption key known only to the sender and receiver of data.
silent discard	The process of discarding a packet without further processing and without notification to the sender.
SNMP	Simple Network Management Protocol.
SSL	Secure Sockets Layer. Program layer that manages the security of messages on a network.
supplicant	The client in an 802.1X-authenticated network.
TACACS+	Terminal Access Controller Access Control System (with enhancements). An authentication protocol that allows a RAS to communicate with an authentication server to determine if a user should have access to a protected network.
TLS	Transport Layer Security.
trap	An SNMP message that reports a significant event, such as a problem, error, or change in state, that occurred within a managed device.
trap sink	The destination for trap messages sent by an SNMP agent on a managed device.

TTLS	Tunneled Transport Layer Security.
user database	A database where a RADIUS server keeps information about users, such as authentication information and network access permissions.
user profile	A record in the user database that describes how a particular user or class of users should be configured during authentication and authorization.
VSA	Vendor Specific Attributes.
WEP	Wired Equivalent Privacy. An encryption method designed to encrypt traffic between a WLAN client and an access point.
WLAN	Wireless Local Area Network.

Appendix B

When to Restart Steel-Belted Radius

This appendix explains the following topics when to stop and restart Steel-Belted Radius.

The *least* drastic action that causes this change to take effect is indicated by **Yes** in this table:

Table 67: When to Stop and Restart Steel-Belted Radius

Item changes:	Save the window or file	Issue a HUP signal	Stop/restart the server
Access window or object	Yes	Also works)	(Also works)
access.ini file	No	No	Yes
*.acc files	No	No	Yes
account.ini file	No	No	Yes
admin.ini file	No	No	Yes
*.aut files	No	(Sometimes)	Yes
blacklist.ini file	No	No	Yes
bounce.ini file (Windows only)	No	No	Yes
Authentication policy	Yes	(Also works)	(Also works)
*.dct files	No	No	Yes
*.dhc files	No	No	Yes
dhcp.ini file	No	No	Yes
*.dir files (see Notes below)	No	(Sometimes)	Yes
*.eap files	No	(Sometimes)	Yes
eap.ini file	No	No	Yes

Item changes:	Save the window or file	Issue a HUP signal	Stop/restart the server
events.ini file	No	No	Yes
filter.ini file	No	Yes	(Also works)
Import *.rif or users file	Yes	(Also works)	(Also works)
*.ini for directed accounting	No	No	Yes
IP Pools dialog or object	Yes	(Also works)	(Also works)
IPX Pools dialog or object	Yes	(Also works)	(Also works)
lockout.ini file	No	No	Yes
Log levels (in radius.ini file)	No	Yes	(Also works)
Profiles dialog or object	Yes	(Also works)	(Also works)
Proxy dialog or object	Yes	(Also works)	(Also works)
*.pro files	No	Yes	(Also works)
proxy.ini file (see Notes below)	No	(Sometimes)	Yes
radius.dct file (see Notes below)	No	No	Yes
radius.ini file	No	No	Yes
RADIUS Clients dialog or object	Yes	(Also works)	(Also works)
Servers dialog or object	Yes	(Also works)	(Also works)
services file	No	No	Yes
tacplus.ini file	No	No	Yes
TLS and TTLS	No	Yes	(Also works)
Trace levels	No	Yes	(Also works)

Item changes:	Save the window or file	Issue a HUP signal	Stop/restart the server
Tunnels panel or object	Yes	(Also works)	(Also works)
Users dialog or object	Yes	(Also works)	(Also works)
vendor.ini file	No	No	Yes

Appendix C

Technical Notes

This appendix contains the following technical bulletins:

- LDAP Support for Novell eDirectory
- Service Type Mapping
- CCA Support for 3COM
- Ascend Filter Translation
- Idapauth Extensions
- Ericsson's e-h235 Authentication Protocol
- Uniport Plug-In
- Windows Performance Monitor


LDAP Support for Novell eDirectory


The Steel-Belted Radius LDAP authentication plug-in contains features to enable greater interoperability with Novell eDirectory.

If you have configured eDirectory to limit the number of grace logins available to a user, Steel-Belted Radius can be configured to coordinate with eDirectory on this feature. Each time a user authenticates, the number of grace logins available is decremented until the account is locked out and needs an administrator to unlock it. A profile is assigned to these users — a profile that overrides their normal profile — when they are being authenticated using a grace login.

The features include:

- **Allowing Expired Accounts:** When enabled, this feature allows users to log in even after their account has expired.


 **Note:** As eDirectory itself does not check the password, this feature should be used only if the administrator has configured the ProfileForExpiredUsers setting to assign an alternate profile to the user, one that would inform the user of their account status but not allow a usable connection to the network. For example, you can use http redirection to force the connection to a web page with relevant information.


 **Note:** Administrators should contact their NAS vendors to determine the capabilities of their NAS equipment and what attribute-value pairs would be needed to create such a connection.

Grace Logins: When grace logins are limited in eDirectory, Steel-Belted Radius can be configured to accept or reject a user whose password has expired. This user is said to be in grace login mode; the user can also be allowed to log in but is provided with an alternate profile.

 **Note:** The grace login feature requires NetWare 6.0 or later with eDirectory 8.6 or later.

- **BindName:** You can use the BindName technique to search the eDirectory directory for a matching user and, having retrieved the user's DN, apply the Bind technique to authenticate the user's credentials. This combination allows the user to specify their common name (rather than the more cumbersome DN) when requesting authentication.

 **Note:** This feature works only if the NetWare server accepts LDAP Bind requests for users who are in grace login state. Earlier versions of the NetWare server did not support this feature.

 **Note:** You must configure the eDirectory server to 'Allow Clear_text passwords' to use these LDAP extensions. You can do this from the ConsoleOne application, in the Properties section of the LDAP group entry for your server.

Configuration

The [NDS] section (**Table 68**) has been added to the **ldapauth.aut** file to configure these features.

Table 68: [NDS] Settings

Field	Usage
Enable	Set to 1 to enable the Novell eDirectory (NDS) extensions. Default value is 0.
AllowExpiredAccountsForUsers	Set to 1 to allow users to authenticate even after their account has expired. Default value is 0. Important: This requires that the Netware server notify Steel-Belted Radius that the user's account has expired when the Netware server is attempting to Bind.
ProfileForExpiredUsers	The name of the profile to assign a user (as an override) if authenticated with an expired account. If you do not provide a value for this setting, the user is accepted with the usual profile and attributes. We recommend that you provide the user with a profile with restricted access.
AllowGraceLoginsForUsers	Set to 1 if users should be allowed to be authenticated in grace login mode. This decrements the grace login counter, and rejects the user when it has run out. Default value is 1.
ProfileForGraceLoginUsers	ProfileForGraceLoginUsers The name of the profile to assign a user (as an override) if authenticated in grace login mode. If you do not provide a value for this setting, the user is accepted with the usual profile and attributes.

If Enable is set to 1, Steel-Belted Radius works as follows:

- If the eDirectory directory is configured to operate without grace logins:
 - If **AllowExpiredAccountsForUsers** is set to 0 (the default), users with expired passwords are rejected.
 - If **AllowExpiredAccountsForUsers** is set to 1, users with expired accounts are accepted; the attributes returned in the Access-Accept response are either the attributes normally assigned to the user or, if the **ProfileForExpiredUsers** setting is specified, the attributes specified in that profile. If you enable this feature, we recommend that you configure the

ProfileForExpiredUsers setting.

- If the eDirectory directory is configured to operate with grace logins:
 - If **AllowGraceLoginsForUsers** is set to 0, users with correct but about-to-expire passwords are rejected.
 - If **AllowGraceLoginsForUsers** is set to 1 (the default), users with correct but about-to-expire passwords are accepted; the attributes returned in the Access-Accept are either the regular attributes assigned to the user or, if **ProfileForGraceLoginUsers** is specified, the attributes specified in that profile.

Sample ldapauth.aut file

```
[Bootstrap]
LibraryName=ldapauth.dll
Enable=1
InitializationString=LDAP

[Settings]
MaxConcurrent=1
Timeout=20
ConnectTimeout=25
QueryTimeout=10
WaitReconnect=2
MaxWaitReconnect=360
BindName=uid=<User-Name>,ou=sales,o=bigco.com
LogLevel = 0
UpperCaseName = 0
PasswordCase=original
PasswordFormat=0
Search = DoLdapSearch
SSL = 0

[Server]
s1=

[Server/s1]
Host=192.168.5.110
Port = 389

[Request]
%UserName = User-Name

[Response]
%profile= attThatContainsUserProfile

[Search/DoLdapSearch]
;Bind as a privileged user or someone that has the right to
; search the tree and retrieve the DN of users
bind=cn=administrator,o=netware6
Password= support
Base = o=netware6
Scope = 2
```

```

Filter = uid=<User-Name>
%DN = dn
;if the user is found perform search getprofile
onfound = GetProfile
;else reject the user
onnotfound=$reject
[Search/GetProfile]
; bind using the DN retrieved in doLdapSearch
Bind = <dn>
;You do not have to supply the password SBR knows to use the
;one received in the auth request.
;Setting base to the DN is most efficient
Base =<DN>
Scope = 2
Filter = uid=<User-Name>
Attributes = AttrList

[Attributes/AttrList]
attThatContainsUserProfile

[NDS]
Enable=1
AllowExpiredAccountsForUsers=1
ProfileForExpiredUsers=Expired
AllowGraceLoginsForUsers=1
ProfileForGraceLoginUsers=Grace

[Attributes/AttrList]
;Filter-Id
;Session-Timeout
;thepasswordis

```

CCA Support for 3COM

Steel-Belted Radius can support the generation of 3Com CCA tunnel attributes.

Configuration

To enable the return of the required CCA tunnel attributes, the ccagw.ini file must be modified.

The ccagw.ini file contains information about gateways, which are stored in the [gateway] sections. A [gateway] section must be present for each gateway supported. The following table describes each field:

Table 69: ccagw.ini File

Setting	Meaning
Address	The address of the gateway.
TunnelRefresh	The number of seconds before the tunnel refreshes. The default value is 0.

Setting	Meaning
Description	A text string describing the gateway.
Secret	The shared secret between Steel-Belted Radius and this gateway device.

For example:

```
[PulseSecure-Gateway]
Address = 200.47.98.142
TunnelRefresh = 3600
Description = Jersey City facility, East Coast subscribers
Secret = Holland Tunnel
```

Setting User and Profile Attributes


To enable this functionality for a particular user, the return list for the user must contain the following attributes:

```
Tunnel-Authentication
VPN-Gateway
```

Both of these attributes are defined as strings. The value of each attribute must be set to the name of the gateway used in the ccagw.ini file. For example, the return list of a user would have to include:

```
Tunnel-Authentication = PulseSecure-Gateway
VPN-Gateway = PulseSecure-Gateway
```

It is important to make sure that both attributes name the correct gateway. If an unknown gateway is named, the request is rejected.

 **Note:** Steel-Belted Radius is capable of returning multiple pairs of attributes for different gateways. For each gateway named in one of the attributes, a different random session key is generated.

 **Note:** Please see your 3Com documentation for more information.

Ascend Filter Translation

Ascend defines two attributes — Ascend-Data-Filter (242) and Ascend-Call-Filter (243) — that contain structured binary data representing a filter to be applied to the NAS device.

Instead of entering hexadecimal strings to configure these attributes, users can configure these attributes as text strings. Steel-Belted Radius automatically converts the text strings to the proper binary representation. The original filter attributes are still supported, and these attributes still may be configured as hexadecimal strings.

The following attributes allow configuration as text:

```
Ascend-Data-Filter-String
Ascend-Call-Filter-String
```

When Steel-Belted Radius formats a response packet, it translates the string version of the attribute to the appropriate binary value, and returns the attribute in the Access-Accept message.

Configuration

These attributes may be entered as text strings through the SBR Administrator. The attributes may also be returned from an LDAP or SQL database during authentication.

No syntax validation is performed when the attribute is configured. The validation of syntax occurs only when the response packet is formatted. If the syntax is invalid, a reject response is issued and an error is logged.



Note: These attributes should be tested before configured on a production server.

Two types of filter are supported: "ip" and "generic". "ipx" filters are not supported.

Syntax

In the syntax descriptions below, brackets [] indicate that the items enclosed are optional.

ip [direction] [action] [srcip address[/mask]] [dstip address[/mask]] protocol [srcport operator port] [dstport operator port]

Table 70: ip and generic Filters

Parameter	Values
direction	May be "in" or "out". The default is "out".
action	May be "forward" or "drop". The default is "drop".
address	An IP address in decimal dotted notation.
mask	The number of bits (decimal) in the network portion, from 0 through 32. The default is based on class of network.
protocol	<p>The protocol number (decimal); for example, 6 for TCP or 17 for UDP. The following protocol names are translated to the proper number:</p> <ul style="list-style-type: none"> • icmp(1) • tcp(6) • udp(17) • ospf(89).
operator	May be = (equal sign), != (exclamation and equal sign), < (less than), or > (greater than).
port	<p>The port number (decimal). In addition, the following service names are translated to the proper port number:</p> <ul style="list-style-type: none"> • ftp-data(20)•www(80) • ftp(21)•kerberos(88) • telnet(23)•hostname(101) • smpt(25)•nntp(119) • nameserver(42)•ntp(123) • domain(53)•exec(512) • tftp(69)•login(513) • gopher(70)•cmd(514) • finger(79)•talk(517)

Example:

ip out forward srcip 10.1.1.0/24 6 dstport = 80 srcport < 1023



Note: Please see your Ascend documentation for details about the syntax for these attributes.

Ericsson Enhanced Token Caching

This section pertains only to Ericsson equipment that supports enhanced token caching.

Enhanced token caching allows the administrator to specify that particular users are authenticated with both an ordinary password and a SecurID passcode. For such users, the ordinary PAP or CHAP password is checked first. If this first authentication is successful, the user's SecurID passcode is authenticated. Only if both authentications succeed is the user allowed access.



Note: The enhanced token caching feature does not interact in any way with the ordinary token caching feature described in the above section. Enhanced token caching is required to support the newer firmware releases on Ericsson devices.

Enhanced Token Caching Configuration

To enable enhanced token caching, a file with extension .aut must be included in the server directory—typically named sidalt.aut. The file has the following format:

[Bootstrap]

LibraryName = sidalt.dll

Enable = { 0 | 1 }

InitializationString = string

[Settings]

TokenAttr = string

CacheTimeoutAttr = string MessageID

= { 0 | 1 } ChallengeTokenInPassword

= { 0 | 1 }

Table 71 describes each field in the sidalt.aut file.

Table 71: sidalt.aut Syntax

Sidalt.aut Field	Meaning
Enable	<ul style="list-style-type: none"> Set to 0 to disable. Set to 1 to enable. <p>Default value is 0.</p>
LibraryName	<p>Identifies the dynamic link library used to process SecurID authentication.</p> <p>Default value is sidalt.dll.</p>
InitializationString	<p>Identifies the enhanced token caching software component for logging purposes. A typical value might be SecurID Alt.</p> <p>This field is required.</p>


Sidalt.aut Field	Meaning
TokenAttr	<p>The name of the Access-Request attribute containing the passcode or other information to be passed to the RSA SecurID server. This attribute must match the corresponding dictionary (.dct file) entry.</p> <p>This field is required.</p>
CacheTimeoutAttr	<p>The name of the Access-Response attribute containing the number of seconds a passcode remains in the cache from the time it was first validated by the RSA SecurID server. This attribute must match the corresponding dictionary (.dct file) entry.</p> <p>This field is required.</p>
MessageID	<p>Controls the format of Reply-Message attribute response packets, which are used to prompt the user for information during a challenge, and to inform the user of results.</p> <ul style="list-style-type: none"> If set to 0, the Reply-Message attribute consists only of a text message. If set to 1, the Reply-Message attribute consists of a 1-byte message ID followed by a text message. Default value is 0.
ChallengeTokenInPassword	<p>Allow test clients to interpolate with the enhanced token caching plug-in.</p> <ul style="list-style-type: none"> If set to 0, passcode or other information entered by the user as a response to a challenge appears in the TokenAttr entry. If set to 1, passcode or other information entered by the user as a response to a challenge appears in the User-attribute, rather than in the attribute specified by the TokenAttr entry.

Enhanced Token Caching Administration

To authenticate a user through the enhanced token caching component, the following must be true:

- The attribute specified by the TokenAttr entry must be present in the Access-Request.
- The return list specified for the user, either directly or through a profile, must include the attribute specified by the CacheTimeoutAttr entry.

If either attribute is not supplied, the user is assumed not to require enhanced token caching authentication, and is accepted.

 **Note:** See your Ericsson product documentation for information about NAS and PPP client operation under the enhanced token caching authentication method.

Uniport Plug-In

3Com's Uniport project can operate with Steel-Belted Radius via a plug-in.

Operation

Uniport requires RADIUS call-type determination as a back-up for SIP call-type determination. To determine call-type, the HiPerARC system sends Steel-Belted Radius a request containing a Service-Type attribute of Call-Check (10) and a User-Name attribute in which the value is the same as the Called-Station-Id (DNIS) attribute. The type of call is then determined based on the User-Name (DNIS), and the appropriate Service-Type attribute returned in the Access-Accept packet.

A Uniport plug-in method is instantiated for each value of the Service-Type attribute which can be returned in the Access-Accept. The proper method is utilized using proxy mapping to a directed realm which specifies the

method instance. The method then sets the configured profile in the response and indicates it was successful.

The Uniport methods return a Reject if a Service-Type attribute with a Call-Check value is not present in the request, if User-Name or Called-Station-Id attributes are not present, or if their values are not identical.

Configuration

The attribute(s) to be returned in the Access-Accept to identify the call-type are defined as Steel-Belted Radius profiles. For example, a FAX profile may be created which would return a value of 96 in a Service-Type attribute.

The Uniport methods are configured with *.AUT files which specify the profile to return. The method is identified and associated with a directed realm by the initialization string.

For example, a method to return the FAX profile may use a configuration file such as FAX.AUT, which would have the following settings:

```
[Bootstrap]
Enable = 1
InitializationString = UNIPORT FAX
Profile = FAX
LibraryName = Uniport.so
```

The corresponding directed realm would then identify the method in its *.DIR file. For example, in the FAX.DIR file the settings might be:

```
[Auth]
Enable = 1

[AuthMethods]
Uniport fax
```

The directed realms which refer to the Uniport methods are mapped in the [AuthAttributeMap] of PROXY.INI. A sample map might appear as:

```
[AuthAttributeMap]
Fax
Service-Type = 10
Called-Station-Id = 6175471047
FoIP
Service-Type = 10
Called-Station-Id = 617*
VoIP
Service-Type = 10
```

In the preceding example, the number 6175471047 would be directed to the Fax realm, which in turn would use the Uniport method which returns the Fax profile. Similarly, 6174976339 would result in a FoIP type and 5085551234 in a VoIP type (as the default).



Note: Wildcards must be listed after any numbers that they might “contain.” In the preceding example, the 617* wildcard must appear after the number 6175471047, as this last number would be contained within the range of numbers described by the wildcard.

If you want a default profile, the map may be configured to direct the request to a Uniport method by default. The same result may be obtained by omitting the default from the map and setting the first method in the authentication method chain to the desired default.

If you do not want a default profile, configure the map to direct requests by default to a method which has no profile set; the method returns with a value to indicate a failure to authenticate.

Windows Performance Monitor

The Steel-Belted Radius service has information which can be viewed with the Performance Monitor on a Windows administrative workstation or server. You can start multiple instances of the Windows Performance Monitor to display performance statistics graphs for more than one Steel-Belted Radius server simultaneously.

To view a graph of Steel-Belted Radius performance:

1. Run the Windows performance monitor by choosing **Start > Control Panel > Administrative Tools > Performance**.

2. Click the + button in the Performance window (or press CTRL+I).

The Add Counters window opens.

3. Pull down the **Performance Object** list and choose **Steel-Belted Radius**.

If you are running multiple Steel-Belted Radius servers, select the one you want to monitor from the **Select counters from computer** list.

4. If you want to select the counters that you want to graph, click the **Select counters from list** radio button, choose the counter you want, and click **Add**. Continue choosing counters and clicking Add until all desired counters have been selected.

If you want to display all counters for Steel-Belted Radius, click the **All counters** radio button and click **Add**.

Most perfmon counters relating to Steel-Belted Radius have self-explanatory names, such as Acct Failures - Insufficient Resources or Acct Failures - Invalid Shared Secret.

Of special interest is the Failed Auths - n counter, where n is a number between 1 and 16. You can set up as many as 16 Failed Auths - n counters, where each counter tracks the number of failed authentication requests that were encountered for all of the RADIUS clients that you have mapped to collection number n.

To set up the Failed Auths - n counter, you must configure the [FailedAuthOriginStats] section of radius.ini. For information on radius.ini, refer to the Steel-Belted Radius Reference Guide.

5. Click **Close** when you are finished adding counters.

The Performance Monitor window displays a graph of the counters you have selected. The graph updates itself at regular intervals until you close the Performance Monitor window.

6. Optionally, specify the color, scale, line width, and line style for one or more Steel-Belted Radius counters.

Right-click the name of a counter and choose **Properties** from the context menu. When the System Monitor Properties window opens, specify the characteristics you want the graph of the counter to use.

Table 72 describes the meaning of each perfmon counter.

Table 72: perfmon Counters

perfmon Counter	Meaning
Acct Failures - Insufficient Resources	The number of accounting requests that were discarded because the RADIUS server was unable to obtain sufficient system resources to process the request.

perfmon Counter	Meaning
Acct Failures - Invalid Clients	The number of accounting requests that were discarded because the RADIUS client identified in the request was not defined in the RADIUS server database.
Acct Failures - Invalid Requests	The number of accounting requests that were discarded because the request was malformed or contained invalid attributes.
Acct Failures - Invalid Shared Secret	The number of accounting requests that were discarded because the request contained an invalid digital signature. This is usually due to a mismatch in the shared secrets defined on the RADIUS client and the RADIUS server.
Acct Proxy Failures	The number of forwarded accounting requests for which failures were encountered.
Acct Requests Forwarded	The number of accounting requests that were forwarded to other RADIUS servers.
Acct Requests Retried	The number of unique accounting requests for which retries were received by the RADIUS server.
Acct Requests Retried/sec	The number of accounting requests per second for which one or more retries has been received by the RADIUS server.
Acct Retry Requests	The number of actual accounting request retries received by the RADIUS server.
Acct Retry Requests/sec	The number of accounting request retries per second received by the RADIUS server.
Acct Service Time	The number of seconds that elapsed from the time the last completed accounting request was received to the time the RADIUS server sent a response. Responses generated by proxies
Acct Starts	The number of accounting start requests received by the RADIUS server. An accounting start signifies the granting of a connection to an end-user by the remote access server.
Acct Starts/sec	The number of accounting start requests received by the RADIUS server per second. An accounting start signifies the granting of a connection to an end-user by the remote access
Acct Stops	The number of accounting stop requests received by the RADIUS server. An accounting stop signifies that an end-user has disconnected from the remote access server.
Acct Stops/sec	The number of accounting stop requests received by the RADIUS server per second. An accounting stop signifies that an end-user has disconnected from the remote access server.
Auth Failure - Authentication Failures	Number of unique authentication requests to which the RADIUS server replied with a reject because no user specified in the database possessed a matching password. A mismatch in
Auth Failure - Checklist Mismatches	Number of unique authentication requests to which the RADIUS server replied with a reject because the request did not include required checklist information.
Auth Failure - Insufficient Resources	Number of unique authentication requests to which the RADIUS server replied with a reject because the RADIUS server ran into a system resource limitation.
Auth Failure - Invalid Clients	Number of unique authentication requests to which the RADIUS server replied with a reject because the request was from a RADIUS client not identified in the RADIUS server's database.
Auth Failure - Invalid Requests	Number of unique authentication requests to which the RADIUS server replied with a reject because the request was malformed or contained invalid attributes.

perfmon Counter	Meaning
Auth Proxy Failures	The number of forwarded authentication requests for which failures were encountered.
Auth Proxy Rejects	The number of forwarded authentication requests for which rejects were received from the target RADIUS server.
Auth Requests	The number of unique authentication requests that the RADIUS server has received.
Auth Requests Forwarded	The number of authentication requests that were forwarded to another RADIUS server.
Auth Requests Retried	The number of unique authentication requests for which retries were received by the RADIUS server.
Auth Requests Retried/sec	The number of authentication requests per second for which one or more retries has been received by the RADIUS server.
Auth Requests/sec	The number of unique authentication requests that the RADIUS server has received per second.
Auth Retry Requests	The number of actual authentication request retries received by the RADIUS server.
Auth Retry Requests/sec	The number of authentication request retries per second received by the RADIUS server.
Auth Service Time	The number of seconds that elapsed from the time the last completed authentication request was received to the time the RADIUS server sent an Accept response. Accept
Auth SQL Disconnects	The number of times an existing connection to a SQL authentication database failed.
Auth SQL Failures	The number of times an attempt to connect to a SQL authentication database failed.
Auth SQL Records Not Found	The number of times no record was found in a SQL authentication database for the specified username.
Auth SQL Timeouts	The number of times a timeout occurred attempting to execute a SQL authentication request.
Auth Successes	The number of unique authentication requests to which the RADIUS server replied with an Accept.
Auth Successes/sec	The number of unique authentication requests to which the RADIUS server replied with an accept per second.
Concurrency Auth Failures	The number of times an authentication request was forwarded to the concurrency server and the concurrency server returned a reject for reasons other than users being over their
Concurrency Auth Service Time	The number of seconds elapsed from the last time an authentication request was sent to the concurrency server and a response was received.
Concurrency Auth Timeouts	The number of times an authentication request was forwarded to the concurrency server and no response was received within the configured time for the proxy entry.
Concurrency Over Port Limit	The number of times an authentication request was forwarded to the concurrency server and the concurrency server returned a reject because users were over their port limits.

perfmon Counter	Meaning
Failed Auths - 1	The number of failed authentication requests that were encountered for clients categorized in collection number 1.
Failed Auths - 2	The number of failed authentication requests that were encountered for clients categorized in collection number 2.
Failed Auths - 3	The number of failed authentication requests that were encountered for clients categorized in collection number 3.
Failed Auths - 4	The number of failed authentication requests that were encountered for clients categorized in collection number 4.
Failed Auths - 5	The number of failed authentication requests that were encountered for clients categorized in collection number 5.
Failed Auths - 6	The number of failed authentication requests that were encountered for clients categorized in collection number 6.
Failed Auths - 7	The number of failed authentication requests that were encountered for clients categorized in collection number 7.
Failed Auths - 8	The number of failed authentication requests that were encountered for clients categorized in collection number 8.
Failed Auths - 9	The number of failed authentication requests that were encountered for clients categorized in collection number 9.
Failed Auths - 10	The number of failed authentication requests that were encountered for clients categorized in collection number 10.
Failed Auths - 11	The number of failed authentication requests that were encountered for clients categorized in collection number 11.
Failed Auths - 12	The number of failed authentication requests that were encountered for clients categorized in collection number 12.
Failed Auths - 13	The number of failed authentication requests that were encountered for clients categorized in collection number 13.
Failed Auths - 14	The number of failed authentication requests that were encountered for clients categorized in collection number 14.
Failed Auths - 15	The number of failed authentication requests that were encountered for clients categorized in collection number 15.
Failed Auths - 16	The number of failed authentication requests that were encountered for clients categorized in collection number 16.
Forwarded Requests Retried	The number of unique forwarded accounting and authentication requests for which retries were transmitted by the RADIUS server.
Forwarded Requests Retried/sec	The number of unique forwarded accounting and authentication requests for which retries were transmitted per second by the RADIUS server.
Forwarded Retry Requests	The number of actual retransmissions of forwarded accounting and authentication request performed by the RADIUS server.
Forwarded Retry Requests/sec	The number of actual retransmissions of forwarded accounting and authentication request per second performed by the RADIUS server.

perfmom Counter	Meaning
Proxy Failures - Insufficient Resources	The number of authentication and accounting requests that were forwarded to other RADIUS servers for which the RADIUS server was unable to obtain sufficient system resources to
Proxy Failures - Invalid Response	The number of authentication and accounting requests that were forwarded to other RADIUS servers for which malformed or invalid responses were received.
Proxy Failures - Invalid Shared Secret	The number of authentication and accounting requests that were forwarded to other RADIUS servers for which responses were discarded because the response contained an invalid
Proxy Failures - Time Out	The number of authentication and accounting requests that were forwarded to other RADIUS servers for which no response was received after the specified number of retries.
Seconds since started	Number of seconds Steel-Belted Radius has been running.
Sessions Online	The number of sessions currently active in the RADIUS server's Sessions list.
Static Acct Service Time	The number of seconds elapsed from the last time an accounting request was sent to the static accounting proxy server and a response was received.
Total Acct Failures	The number of unique accounting requests to which the RADIUS server did not reply. Reasons for the failures are identified in other statistics.
Total Acct Failures/sec	The number of unique accounting requests to which the RADIUS server did not reply per second because of an error. Reasons for the failures are identified in other statistics.
Total Acct Offs	The number of accounting off requests received by the RADIUS server. An accounting off signifies that the accounting support in the RADIUS client has been disabled. This request is
Total Acct Offs/sec	The number of accounting off requests received by the RADIUS server per second.
Total Acct Ons	The number of accounting on requests received by the RADIUS server. An accounting on signifies that the accounting support in the RADIUS client has been enabled. This request is
Total Acct Ons/sec	The number of accounting on requests received by the RADIUS server per second.
Total Auth Challenges	The number of authentication requests that resulted in a RADIUS challenge response.
Total Auth Failures	The number of unique authentication requests to which the RADIUS server replied with a reject. Reasons for the failures are identified in other statistics.
Total Auth Failures/sec	The number of unique authentication requests to which the RADIUS server replied with a reject, per second. Reasons for the failures are identified in other statistics.
Total Forwarded Request Failures	The number of forwarded authentication and accounting requests that encountered failures.
Total Forwarded Request Failures/sec	The number of forwarded authentication and accounting requests that encountered failures, per second.
Total Forwarded Requests	The number of authentication and accounting requests that were forwarded to other RADIUS servers.
Total Forwarded Requests/sec	The number of authentication and accounting requests per second that were forwarded to other RADIUS servers.

perfmon Counter	Meaning
Users Online	The number of unique users represented in the RADIUS server's Sessions List.

Appendix D

Authentication Protocols

This appendix provides a matrix of authentication methods and their supported authentication protocols.

Table 73: Authentication Protocols

Method	PAP	CHAP	MS-CHAP	MS-CHAP-V2	LEAP	EAPM-SCHAP-V2	EAP-MD5	PAP/Token card	EAP/Token card
Microsoft PEAP available inner authentication protocols	No	No	No	No	No	Yes	No	No	No
Cisco PEAP available inner authentication protocols	No	No	No	No	Yes	Yes	Yes	No	Yes
TTLS available inner authentication protocols	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A
Local (password saved as Allow PAP only, {SHA} or {crypt}).	Yes	No	No	No	No	No	No	N/A	N/A
Windows Domain Authentication									
Windows Domain Group	Yes	No	Yes	Yes	Yes	Yes	No	N/A	N/A
Windows Domain User	Yes	No	Yes	Yes	Yes	Yes	No	N/A	N/A
UNIX authentication methods									
UNIX User	Yes	No	No	No	No	No	No	N/A	N/A
UNIX Group	Yes	No	No	No	No	No	No	N/A	N/A
Other authentication plug-ins									
RSA SecurID	Yes	No	No	No	No	No	No	N/A	Yes
TACACS+	Yes	Yes	No	No	No	No	Yes	N/A	N/A


Method	PAP	CHAP	MS-CHAP	MS-CHAP-V2	LEAP	EAPM-SCHAP-V2	EAP-MD5	PAP/Token card	EAP/Token card
LDAP									
BIND (this includes AD and eDirectory/NDS)	Yes	No	No	No	No	No	No	N/A	N/A
BINDNAME (password stored in clear text)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A
BINDNAME (password stored in SHA Crypt text)	Yes	No	No	No	No	No	No	N/A	N/A
BINDNAME (password stored as MD4 hash of	Yes	No	No	Yes	No	Yes	No	N/A	N/A
BINDNAME (password stored as enc-md5)	Yes	Yes	No	No	No	No	No	N/A	N/A
SQL									
Password stored in clear text	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A
Password password stored in SHA Crypt text	Yes	No	No	No	No	No	No	N/A	N/A
Password stored as {MD4} hash of unicode	Yes	No	No	Yes	No	Yes	No	N/A	N/A
Password stored as {enc- md5}	Yes	Yes	No	No	No	No	No	N/A	N/A

Appendix E

Importing and Exporting Data

This appendix describes how to export database information from one Steel-Belted Radius server to an XML file, and then selectively import database information into another Steel-Belted Radius server. The ability to export and import information facilitates configuration of multiple Steel-Belted Radius servers.

Steel-Belted Radius uses XML files with UTF-8 encoding to store exported information. Export files contain only those attributes that have been assigned values, including defaults. For example, if an exported local user item does not have a profile associated with it, the exported information will not identify a profile name, though it will include default values required by Steel-Belted Radius.

 **Note:** Versions of Steel-Belted Radius earlier than Version 5.0 used a file format called RADIUS Import File (RIF) to export and import information. For backward compatibility, Steel-Belted Radius includes a utility to convert RIF files to XML format. For more information, see the Steel-Belted Radius Installation and Upgrade Guide.

Exporting to a RADIUS Information File via Legacy SBR Administrator

To export information from the Steel-Belted Radius database to an XML file:

1. Run the SBR Administrator.
2. Choose **File > Export**.
3. When the Export dialog (Figure 228) opens, select the information you want to export.

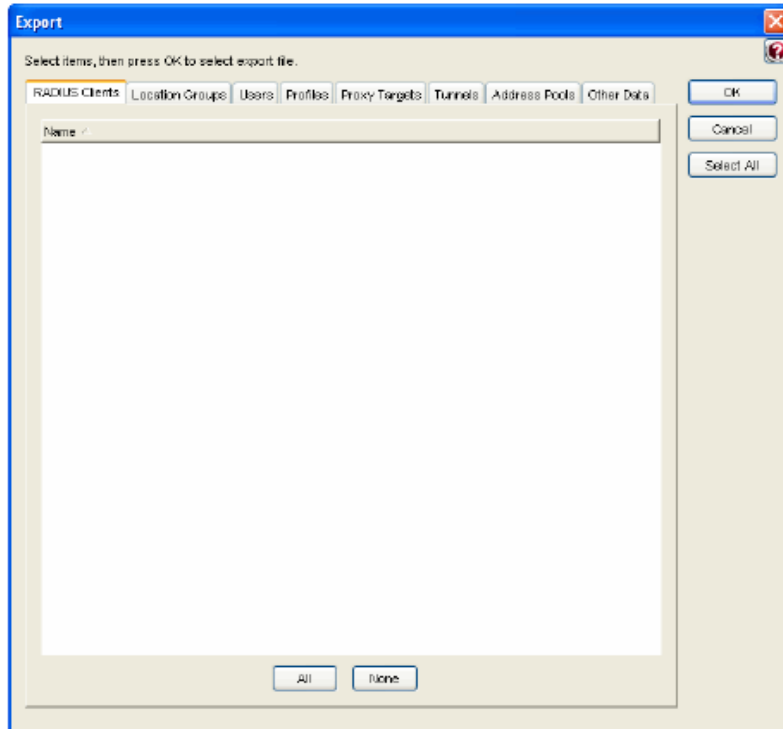
Each tab in the dialog lists exportable items of a particular category. For each category, select the appropriate tab and click each item you'd like to export. To select a contiguous range of items, select the first item in the range, hold down the Shift key, and click the last item in the range.

To select a non-contiguous set of items, hold down the Ctrl key as you click each item you want.

To select all items in a category, click **All**.

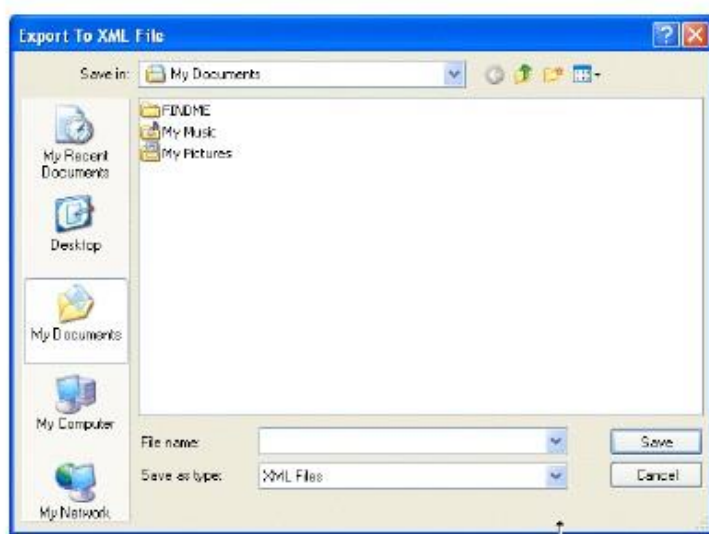
To select all items in all categories, click **Select All**.

Figure 228: Export Dialog



4. After you have selected the items you want to export, click **OK**.
5. When the Export to XML dialog opens, specify a file name and click **Save**.

Figure 229: Export to XML Dialog



Exporting to a RADIUS Information File via WebGUI

To export information from the Steel-Belted Radius database to an XML file:

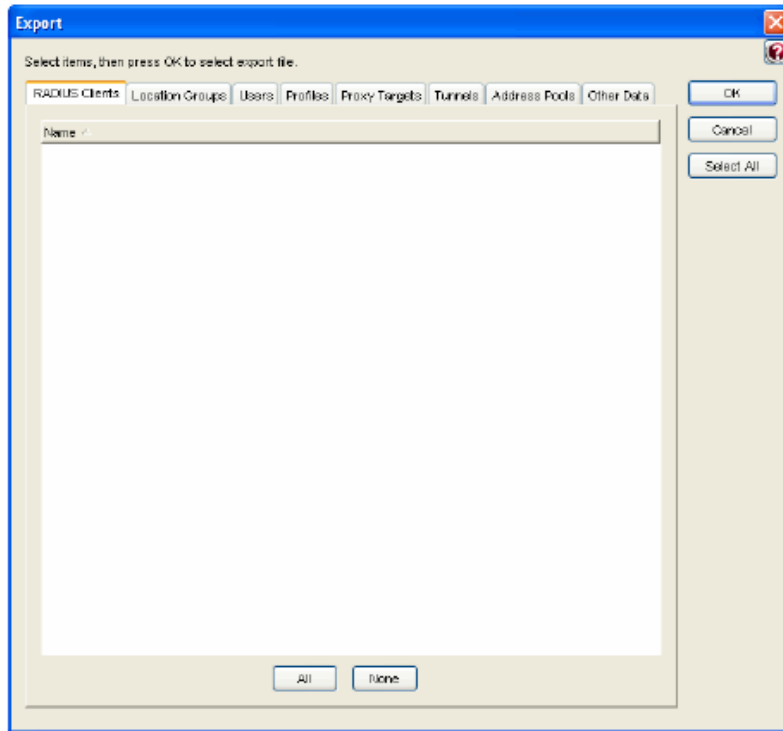
1. From the WebGUI, choose **Maintenance > Operations > Export**.
2. When the Export dialog (Figure 228) opens, select the information you want to export.

Each tab in the dialog lists exportable items of a particular category. For each category, select the appropriate tab and click each item you'd like to export.

To select all items in a category, select the check box in the table header in each category.

To select all items in all categories, select the **Export All Data** check box.

Figure 230: Export Dialog

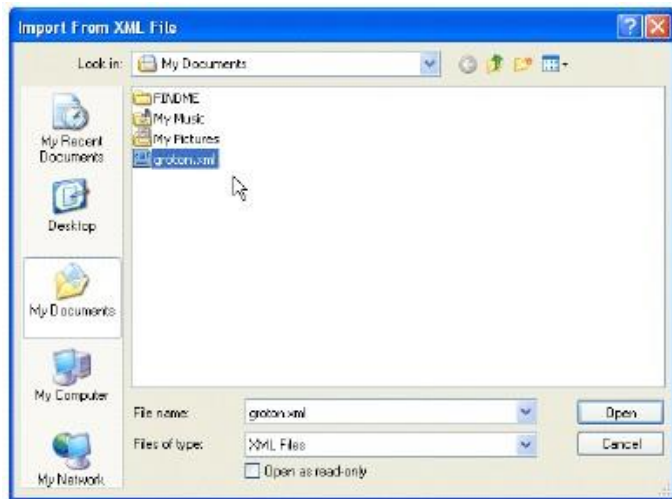


3. After you have selected the items you want to export, click **OK**.
4. SBR-E_Export.xml file will be automatically downloaded.

Importing into the Steel-Belted Radius Database via Legacy SBR Administrator

To import information from an XML file into the database on your Steel-Belted Radius server:

1. Run the SBR Administrator.
2. Choose File > **Import**.
3. When the Import from XML dialog opens, select the XML file containing the information you want to import and click **Open**.

Figure 231: Import from XML File Dialog

4. When the Import dialog (Figure 232) opens, specify whether what the SBR Administrator should do when it finds an object with the same name in the Steel-Belted Radius database.
 - Click Skip if you want SBR Administrator to leave the item already in the database intact.
 - Click Replace if you want SBR Administrator to overwrite the item in the database with the imported information.
5. Select the information you want to import by clicking each tab and selecting items to import.

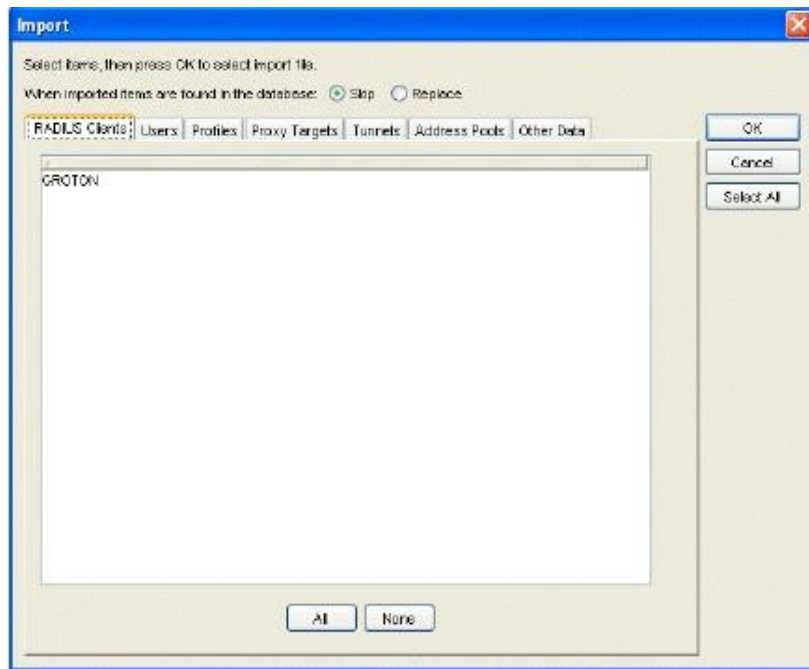
To select a contiguous range of items, select the first item in the range, hold down the SHIFT key, and click the last item in the range.

To select a non-contiguous set of items, hold down the Ctrl key as you click each item you want.

To select all items in a category, click **All**.

To select all items in all categories, click **Select All**.

Figure 232: Import Dialog



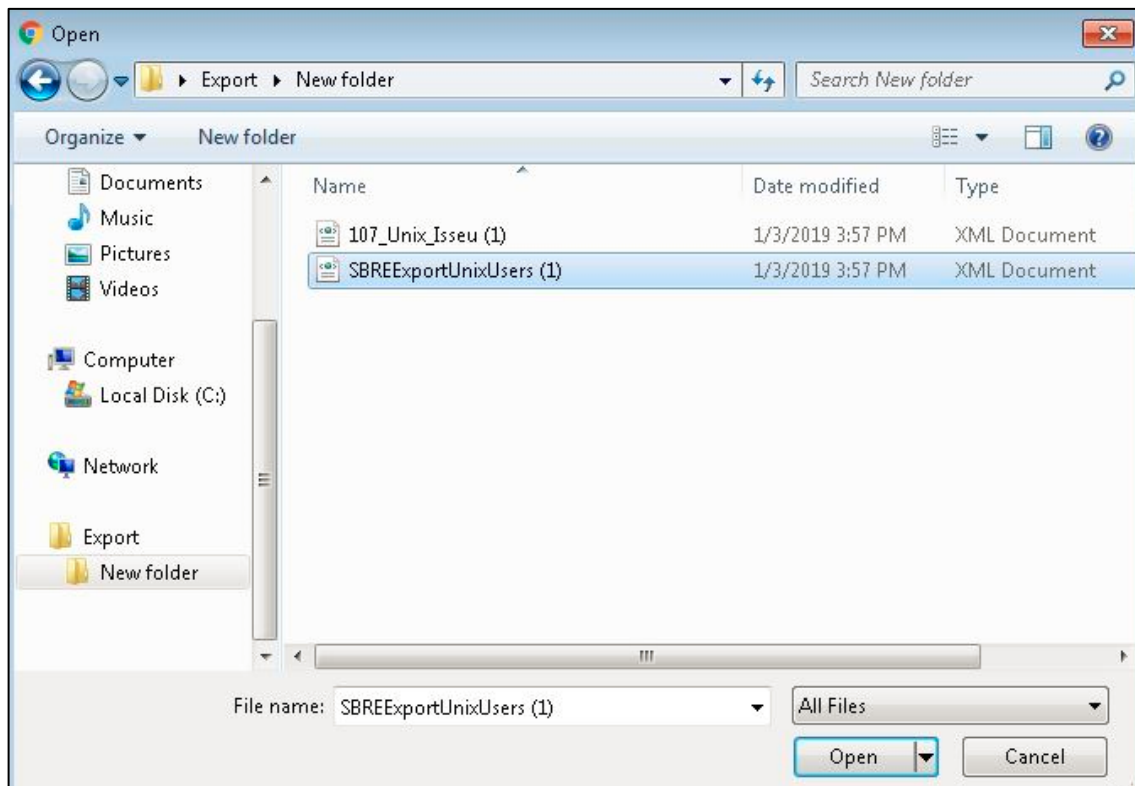
6. After you select all the items you want, click **OK**. The items you selected are added to the Steel-Belted Radius database.

Importing into the Steel-Belted Radius Database via WebGUI

To import information from an XML file into the database on your Steel-Belted Radius server:

1. From the WebGUI, choose **Maintenance > Operations > Import**.
2. Click the **Choose File/Browse** Button, select the xml file containing the information you want to Import and click **Import**.

Figure 233: Import from XML File Page

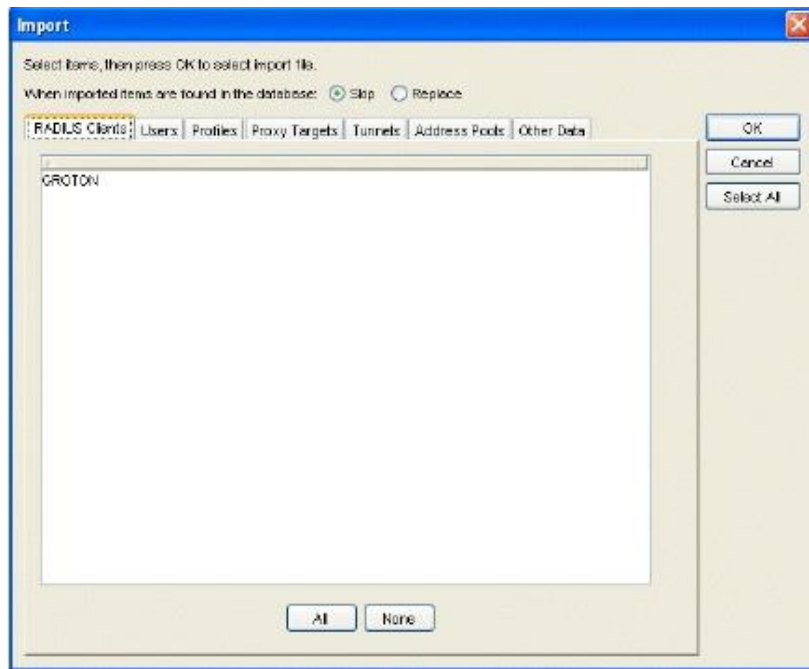


3. When the Import dialog (Figure 232) opens, specify whether what the SBR Administrator should do when it finds an object with the same name in the Steel-Belted Radius database.
 - Click Skip if you want SBR Administrator to leave the item already in the database intact.
 - Click Replace if you want SBR Administrator to overwrite the item in the database with the imported information.
4. Select the information you want to import by clicking each tab and selecting items to import.

To select all items in a category, select the check box in the table header in each category.

To select all items in all categories, select the **Import All Data** check box.

Figure 234: Import Dialog



5. After you select all the items you want, click **OK**. The items you selected are added to the Steel-Belted Radius database.

Appendix F

Stopping and Starting Steel-Belted Radius

This appendix describes how to stop and restart the Steel-Belted Radius server.

Stopping the Steel-Belted Radius Server

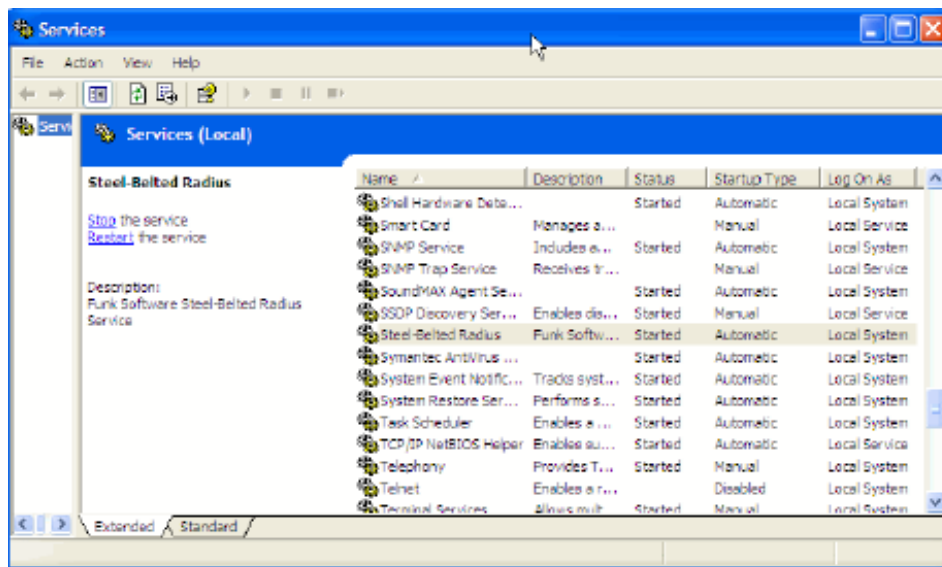
After the Steel-Belted Radius service (Windows) or RADIUS daemon (Linux) is installed, it stops and starts automatically each time you shut down or restart the server. If you modify the settings in the Steel-Belted Radius configuration files, you may need to restart the Steel-Belted Radius server manually before the server recognizes its new settings.

Windows

You can stop the Steel-Belted Radius service at any time by performing the following steps:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window opens, click the Steel-Belted Radius entry.

Figure 235: Services Window



3. Click the **Stop the service** button.

Linux

After the RADIUS daemon is installed on the server, it stops and starts automatically each time you shut down or restart the server. You can stop the RADIUS daemon on a Linux server at any time by issuing the following commands:

```
cd server-directory
./sbrd stop
```

When you execute the sbrd stop command, Steel-Belted Radius allows its subsystems to complete outstanding work, release resources, and then stops the radius service gracefully.

If Steel-Belted Radius fails to stop after you issue an `sbrd stop` command, you can use the optional `force` argument to terminate all subsystems immediately.

```
cd server-directory  
./sbrd stop force
```

Starting the Steel-Belted Radius Server

You must restart the Steel-Belted Radius service (Windows) or RADIUS daemon (Linux) after you modify the Steel-Belted Radius configuration files.

Windows

To start the Steel-Belted Radius service on a Windows server after it has been stopped:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window (Figure 235) opens, click the Steel-Belted Radius entry.
3. Click the **Start the service** button.

To restart the Steel-Belted Radius service without stopping it:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window (Figure 235) opens, click the Steel-Belted Radius entry.
3. Click the **Restart the service** button.

Linux

Use the following command to start the RADIUS daemon after you have issued an `sbrd stop` command on a Linux server:

```
cd server-directory  
./sbrd start
```

When you execute the `sbrd start` command, Steel-Belted Radius starts the radius service.

If you change configuration settings for your Steel-Belted Radius server, you may need to restart the server to make the changes effective. As an alternative to issuing an `sbrd stop` command immediately followed by an `sbrd start` command, you can use the `sbrd restart` command when you want to restart Steel-Belted Radius. When you issue the `sbrd restart` command, the system shuts down the radius service (if it is running), and then immediately starts the radius service.

```
cd server-directory  
./sbrd restart
```

Displaying RADIUS Status Information (Linux)

You can use the `sbrd status` command to display status information for the RADIUS daemon.

```
cd server-directory  
./sbrd status
```

Figure 236 illustrates the output of the `sbrd status` command.

Figure 236: Output of sbrd status Command

```
> sbrd status

— Shared Memory Segments —
key shmownerpermsbytesnatchstatus
0x42545256891968ecarter60080000002

— Semaphore Arrays —
key semownerpermsnsems
0x42545256167116ecarter660250

ecarter 26066 radius -d/home/ecarter/sbr/5.0.5.1553/funk/radius
sbr.xml
radius processes are running
radius state is running
radius status 1101


Aggregate state is running
```

Appendix G

Stopping and Starting “Steel-Belted Radius Jetty Server”

Windows

Once you start Steel-Belted Radius Service, another service for Java Web server (Jetty) will be created automatically. You can use the entry “Steel-Belted Radius Jetty Server” service to start/restart and stop the Java Web server.

 **Note:** When you stop the “Steel-Belted Radius” Service, the “Steel-Belted Radius Jetty Server” Service will be stopped and uninstalled automatically. Similarly, when you restart the “Steel-Belted Radius” Service, the “Steel-Belted Radius Jetty Server” Service will be restarted automatically.

Stopping Jetty Server

You can stop the “Steel-Belted Radius Jetty Server” service at any time by performing the following steps:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window opens, click the Steel-Belted Radius Jetty Server entry.
3. Click **Stop the service** button.

Starting Jetty Server

To start the “Steel-Belted Radius Jetty Server service” on a Windows server after it has been stopped, perform the following steps:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window Figure 235: Services Window opens, click the Steel-Belted Radius Jetty Server entry.
3. Click **Start the service** button.

Restarting Jetty Server

To restart the “Steel-Belted Radius service” without stopping it, perform the following steps:

1. Choose **Start > Control Panel > Administrative Tools > Services**.
2. When the Services window Figure 235: Services Window opens, click the Steel-Belted Radius Jetty Server entry.
3. Click **Restart the service** button.

Linux

The Steel-Belted radius Java Web server (Jetty) will be started/stopped/restarted automatically along with the radius server. However, you can start/stop/restart the SBR Jetty server separately by using the following steps:

Stopping Jetty Server

Run the following commands to stop the jetty server

```
cd server-directory
./sbrd jettystop
```

Starting Jetty Server

Run the following commands to start the jetty server

```
cd server-directory
./sbrd jettystart
```

Restarting Jetty Server

Run the following commands to restart the jetty server

```
cd server-directory
./sbrd jettyrestart
```

Viewing the Status of Jetty Server

To view the status of Java Web server, run the following command

Figure 237: Viewing status of Jetty Server

```
[root@pbuaricent2-rhel6-4 radius]# ./sbrd status

----- Essential Network Status -----
Protocol      Local Address      Foreign Address
tcp           0 0 0.0.0.0:1812        0.0.0.0:*          LISTEN
tcp           0 0 0.0.0.0:1813        0.0.0.0:*          LISTEN
udp           0 0 10.96.176.74:1812   0.0.0.0:*
udp           0 0 10.96.176.74:1813   0.0.0.0:*
udp           0 0 10.96.176.74:1645   0.0.0.0:*
udp           0 0 10.96.176.74:1646   0.0.0.0:*

root    30089 radius sbr.xml
radius processes are active
radius lock files exist
radius state is running
radius status 1100

----- WebServer Status -----
root    31795 jetty
Java WebServer is active

watchdog processes are inactive
watchdog state is stopped
watchdog status 1000

aggregate state is running
```


Appendix H

Use Custom SSL Certificate for Launching SBR-E Web UI

By default, Java Web server (Jetty) uses a self-signed certificate in its keystore (for https). To use a custom certificate, edit configurations in the **application.properties** file.

Perform the following steps to edit:

1. Go to **<SBR_INSTALLED_DIR>\Service\Website\jetty** (in Windows) or **<SBR_INSTALLED_DIR/radius/website/jetty** (in Linux).
2. Take a backup of "**application.properties**" file as "application.properties-orig".
3. Open the "**application.properties**" file to edit.
4. Default configurations will be as follows:

```
# The format used for the keystore
server.ssl.key-store-type=PKCS12 (Default keystore)
# The path to the keystore containing the certificate
server.ssl.key-store=classpath:SBRWebServer.p12 (self-signed certificate inside Web server)
# The password of the certificate
server.ssl.key-store-password=pulsesbr (password of the self-signed certificate).
```

5. If you have a .pfx or .p12 certificate then configure the key store type as follows:

```
server.ssl.key-store-type=PKCS12
If you have a .jks certificate, then configure the type as follows,
server.ssl.key-store-type=JKS
```

6. Set the path to the keystore containing the certificate (server.ssl.key-store)
Configure the path of the certificate keystore as follows:

```
server.ssl.key-store=<absolute path of certificate>
Example:
server.ssl.key-store=/opt/certs/customSSLCert.p12
```

7. Set the password of the certificate (server.ssl.key-store-password)
server.ssl.key-store-password=<password to open the certificate>
8. After setting all the properties, save the file and restart Java Web server (Jetty).

```
Linux: ./sbrd jettyrestart
Windows: Restart "Steel-Belted Radius Jetty Server" service from Services.msc
```

9. When you launch SBR Web UI, you will be able to see the custom certificate in the web browser.

Index

Symbols

%AuthType	244
%FullName	244
%Name.....	218
%NASAddress	218, 244
%NASModel.....	219, 244
%NASName	218, 219, 244
%OriginalUserName	218
%Password	219
%password.	219
%Time.....	244
%TransactionTime	244
%Type.....	244
%UserName.	218
Numerics	
802.1X access point	3
A	
access client.....	3
Access-Accept message.....	4
Access-Reject message.....	4
Access-Request message.....	17
account.ini.....	259
Acct-Authentic	274
Acct-Delay-Time.....	274
Acct-Status-Type.....	274
Acct-Termination-Cause	275
address leak.....	30
address pools	
IPX	104

attribute mapping.....	18
attributes.....	5
Authenticate-Only requests.....	19
authentication	
inner.....	142
authentication methods list.....	17, 170, 217
authlog.ini.	259
authReport.ini	259
authReportAccept.ini.	259
authReportBadSharedSecret.ini.....	259
authReportReject.ini.	259
authReportUnknownClient.ini	259
automatic EAP helper	122
automatic EAP helpers.	122
B	
Bind Authentication.	229
BindName Authentication.....	229
Bootstrap section	
in sidalt.aut file	292
C	
cache, flushing.....	166
CacheTimeoutAttr.	292
challenge.	23
ChallengeTokenInPassword	293
CHAP	22
checklist attributes.	11
concurrent connections	81
concurrent tunnel connections	32, 95
concurrent users.....	31
CRL cache, flushing	166
D	

Diffie-Hellman.....	134, 141, 149, 155, 162	host agent.....	9
digest.....	23	I	
directed authentication.....	18	InitializationString	20, 21, 216, 292
domain controller	142	inner authentication.....	142
Dropped Packet.....	252, 253	Insufficient Resources.....	252, 254
E		Invalid Client.....	254
EAP		Invalid Request	252, 253
EAP Identity Response.....	121	Invalid Shared Secret	254
EAP Setup window.....	170	IP address pool.....	207
		IP address pools.....	101
EAP-Message attribute	121, 123	IP Pools tab.....	101
EAP-PEAP	156	IPX address pool.....	207
EAP-TTLS	141	IPX address pools.....	104
echo property.....	13	IPX Pools tab	104
eDirectory	285	L	
Enable	292	LDAP	142
Enc-md5	222, 234	log files	25
exponentiation	134, 141, 149, 155, 162	LogAccept	272
Extensible Authentication Protocol, see EAP external		LogLevel.....	272
accounting.....	25	LogReject.....	272
external authentication.....	18	M	
F		Make/model field.....	0
Failed Authentication.....	252	MaxConcurrent.....	220, 247
Failed on Checklist.....	252	Maximum concurrent connections field.....	1
Flush CRL Caches.....	166	MD4	222, 234
force	308	MessageID.....	293
Framed-Compression.....	12	MS-CHAP	22
FramedIPAddressHint	28	MS-CHAP-V2	22
H		MS-CHAP-v2.....	122
hint.		multi-valued attributes.	12
.....	2	mutual authentication.	129

N	
Native User.....	17, 65, 72
Native User authentication.....	17
NDS, see Novell eDirectory	
negative number, in attributes.....	12
network access device (NAD).....	3
Next Level Aggregator IDs.....	35
Novell eDirectory.....	285
Novell NDS.....	285
O	
Oracle.....	217, 222, 243, 248
orderable attributes.....	12
P	
panelTunnels.....	96
PAP.....	22
pass-through authentication.....	17
password output parameter.....	219
PEAP.....	156
perfmon counters.....	296
phantom records.....	32
pool	
IP address.....	101
Prefetch-capable.....	124
profiles.....	83
Proxy Failure.....	252, 254
proxy RADIUS.....	17
proxy RADIUS authentication.....	17
R	
RADIUS daemon, starting and stopping.....	307, 308
RADIUS server.....	4
radius.dct.....	10
radiusclass.....	189
radiusdir.....	xiv
radsql.acc.....	241
radsql.aut.....	216
radsqljdbc.acc.....	241
redundancy.....	7
Rejected by Proxy.....	252
rejection messages.....	171
retry policy.....	89
return-list attributes.....	11
RSA SecurID.....	4, 20, 167
S	
sbrd restart.....	309
sbrd start.....	309
sbrd status.....	310
sbrd stop.....	308
sbrd stop force.....	308
sbrsetuptool.....	180, 181
SecurID.....	4
see RSA SecurID	
SecurID authentication.....	167
SecurID user.....	74
SecurID, see RSA SecurID	
session resumption.....	126
Session-Timeout attribute.....	126
Settings section	
in sidalt.aut file.....	292
shared secret.....	8, 9
sidalt.aut.....	292
signed integer, in attributes.....	12
Site Level Aggregator IDs.....	35

SQL	142
sqlacct.acc	241
sqlauth.aut	216
stop force	308
system assigned values	12
T	
tab	
IP Pools	101
IPX Pools	104
TACACS+	4, 20, 23, 168
TokenAttr	292
Top Level Aggregator IDs	35
TraceLevel	272
tunnel connections, concurrent	32, 95
tunnels	96, 206
Tunnels panel	96
U	
UNIXcrypt	221, 222, 233, 234
User type field	1
User-Name attribute	122
users, concurrent	31
V	
vendor-specific attributes	10