



RADIUS Configuration Guide, Cisco IOS Release 15S

Americas Headquarters

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
<http://www.cisco.com>
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental.

Cisco and the Cisco logo are trademarks or registered trademarks of Cisco and/or its affiliates in the U.S. and other countries. To view a list of Cisco trademarks, go to this URL: <http://www.cisco.com/go/trademarks>. Third-party trademarks mentioned are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (1110R)

© 2014 Cisco Systems, Inc. All rights reserved.



CONTENTS

CHAPTER 1

Configuring RADIUS 1

Finding Feature Information	1
Information About RADIUS	1
RADIUS Operation	1
RADIUS Attributes	2
Vendor-Proprietary RADIUS Attributes	2
RADIUS Tunnel Attributes	2
Preauthentication on a RADIUS Server	3
RADIUS Profile for DNIS or CLID Preauthentication	3
RADIUS Profile for Call Type Preauthentication	3
RADIUS Profile for Preauthentication Enhancements for Callback	4
RADIUS Profile for a Remote Hostname Used for Large-Scale Dial-Out	4
RADIUS Profile for Modem Management	4
RADIUS Profile for Subsequent Authentication	5
RADIUS Profile for Subsequent Authentication Types	6
RADIUS Profile to Include the Username	6
RADIUS Profile for Two-Way Authentication	7
RADIUS Profile to Support Authorization	7
RADIUS Authentication	8
RADIUS Authorization	8
RADIUS Accounting	8
RADIUS Login-IP-Host	8
RADIUS Prompt	9
Vendor-Specific RADIUS Attributes	9
Static Routes and IP Addresses on the RADIUS Server	10
How to Configure RADIUS	10
Configuring Device-to-RADIUS Server Communication	10
Configuring a Device for Vendor-Proprietary RADIUS Server Communication	12

Configuring a Device to Expand Network Access Server Port Information	14
Replacing the NAS-Port Attribute with the RADIUS Attribute	16
Configuring AAA Server Groups	17
Configuring AAA Server Groups with a Deadtimer	18
Configuring AAA DNIS Preauthentication	19
Configuring AAA Server Group Selection Based on DNIS	20
Configuring AAA Preauthentication	22
Configuring DNIS Preauthentication	23
Configuring a Guard Timer	25
Configuring the Suffix and Password in RADIUS Access Requests	26
Monitoring and Maintaining RADIUS	28
Configuration Examples for RADIUS	29
Example: RADIUS Authentication and Authorization	29
Example: RADIUS Authentication, Authorization, and Accounting	29
Example: Vendor-Proprietary RADIUS Configuration	30
Example: RADIUS Server with Server-Specific Values	31
Example: Device-to-RADIUS Server Communication	31
Example: Multiple RADIUS Server Entries for the Same Server IP Address	31
Examples: AAA Server Groups	32
Example: Multiple RADIUS Server Entries Using AAA Server Groups	32
Example: AAA Server Group Selection Based on DNIS	33
Examples: AAA Preauthentication	33
Example RADIUS User Profile with RADIUS Tunneling Attributes	34
Examples: Guard Timer for ISDN and CAS	35
Additional References	35
Feature Information for Configuring RADIUS	37

CHAPTER 2**Framed-Route in RADIUS Accounting 39**

Finding Feature Information	39
Prerequisites for Framed-Route in RADIUS Accounting	39
Information About Framed-Route in RADIUS Accounting	40
Framed-Route Attribute 22	40
Framed-Route in RADIUS Accounting Packets	40
How to Monitor Framed-Route in RADIUS Accounting	40
Additional References	41

Feature Information for Framed-Route in RADIUS Accounting 43

CHAPTER 3**RFC-2867 RADIUS Tunnel Accounting 45**

Finding Feature Information 45

Restrictions for RFC-2867 RADIUS Tunnel Accounting 46

Information About RFC-2867 RADIUS Tunnel Accounting 46

RADIUS Attributes Support for RADIUS Tunnel Accounting 46

How to Configure RADIUS Tunnel Accounting 52

Enabling Tunnel Type Accounting Records 52

What To Do Next 54

Verifying RADIUS Tunnel Accounting 54

Configuration Examples for RADIUS Tunnel Accounting 55

Configuring RADIUS Tunnel Accounting on LAC Example 55

Configuring RADIUS Tunnel Accounting on LNS Example 56

Additional References 58

Feature Information for RFC-2867 RADIUS Tunnel Accounting 59

CHAPTER 4**RADIUS Centralized Filter Management 61**

Finding Feature Information 61

Prerequisites for RADIUS Centralized Filter Management 61

Restrictions for RADIUS Centralized Filter Management 62

Information About RADIUS Centralized Filter Management 62

Cache Management 62

New Vendor-Specific Attribute Support 63

How to Configure Centralized Filter Management for RADIUS 63

Configuring the RADIUS ACL Filter Server 63

Configuring the Filter Cache 64

Verifying the Filter Cache 65

Troubleshooting Tips 65

Monitoring and Maintaining the Filter Cache 66

Configuration Examples for RADIUS Centralized Filter Management 66

NAS Configuration Example 66

RADIUS Server Configuration Example 66

RADIUS Dictionary and Vendors File Example 67

Debug Output Example 67

Additional References	67
Feature Information for RADIUS Centralized Filter Management	69

CHAPTER 5**RADIUS Debug Enhancements 71**

Finding Feature Information	71
Prerequisites for RADIUS Debug Enhancements	71
Restrictions for RADIUS Debug Enhancements	72
Information About RADIUS Debug Enhancements	72
RADIUS Overview	72
Benefits of RADIUS Debug Enhancements	72
How to Enable RADIUS Debug Parameters	72
Enabling RADIUS Debug Parameters	72
Verifying RADIUS Debug Parameters	73
Configuration Examples for RADIUS Debug Enhancements	74
Enabling RADIUS Debug Parameters Example	74
Verifying RADIUS Debug Parameters Example	74
Additional References	76
Feature Information for RADIUS Debug Enhancements	77
Glossary	77

CHAPTER 6**RADIUS Logical Line ID 79**

Finding Feature Information	79
Prerequisites for RADIUS Logical Line ID	80
Restrictions for RADIUS Logical Line ID	80
Information About RADIUS Logical Line ID	80
How to Configure RADIUS Logical Line ID	81
Configuring Preauthorization	81
Configuring the LLID in a RADIUS User Profile	82
Verifying Logical Line ID	82
Configuration Examples for RADIUS Logical Line ID	83
LAC for Preauthorization Configuration Example	83
RADIUS User Profile for LLID Example	84
Additional References	84
Feature Information for RADIUS Logical Line ID	86
Glossary	87

CHAPTER 7**RADIUS Route Download 89**

- Finding Feature Information 89
- Prerequisites for RADIUS Route Download 90
- How to Configure RADIUS Route Download 90
 - Configuring RADIUS Route Download 90
 - Verifying RADIUS Route Download 90
- Configuration Examples for RADIUS Route Download 91
 - RADIUS Route Download Configuration Example 91
- Additional References 91
- Feature Information for RADIUS Route Download 92

CHAPTER 8**RADIUS Server Load Balancing 95**

- Finding Feature Information 95
- Prerequisites for RADIUS Server Load Balancing 95
- Restrictions for RADIUS Server Load Balancing 96
- Information About RADIUS Server Load Balancing 96
 - RADIUS Server Load Balancing Overview 96
 - Transaction Load Balancing Across RADIUS Server Groups 96
 - RADIUS Server Status and Automated Testing 97
- How to Configure RADIUS Server Load Balancing 98
 - Enabling Load Balancing for a Named RADIUS Server Group 98
 - Enabling Load Balancing for a Global RADIUS Server Group 99
 - Troubleshooting RADIUS Server Load Balancing 100
- Configuration Examples for RADIUS Server Load Balancing 102
 - Example: Enabling Load Balancing for a Global RADIUS Server Group 102
 - Example: Server Configuration and Enabling Load Balancing for Global RADIUS Server Group 104
 - Example: Debug Output for Global RADIUS Server Group 105
 - Example: Server Status Information for Global RADIUS Server Group 105
 - Example: Enabling Load Balancing for a Named RADIUS Server Group 106
 - Example: Server Configuration and Enabling Load Balancing for Named RADIUS Server Group 108
 - Example: Debug Output for Named RADIUS Server Group 109
 - Example: Server Status Information for Named RADIUS Server Group 109

Example: Monitoring Idle Timer	110
Example: Server Configuration and Enabling Load Balancing for Idle Timer Monitoring	111
Example: Debug Output for Idle Timer Monitoring	111
Example: Configuring the Preferred Server with the Same Authentication and Authorization Server	112
Example: Configuring the Preferred Server with Different Authentication and Authorization Servers	112
Example: Configuring the Preferred Server with Overlapping Authentication and Authorization Servers	112
Example: Configuring the Preferred Server with Authentication Servers As a Subset of Authorization Servers	113
Example: Configuring the Preferred Server with Authentication Servers As a Superset of Authorization Servers	113
Additional References for RADIUS Server Load Balancing	113
Feature Information for RADIUS Server Load Balancing	114

CHAPTER 9**RADIUS Support of 56-Bit Acct Session-Id 117**

Finding Feature Information	117
Prerequisites for RADIUS Support of 56-Bit Acct Session-Id	118
Information About RADIUS Support of 56-Bit Acct Session-Id	118
Acct-Session-Id Attribute	118
Acct-Session-Id-Count Attribute	118
How to Configure RADIUS Support of 56-Bit Acct Session-Id	118
Configuring RADIUS Support of 56-Bit Acct Session-Id	118
Configuration Examples for RADIUS Support of 56-Bit Acct Session-Id	119
Configuring RADIUS Support of 56-Bit Acct Session-Id Example	119
Additional References	119
Feature Information for RADIUS Support of 56-Bit Acct Session-Id	121

CHAPTER 10**RADIUS Tunnel Preference for Load Balancing and Fail-Over 123**

Finding Feature Information	123
Prerequisites	124
Restrictions	124
Information About RADIUS Tunnel Preference for Load Balancing and Fail-Over	124

Industry-Standard Rather Than Proprietary Attributes	124
Load Balancing and Fail-Over in a Multivendor Network	125
Related Features and Technologies	125
How RADIUS Tunnel Preference for Load Balancing and Fail-Over is Configured	126
Configuration Example for RADIUS Tunnel Preference for Load Balancing and Fail-Over	126
Additional References	126
Feature Information for RADIUS Tunnel Preference for Load Balancing and Fail-Over	128
Glossary	128

CHAPTER 11

RADIUS Server Reorder on Failure	131
Finding Feature Information	131
Prerequisites for RADIUS Server Reorder on Failure	132
Restrictions for RADIUS Server Reorder on Failure	132
Information About RADIUS Server Reorder on Failure	132
RADIUS Server Failure	132
How the RADIUS Server Reorder on Failure Feature Works	132
When RADIUS Servers Are Dead	133
How to Configure RADIUS Server Reorder on Failure	133
Configuring a RADIUS Server to Reorder on Failure	133
Monitoring RADIUS Server Reorder on Failure	135
Configuration Examples for RADIUS Server Reorder on Failure	137
Configuring a RADIUS Server to Reorder on Failure Example	137
Determining Transmission Order When RADIUS Servers Are Dead	138
Additional References	139
Related Documents	139
Standards	139
MIBs	140
RFCs	140
Technical Assistance	140
Feature Information for RADIUS Server Reorder on Failure	140



CHAPTER

1

Configuring RADIUS

The RADIUS security system is a distributed client/server system that secures networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco devices and send authentication requests to a central RADIUS server that contains all user authentication and network service access information.

- [Finding Feature Information, page 1](#)
- [Information About RADIUS, page 1](#)
- [How to Configure RADIUS, page 10](#)
- [Configuration Examples for RADIUS, page 29](#)
- [Additional References, page 35](#)
- [Feature Information for Configuring RADIUS, page 37](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About RADIUS

RADIUS Operation

When a user attempts to log in and authenticate to an access server using RADIUS, the following steps occur:

- 1 The user is prompted to enter the username and password.
- 2 The username and encrypted password are sent over the network to the RADIUS server.

- 3 The user receives one of the following responses from the RADIUS server:
 - 1 ACCEPT—The user is authenticated.
 - 2 CHALLENGE—A challenge is issued by the RADIUS server. The challenge collects additional data from the user.
 - 3 CHANGE PASSWORD—A request is issued by the RADIUS server, asking the user to select a new password.
 - 4 REJECT—The user is not authenticated and is prompted to reenter the username and password, or access is denied.

The ACCEPT or REJECT response is bundled with additional data that is used for EXEC or network authorization. You must first complete RADIUS authentication before using RADIUS authorization. The additional data included with the ACCEPT or REJECT packets consists of the following:

- Services that the user can access, including connections such as Telnet, rlogin, or local-area transport (LAT), and services such as PPP, Serial Line Protocol (SLIP), or EXEC services.
- Connection parameters, including the host or client IP address, access list, and user timeouts.

RADIUS Attributes

The network access server monitors the RADIUS authorization and accounting functions defined by RADIUS attributes in each user profile:

Vendor-Proprietary RADIUS Attributes

An Internet Engineering Task Force (IETF) standard for RADIUS specifies a method for communicating vendor-proprietary information between the network access server and the RADIUS server. Some vendors, nevertheless, have extended the RADIUS attribute set in a unique way. Cisco software supports a subset of vendor-proprietary RADIUS attributes.

RADIUS Tunnel Attributes

RADIUS is a security server AAA protocol originally developed by Livingston, Inc. RADIUS uses attribute value (AV) pairs to communicate information between the security server and the network access server.

RFC 2138 and RFC 2139 describe the basic functionality of RADIUS and the original set of IETF-standard AV pairs used to send AAA information. Two IETF standards, “RADIUS Attributes for Tunnel Protocol Support” and “RADIUS Accounting Modifications for Tunnel Protocol Support,” extend the IETF-defined set of AV pairs to include attributes specific to VPNs. These attributes are used to carry the tunneling information between the RADIUS server and the tunnel initiator.

RFC 2865 and RFC 2868 extend the IETF-defined set of AV pairs to include attributes specific to compulsory tunneling in VPNs by allowing the user to specify authentication names for the network access server and the RADIUS server.

Cisco devices and access servers support new RADIUS IETF-standard virtual private dialup network (VPDN) tunnel attributes.

Preauthentication on a RADIUS Server

RADIUS attributes are configured in the RADIUS preauthentication profiles to specify preauthentication behavior. In addition to configuring preauthentication on your Cisco device, you must set up the preauthentication profiles on the RADIUS server.

RADIUS Profile for DNIS or CLID Preauthentication

To configure the RADIUS preauthentication profile, use the Dialed Number Identification Service (DNIS) or Calling Line Identification (CLID) number as the username, and use the password defined in the **dnis** or **clid** command as the password.



Note

The preauthentication profile must have “outbound” as the service type because the password is predefined on the network access server (NAS). Setting up the preauthentication profile in this manner prevents users from trying to log in to the NAS with the username of the DNIS number, CLID number, or call type and an obvious password. The “outbound” service type is also included in the Access-Request packet sent to the RADIUS server.

RADIUS Profile for Call Type Preauthentication

To set up the RADIUS preauthentication profile, use the call type string as the username, and use the password defined in the **ctype** command as the password. The table below lists the call type strings that can be used in the preauthentication profile.

Table 1: Call Type Strings Used in Preauthentication

Call Type String	ISDN Bearer Capabilities
digital	Unrestricted digital, restricted digital.
speech	Speech, 3.1 kHz audio, 7 kHz audio. Note This is the only call type available for channel-associated signaling (CAS) .
v.110	Anything with the V.110 user information layer.
v.120	Anything with the V.120 user information layer.

**Note**

The preauthentication profile must have “outbound” as the service type because the password is predefined on the NAS. Setting up the preauthentication profile in this manner prevents users from trying to log in to the NAS with the username of the DNIS number, CLID number, or call type and an obvious password. The “outbound” service type is also included in the Access-Request packet sent to the RADIUS server and should be a checkin item if the RADIUS server supports checkin items.

RADIUS Profile for Preauthentication Enhancements for Callback

Callback allows remote network users such as telecommuters to dial in to the NAS without being charged. When callback is required, the NAS hangs up the current call and dials the caller back. When the NAS performs the callback, only information for the outgoing connection is applied. The rest of the attributes from the preauthentication access-accept message are discarded.

**Note**

The destination IP address is not required to be returned from the RADIUS server.

The following example shows a RADIUS profile configuration with a callback number of 555-0101 and the service type set to outbound. The `cisco-avpair = “preauth:send-name=<string>”` uses the string “user1” and the `cisco-avpair = “preauth:send-secret=<string>”` uses the password “cisco.”

```
5550101 password = "cisco", Service-Type = Outbound
Service-Type = Callback-Framed
Framed-Protocol = PPP,
Dialback-No = "5550119"
Class = "ISP12"
cisco-avpair = "preauth:send-name=user1"
cisco-avpair = "preauth:send-secret=cisco"
```

RADIUS Profile for a Remote Hostname Used for Large-Scale Dial-Out

The following example protects against accidentally calling a valid telephone number but accessing the wrong device by providing the name of the remote device, for use in large-scale dial-out:

```
5550101 password = "PASSWORD1", Service-Type = Outbound
Service-Type = Callback-Framed
Framed-Protocol = PPP,
Dialback-No = "5550190"
Class = "ISP12"
cisco-avpair = "preauth:send-name=user1"
cisco-avpair = "preauth:send-secret=PASSWORD1"
cisco-avpair = "preauth:remote-name=Device2"
```

RADIUS Profile for Modem Management

When DNIS, CLID, or call type preauthentication is used, the affirmative response from the RADIUS server might include a modem string for modem management in the NAS through vendor-specific attribute (VSA) 26. The modem management VSA has this syntax:

```
cisco-avpair = "preauth:modem-service=modem min-speed <
x
```

```

> max-speed <
y
>
modulation <
z
> error-correction <
a
> compression <
b
>"

```

The table below lists the modem management string elements within the VSA.

Table 2: Modem Management String

Command	Argument
min-speed	300 to 56000, any
max-speed	300 to 56000, any
modulation	K56Flex, v22bis, v32bis, v34, v90, any
error-correction	lapm, mnp4
compression	mnp5, v42bis

When the modem management string is received from the RADIUS server in the form of a VSA, the information is passed to the Cisco software and applied on a per-call basis. Modem ISDN channel aggregation (MICA) modems provide a control channel through which messages can be sent during the call setup time. Hence, this modem management feature is supported only with MICA modems. This feature is not supported with Microcom modems.

RADIUS Profile for Subsequent Authentication

If preauthentication passes, you can use vendor-proprietary RADIUS attribute 201 (Require-Auth) in the preauthentication profile to determine whether subsequent authentication is performed. If attribute 201, returned in the access-accept message, has a value of 0, subsequent authentication is not performed. If attribute 201 has a value of 1, subsequent authentication is performed as usual.

Attribute 201 has this syntax:

```

cisco-avpair = "preauth:auth-required=<
n
>"

```

where <n> has the same value range as attribute 201 (that is, 0 or 1).

If attribute 201 is missing in the preauthentication profile, a value of 1 is assumed, and subsequent authentication is performed.



Note

Before you can perform subsequent authentication, you must set up a regular user profile in addition to a preauthentication profile.

RADIUS Profile for Subsequent Authentication Types

If you specified subsequent authentication in the preauthentication profile, you must also specify the authentication types to be used for subsequent authentication. To specify the authentication types allowed in subsequent authentication, use this VSA:

```
cisco-avpair = "preauth:auth-type=<
string
>"
```

The table below lists the allowed values for the `<string>` element.

Table 3: <string> Element Values

String	Description
chap	Requires the username and password for the Challenge-Handshake Authentication Protocol (CHAP) for PPP authentication.
ms-chap	Requires the username and password for the MS-CHAP for PPP authentication.
pap	Requires the username and password for the Password Authentication Protocol (PAP) for PPP authentication.

To specify that multiple authentication types are allowed, you can configure more than one instance of this VSA in the preauthentication profile. The sequence of the authentication type VSAs in the preauthentication profile is significant because it specifies the order of authentication types to be used in the PPP negotiation.

This VSA is a per-user attribute and replaces the authentication type list in the **ppp authentication** interface configuration command.



Note

You should use this VSA only if subsequent authentication is required because it specifies the authentication type for subsequent authentication.

RADIUS Profile to Include the Username

If only preauthentication is used to authenticate a call, the NAS could be missing a username when it brings up the call. RADIUS can provide a username for the NAS to use through RADIUS attribute 1 (User-Name) or through a VSA returned in the Access-Accept packet. The VSA for specifying the username has this syntax:

```
cisco-avpair = "preauth:username=<
string
>"
```

If no username is specified, the DNIS number, CLID number, or call type is used, depending on the last preauthentication command configured (for example, if **clid** was the last preauthentication command configured, the CLID number is used as the username).

If subsequent authentication is used to authenticate a call, there might be two usernames: one provided by RADIUS and one provided by the user. In this case, the username provided by the user overrides the one contained in the RADIUS preauthentication profile. The username provided by the user is used for both authentication and accounting.

RADIUS Profile for Two-Way Authentication

In the case of two-way authentication, the calling networking device must authenticate the NAS. The PAP username and password or CHAP username and password need not be configured locally on the NAS. Instead, the username and password can be included in the Access-Accept messages for preauthentication.



Note

Do not configure the **ppp authentication** command with the **radius** command.

To set up PAP, do not configure the **ppp pap sent-name password** command on the interface. The VSAs “preauth:send-name” and “preauth:send-secret” are used as the PAP username and PAP password for outbound authentication.

For CHAP, “preauth:send-name” is used not only for outbound authentication but also for inbound authentication. For a CHAP inbound case, the NAS uses the name defined in “preauth:send-name” in the challenge packet to the caller networking device. For a CHAP outbound case, both “preauth:send-name” and “preauth:send-secret” are used in the response packet.

The following example shows a configuration that specifies two-way authentication:

```
5550101 password = "PASSWORD2", Service-Type = Outbound
Service-Type = Framed-User
cisco-avpair = "preauth:auth-required=1"
cisco-avpair = "preauth:auth-type=pap"
cisco-avpair = "preauth:send-name=user1"
cisco-avpair = "preauth:send-secret=PASSWORD2"
class = "<some class>"
```



Note

Two-way authentication does not work when resource pooling is enabled.

RADIUS Profile to Support Authorization

If only preauthentication is configured, subsequent authentication is bypassed. Note that because the username and password are not available, authorization is also bypassed. However, you can include authorization attributes in the preauthentication profile to apply per-user attributes and avoid having to return subsequently to RADIUS for authorization. To initiate the authorization process, you must also configure the **aaa authorization network** command on the NAS.

You can configure authorization attributes in the preauthentication profile with one exception: the service-type attribute (attribute 6). The service-type attribute must be converted to a VSA in the preauthentication profile. This VSA has this syntax:

```
cisco-avpair = "preauth:service-type=<
n
>"
```

where <n> is one of the standard RFC 2865 values for attribute 6.

**Note**

If subsequent authentication is required, the authorization attributes in the preauthentication profile are not applied.

RADIUS Authentication

After you have identified the RADIUS server and defined the RADIUS authentication key, you must define method lists for RADIUS authentication. Because RADIUS authentication is facilitated through AAA, you must enter the **aaa authentication** command, specifying RADIUS as the authentication method.

RADIUS Authorization

AAA authorization lets you set parameters that restrict a user's access to the network. Authorization using RADIUS provides one method for remote access control, including one-time authorization or authorization for each service, per-user account list and profile, user group support, and support of IP, IPX, AppleTalk Remote Access (ARA), and Telnet. Because RADIUS authorization is facilitated through AAA, you must enter the **aaa authorization** command, specifying RADIUS as the authorization method.

RADIUS Accounting

The AAA accounting feature enables you to track the services users are accessing and the amount of network resources they are consuming. Because RADIUS accounting is facilitated through AAA, you must enter the **aaa accounting** command, specifying RADIUS as the accounting method.

RADIUS Login-IP-Host

To enable the network access server (NAS) to attempt more than one login host when trying to connect a dial-in user, you can enter as many as three Login-IP-Host entries in the user's profile on the RADIUS server. The following example shows that three Login-IP-Host instances are configured for the user *user1*, and that TCP-Clear is used for the connection:

```
user1 Password = xyz
      Service-Type = Login,
      Login-Service = TCP-Clear,
      Login-IP-Host = 10.0.0.0,
      Login-IP-Host = 10.2.2.2,
      Login-IP-Host = 10.255.255.255,
      Login-TCP-Port = 23
```

The order in which the hosts are entered is the order in which they are attempted. Use the **ip tcp synwait-time** command to set the number of seconds that the NAS waits before trying to connect to the next host on the list; the default is 30 seconds.

Your RADIUS server might permit more than three Login-IP-Host entries; however, the NAS supports only three hosts in Access-Accept packets.

RADIUS Prompt

To control whether user responses to Access-Challenge packets are echoed to the screen, you can configure the Prompt attribute in the user profile on the RADIUS server. This attribute is included only in Access-Challenge packets. The following example shows the Prompt attribute set to No-Echo, which prevents the user's responses from echoing:

```
user1 Password = xyz
Service-Type = Login,
Login-Service = Telnet,
Prompt = No-Echo,
Login-IP-Host = 172.31.255.255
```

To allow user responses to echo, set the attribute to Echo. If the Prompt attribute is not included in the user profile, responses are echoed by default.

This attribute overrides the behavior of the **radius-server challenge-noecho** command configured on the access server. For example, if the access server is configured to suppress echoing, but the individual user profile allows echoing, the user responses are echoed.



Note

If you want to use the Prompt attribute, your RADIUS server must be configured to support Access-Challenge packets.

Vendor-Specific RADIUS Attributes

The IETF standard specifies a method for communicating vendor-specific information between the network access server and the RADIUS server by using the vendor-specific attribute (attribute 26). Vendor-specific attributes (VSAs) allow vendors to support their own extended attributes not suitable for general use. The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. Cisco's vendor ID is 9, and the supported option has vendor type 1, which is named "cisco-avpair." The value is a string with this format:

```
protocol : attribute sep value *
```

"Protocol" is a value of the Cisco "protocol" attribute for a particular type of authorization; protocols that can be used include IP, Internetwork Packet Exchange (IPX), VPDN, VoIP, Secure Shell (SSH), Resource Reservation Protocol (RSVP), Serial Interface Processor (SIP), AirNet, and Outbound. "Attribute" and "value" are an appropriate AV pair defined in the Cisco TACACS+ specification, and "sep" is "=" for mandatory attributes and "*" for optional attributes, allowing the full set of features available for TACACS+ authorization to also be used for RADIUS.

For example, the following AV pair causes Cisco's "multiple named ip address pools" feature to be activated during IP authorization (during PPP's Internet Protocol Control Protocol (IPCP) address assignment):

```
cisco-avpair= "ip:addr-pool=first"
```

If you insert an "*", the AV pair "ip:addr-pool=first" becomes optional. Note that any AV pair can be made optional:

```
cisco-avpair= "ip:addr-pool*first"
```

The following example shows how to cause a user logging in from a network access server to have immediate access to EXEC commands:

```
cisco-avpair= "shell:priv-lvl=15"
```

Other vendors have their own unique vendor IDs, options, and associated VSAs.

Static Routes and IP Addresses on the RADIUS Server

Some vendor-proprietary implementations of RADIUS let the user define static routes and IP pool definitions on the RADIUS server instead of on each individual network access server in the network. Each network access server then queries the RADIUS server for static route and IP pool information.

To have the Cisco device or access server query the RADIUS server for static routes and IP pool definitions when the device starts up, use the **radius-server configure-nas** command.

Because the **radius-server configure-nas** command is performed when the Cisco device starts up, it does not take effect until you enter a **copy system:running-config nvram:startup-config** command.

How to Configure RADIUS

Configuring Device-to-RADIUS Server Communication

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server host** *{hostname | ip-address}* [**auth-port** *port-number*] [**acct-port** *port-number*] [**timeout** *seconds*] [**retransmit** *retries*] [**key string**] [**alias** *{hostname | ip-address}*]
4. **radius-server key** *{0 string | 7 string | string}*
5. **radius-server retransmit** *retries*
6. **radius-server timeout** *seconds*
7. **radius-server deadtime** *minutes*
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Device# configure terminal</pre>	Enters global configuration mode.
Step 3	<p>radius-server host <i>{hostname ip-address}</i> [auth-port <i>port-number</i>] [acct-port <i>port-number</i>] [timeout <i>seconds</i>] [retransmit <i>retries</i>] [key <i>string</i>] [alias <i>{hostname ip-address}</i>]</p> <p>Example:</p> <pre>Device(config)# radius-server host 10.45.1.2</pre>	<p>Specifies the IP address or hostname of the remote RADIUS server host and assigns authentication and accounting destination port numbers.</p> <p>Note In this step, the timeout, retransmission, and encryption key values are configured on a per-server basis.</p> <ul style="list-style-type: none"> • auth-port <i>port-number</i>—configures a specific UDP port on this RADIUS server to be used solely for authentication. • acct-port <i>port-number</i>—configures a specific UDP port on this RADIUS server to be used solely for accounting. • alias—configures up to eight multiple IP addresses for use when referring to RADIUS servers. • To configure the network access server to recognize more than one host entry associated with a single IP address, repeat this command as many times as necessary, making sure that each UDP port number is different. Set the timeout, retransmit, and encryption key values to use with the specific RADIUS host. • If no timeout is set, the global value is used; otherwise, enter a value from 1 to 1000. If no retransmit value is set, the global value is used; otherwise, enter a value from 1 to 1000. If no key string is specified, the global value is used. <p>Note The key is a text string that must match the encryption key used on the RADIUS server. Always configure the key as the last item in the radius-server host command syntax because the leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in your key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.</p>
Step 4	<p>radius-server key <i>{0 string 7 string string}</i></p> <p>Example:</p> <pre>Device(config)# radius-server key myRaDIUSpassword</pre>	<p>Specifies the shared secret text string used between the device and a RADIUS server.</p> <p>Note In this step, the encryption key value is configured globally for all RADIUS servers.</p> <ul style="list-style-type: none"> • Use the 0 string option to configure an unencrypted shared secret. Use the 7 string option to configure an encrypted shared secret.

	Command or Action	Purpose
Step 5	radius-server retransmit <i>retries</i> Example: Device(config)# radius-server retransmit 25	Specifies how many times the device transmits each RADIUS request to the server before giving up (the default is 3). Note In this step, the retransmission value is configured globally for all RADIUS servers.
Step 6	radius-server timeout <i>seconds</i> Example: Device(config)# radius-server timeout 6	Specifies for how many seconds a device waits for a reply to a RADIUS request before retransmitting the request. Note In this step, the timeout value is configured globally for all RADIUS servers.
Step 7	radius-server deadtime <i>minutes</i> Example: Device(config)# radius-server deadtime 5	Specifies for how many minutes a RADIUS server that is not responding to authentication requests is passed over by requests for RADIUS authentication.
Step 8	exit Example: Device(config)# exit	Returns to privileged EXEC mode.

Configuring a Device for Vendor-Proprietary RADIUS Server Communication

Although an IETF standard for RADIUS specifies a method for communicating vendor-proprietary information between the network access server and the RADIUS server, some vendors have extended the RADIUS attribute set in a unique way. Cisco software supports a subset of vendor-proprietary RADIUS attributes.

To configure RADIUS (whether vendor-proprietary or IETF compliant), you must use the **radius-server** commands to specify the host running the RADIUS server daemon and the secret text string it shares with the Cisco device. To identify that the RADIUS server is using a vendor-proprietary implementation of RADIUS, use the **radius-server host non-standard** command. Vendor-proprietary attributes are not supported unless you use the **radius-server host non-standard** command.



Note To configure an IPv4 or IPv6 RADIUS server, use the commands as mentioned below:

- If you have configured an IPv4 RADIUS server, you can use either the **radius-server host** command or the **radius server name** command.
- If you have configured an IPv6 RADIUS server, use the **radius server name** command.

For more information about the **radius server** command, see *Cisco IOS Security Command Reference: Commands M to R*.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server vsa send [accounting | authentication]**
4. **radius-server host {hostname | ip-address} non-standard**
5. **radius-server key {0 string | 7 string | string}**
6. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	radius-server vsa send [accounting authentication] Example: Device(config)# radius-server vsa send	Enables the network access server to recognize and use VSAs as defined by RADIUS IETF attribute 26.
Step 4	radius-server host {hostname ip-address} non-standard Example: Device(config)# radius-server host host1 non-standard	Specifies the IP address or hostname of the remote RADIUS server host and identifies that it is using a vendor-proprietary implementation of RADIUS.

	Command or Action	Purpose
		<p>Note To configure an IPv4 or IPv6 RADIUS server, use the commands as mentioned below:</p> <ul style="list-style-type: none"> • If you have configured an IPv4 RADIUS server, you can use either the radius-server host command or the radius server name command. • If you have configured an IPv6 RADIUS server, use the radius server name command. <p>For more information about the radius server command, see <i>Cisco IOS Security Command Reference: Commands M to R</i>.</p>
Step 5	<p>radius-server key {0 string 7 string string}</p> <p>Example:</p> <pre>Device(config)# radius-server key myRaDIUSpassword</pre>	<p>Specifies the shared secret text string used between the device and the vendor-proprietary RADIUS server.</p> <ul style="list-style-type: none"> • The device and the RADIUS server use this text string to encrypt passwords and exchange responses.
Step 6	<p>exit</p> <p>Example:</p> <pre>Device(config)# exit</pre>	<p>Returns to privileged EXEC mode.</p>

Configuring a Device to Expand Network Access Server Port Information

Sometimes PPP or login authentication occurs on an interface that is different from the interface on which the call itself comes in. For example, in a V.120 ISDN call, login or PPP authentication occurs on a virtual asynchronous interface “ttr”, but the call itself occurs on one of the channels of the ISDN interface.

The **radius-server attribute nas-port extended** command configures RADIUS to expand the size of the NAS-Port attribute (RADIUS IETF attribute 5) field to 32 bits. The upper 16 bits of the NAS-Port attribute display the type and number of the controlling interface; the lower 16 bits indicate the interface undergoing authentication.



Note The **radius-server attribute nas-port format** command replaces the **radius-server extended-portnames** command and the **radius-server attribute nas-port extended** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server configure-nas**
4. **radius-server attribute nas-port format**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	radius-server configure-nas Example: Device(config)# radius-server configure-nas	(Optional) Tells the Cisco device or access server to query the RADIUS server for the static routes and IP pool definitions used throughout its domain. Note Because the radius-server configure-nas command is used when the Cisco device starts up, it does not take effect until you issue a copy system:running-config nvram:startup-config command.
Step 4	radius-server attribute nas-port format Example: Device(config)# radius-server attribute nas-port format	Expands the size of the NAS-Port attribute from 16 to 32 bits to display extended interface information.
Step 5	exit Example: Device(config)# exit	Returns to privileged EXEC mode.

Replacing the NAS-Port Attribute with the RADIUS Attribute

On platforms with multiple interfaces (ports) per slot, the Cisco RADIUS implementation does not provide a unique NAS-Port attribute that permits distinguishing between the interfaces. For example, if a dual PRI is in slot 1, calls on both Serial1/0:1 and Serial1/1:1 appear as NAS-Port = 20101 because of the 16-bit field size limitation associated with the RADIUS IETF NAS-Port attribute. In this case, you can replace the NAS-Port attribute with a VSA (RADIUS IETF attribute 26). Cisco's vendor ID is 9, and the Cisco-NAS-Port attribute is subtype 2. VSAs can be turned on by entering the **radius-server vsa send** command. The port information in this attribute is provided and configured using the **aaa nas port extended** command.

The standard NAS-Port attribute (RADIUS IETF attribute 5) is sent. If you do not want this information to be sent, you can suppress it by using the **no radius-server attribute nas-port** command. After this command is configured, the standard NAS-Port attribute is no longer sent.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server vsa send** [accounting | authentication]
4. **aaa nas port extended**
5. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	radius-server vsa send [accounting authentication] Example: Device(config)# radius-server vsa send	Enables the network access server to recognize and use vendor-specific attributes as defined by RADIUS IETF attribute 26.
Step 4	aaa nas port extended Example: Device(config)# aaa nas port extended	Expands the size of the VSA NAS-Port field from 16 to 32 bits to display extended interface information.

	Command or Action	Purpose
Step 5	exit Example: Device(config)# exit	Returns to privileged EXEC mode.

Configuring AAA Server Groups

To define a server host with a server group name, enter the following commands in global configuration mode. The listed server must exist in global configuration mode.

Before You Begin

Each server in the group must be defined previously using the **radius-server host** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server host** *{hostname | ip-address}* [**auth-port** *port-number*] [**acct-port** *port-number*] [**timeout** *seconds*] [**retransmit** *retries*] [**key string**] [**alias** *{hostname | ip-address}*]
4. **aaa group server** *{radius | tacacs+}* *group-name*
5. **server** *ip-address* [**auth-port** *port-number*] [**acct-port** *port-number*]
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>radius-server host {<i>hostname</i> <i>ip-address</i>} [auth-port <i>port-number</i>] [acct-port <i>port-number</i>] [timeout <i>seconds</i>] [retransmit <i>retries</i>] [key string] [alias {<i>hostname</i> <i>ip-address</i>}]</p> <p>Example:</p> <pre>Device(config)# radius-server host 10.45.1.2</pre>	Specifies and defines the IP address of the server host before configuring the AAA server group.
Step 4	<p>aaa group server {radius tacacs+} <i>group-name</i></p> <p>Example:</p> <pre>Device(config)# aaa group server radius group1</pre>	<p>Defines the AAA server group with a group name.</p> <ul style="list-style-type: none"> • All members of a group must be the same type, that is, RADIUS or TACACS+. This command puts the device in server group RADIUS configuration mode.
Step 5	<p>server <i>ip-address</i> [auth-port <i>port-number</i>] [acct-port <i>port-number</i>]</p> <p>Example:</p> <pre>Device(config-sg-radius)# server 172.16.1.1 acct-port 1616</pre>	<p>Associates a particular RADIUS server with the defined server group.</p> <ul style="list-style-type: none"> • Each security server is identified by its IP address and UDP port number. • Repeat this step for each RADIUS server in the AAA server group.
Step 6	<p>end</p> <p>Example:</p> <pre>Device(config-sg-radius)# end</pre>	Exits server group RADIUS configuration mode and returns to privileged EXEC mode.

Configuring AAA Server Groups with a Deadtimer

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa group server radius** *group*
4. **deadtime** *minutes*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	aaa group server radius group Example: Device(config)# aaa group server radius group1	Defines a RADIUS type server group and enters server group RADIUS configuration mode.
Step 4	deadtime minutes Example: Device(config-sg-radius)# deadtime 1	Configures and defines a deadtime value in minutes. Note Local server group deadtime overrides the global configuration. If the deadtime value is omitted from the local server group configuration, it is inherited from the master list.
Step 5	end Example: Device(config-sg-radius)# end	Exits server group RADIUS configuration mode and returns to privileged EXEC mode.

Configuring AAA DNIS Preauthentication

DNIS preauthentication enables preauthentication at call setup based on the number dialed. The DNIS number is sent directly to the security server when a call is received. If the call authenticated by AAA, it is accepted.

SUMMARY STEPS

1. enable
2. configure terminal
3. aaa preauthorization
4. group {radius | tacacs+ | server-group}
5. dnis [password string]
6. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	aaa preauthorization Example: Device(config)# aaa preauthorization	Enters AAA preauthentication configuration mode.
Step 4	group {radius tacacs+ server-group} Example: Device(config-preauth)# group radius	(Optional) Selects the security server to use for AAA preauthentication requests. <ul style="list-style-type: none"> • The default is RADIUS.
Step 5	dnis [password string] Example: Device(config-preauth)# dnis password dnisspass	Enables preauthentication using DNIS and optionally specifies a password to use in Access-Request packets.
Step 6	end Example: Device(config-preauth)# end	Exits AAA preauthentication configuration mode and returns to privileged EXEC mode.

Configuring AAA Server Group Selection Based on DNIS

To configure the device to select a particular AAA server group based on the DNIS of the server group, configure DNIS mapping. To map a server group with a group name with a DNIS number, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa dnis map enable**
4. **aaa dnis map** *dnis-number* **authentication ppp group** *server-group-name*
5. **aaa dnis map** *dnis-number* **authorization network group** *server-group-name*
6. **aaa dnis map** *dnis-number* **accounting network** [**none** | **start-stop** | **stop-only**] **group** *server-group-name*
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	aaa dnis map enable Example: Device(config)# aaa dnis map enable	Enables DNIS mapping.
Step 4	aaa dnis map <i>dnis-number</i> authentication ppp group <i>server-group-name</i> Example: Device(config)# aaa dnis map 7777 authentication ppp group sg1	Maps a DNIS number to a defined AAA server group; the servers in this server group are being used for authentication.
Step 5	aaa dnis map <i>dnis-number</i> authorization network group <i>server-group-name</i> Example: Device(config)# aaa dnis map 7777 authorization network group sg1	Maps a DNIS number to a defined AAA server group; the servers in this server group are being used for authorization.

	Command or Action	Purpose
Step 6	aaa dnis map <i>dnis-number</i> accounting network [none start-stop stop-only] group <i>server-group-name</i> Example: Device(config)# aaa dnis map 8888 accounting network stop-only group sg2	Maps a DNIS number to a defined AAA server group; the servers in this server group are being used for accounting.
Step 7	exit Example: Device(config)# exit	Exits global configuration mode and returns to privileged EXEC mode.

Configuring AAA Preauthentication

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa preauthorization**
4. **group** *server-group*
5. **clid** [**if-avail** | **required**] [**accept-stop**] [**password** *string*]
6. **ctype** [**if-avail** | **required**] [**accept-stop**] [**password** *string*]
7. **dnis** [**if-avail** | **required**] [**accept-stop**] [**password** *string*]
8. **dnis bypass** *dnis-group-name*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	aaa preauthorization Example: Device(config)# aaa preauthorization	Enters AAA preauthentication configuration mode.
Step 4	group <i>server-group</i> Example: Device(config-preauth)# group sg2	Specifies the AAA RADIUS server group to use for preauthentication.
Step 5	clid [if-avail required] [accept-stop] [password <i>string</i>] Example: Device(config-preauth)# clid required	Preauthenticates calls on the basis of the CLID number.
Step 6	ctype [if-avail required] [accept-stop] [password <i>string</i>] Example: Device(config-preauth)# ctype required	Preauthenticates calls on the basis of the call type.
Step 7	dnis [if-avail required] [accept-stop] [password <i>string</i>] Example: Device(config-preauth)# dnis required	Preauthenticates calls on the basis of the DNIS number.
Step 8	dnis bypass <i>dnis-group-name</i> Example: Device(config-preauth)# dnis bypass group1	Specifies a group of DNIS numbers that will be bypassed for preauthentication.
Step 9	end Example: Device(config-preauth)# end	Exits preauthentication configuration mode and returns to privileged EXEC mode.

Configuring DNIS Preauthentication

To configure DNIS preauthentication, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa preauthorization**
4. **group {radius | tacacs+ | server-group}**
5. **dnis [password string]**
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	aaa preauthorization Example: Router(config)# aaa preauthorization	Enters AAA preauthentication mode.
Step 4	group {radius tacacs+ server-group} Example: Router (config-preauth)# group radius	(Optional) Selects the security server to use for AAA preauthentication requests. <ul style="list-style-type: none"> • The default is RADIUS.
Step 5	dnis [password string] Example: Router(config-preauth)# dnis password dnisspass	Enables preauthentication using DNIS and optionally specifies a password to use in Access-Request packets.
Step 6	end Example: Router(config-preauth)# end	Exits AAA preauthentication configuration mode and returns to privileged EXEC mode.

Configuring a Guard Timer

To set a guard timer to accept or reject a call in the event that the RADIUS server fails to respond to an authentication or preauthentication request, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **isdn guard-timer** *milliseconds* [**on-expiry** {**accept** | **reject**}]
5. **call guard-timer** *milliseconds* [**on-expiry** {**accept** | **reject**}]
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Device(config)# interface serial 1/0/0:23	Enters interface configuration mode.
Step 4	isdn guard-timer <i>milliseconds</i> [on-expiry { accept reject }] Example: Device(config-if)# isdn guard-timer 8000 on-expiry reject	Sets an ISDN guard timer to accept or reject a call in the event that the RADIUS server fails to respond to a preauthentication request.
Step 5	call guard-timer <i>milliseconds</i> [on-expiry { accept reject }] Example: Device(config-if)# call guard-timer 2000 on-expiry accept	Sets a CAS guard timer to accept or reject a call in the event that the RADIUS server fails to respond to a preauthentication request.

	Command or Action	Purpose
Step 6	end Example: Device(config-if)# end	Exits interface configuration mode and returns to privileged EXEC mode.

Configuring the Suffix and Password in RADIUS Access Requests

Large-scale dial-out eliminates the need to configure dialer maps on every NAS for every destination. Instead, you can create remote site profiles that contain outgoing call attributes on the AAA server. The profile is downloaded by the NAS when packet traffic requires a call to be placed to a remote site.

You can configure the username in the Access-Request message to RADIUS. The default suffix of the username, “-out,” is appended to the username. The format for composing the username attribute is the IP address plus the configured suffix.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa route download** *time*
5. **aaa authorization configuration default**
6. **interface dialer** *number*
7. **dialer aaa**
8. **dialer aaa suffix** *suffix* **password** *password*
9. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	aaa new-model Example: Device(config)# aaa new-model	Enables the AAA access control model.
Step 4	aaa route download <i>time</i> Example: Device(config)# aaa route download 450	Enables the download static route feature and sets the amount of time in minutes between downloads.
Step 5	aaa authorization configuration default Example: Device(config)# aaa authorization configuration default	Downloads static route configuration information from the AAA server using TACACS+ or RADIUS.
Step 6	interface dialer <i>number</i> Example: Device(config)# interface dialer 1	Defines a dialer rotary group and enters interface configuration mode.
Step 7	dialer aaa Example: Device(config-if)# dialer aaa	Allows a dialer to access the AAA server for dialing information.
Step 8	dialer aaa suffix <i>suffix</i> password <i>password</i> Example: Device(config-if)# dialer aaa suffix @samp password password12	Allows a dialer to access the AAA server for dialing information and specifies a suffix and nondefault password for authentication.
Step 9	exit Example: Device(config-if)# exit	Exits interface configuration mode and returns to privileged EXEC mode.

Monitoring and Maintaining RADIUS

SUMMARY STEPS

1. `enable`
2. `debug radius`
3. `show radius statistics`
4. `show aaa servers`
5. `exit`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	debug radius Example: Device# debug radius	Displays information associated with RADIUS.
Step 3	show radius statistics Example: Device# show radius statistics	Displays the RADIUS statistics for accounting and authentication packets.
Step 4	show aaa servers Example: Device# show aaa servers	Displays the status and number of packets that are sent to and received from all public and private AAA RADIUS servers as interpreted by the AAA Server MIB.
Step 5	exit Example: Device# exit	Exits the device session.

Configuration Examples for RADIUS

Example: RADIUS Authentication and Authorization

The following example shows how to configure the device to authenticate and authorize using RADIUS:

```
aaa authentication login use-radius group radius local
aaa authentication ppp user-radius if-needed group radius
aaa authorization exec default group radius
aaa authorization network default group radius
```

The lines in this sample RADIUS authentication and authorization configuration are defined as follows:

- The **aaa authentication login use-radius group radius local** command configures the device to use RADIUS for authentication at the login prompt. If RADIUS returns an error, the user is authenticated using the local database. In this example, **use-radius** is the name of the method list, which specifies RADIUS and then local authentication.
- The **aaa authentication ppp user-radius if-needed group radius** command configures the Cisco software to use RADIUS authentication for lines using PPP with CHAP or PAP if the user has not already been authorized. If the EXEC facility has authenticated the user, RADIUS authentication is not performed. In this example, **user-radius** is the name of the method list defining RADIUS as the if-needed authentication method.
- The **aaa authorization exec default group radius** command sets the RADIUS information that is used for EXEC authorization, autocommands, and access lists.
- The **aaa authorization network default group radius** command sets RADIUS for network authorization, address assignment, and access lists.

Example: RADIUS Authentication, Authorization, and Accounting

The following example shows a general configuration using RADIUS with the AAA command set:

```
radius-server host 10.45.1.2
radius-server key myRaDiUSpassWoRd
username root password ALongPassword
aaa authentication ppp dialins group radius local
aaa authorization network default group radius local
aaa accounting network default start-stop group radius
aaa authentication login admins local
aaa authorization exec default local
line 1 16
  autoselect ppp
  autoselect during-login
  login authentication admins
  modem ri-is-cd
interface group-async 1
  encaps ppp
  ppp authentication pap dialins
```

The lines in this example RADIUS authentication, authorization, and accounting configuration are defined as follows:

- The **radius-server host** command defines the IP address of the RADIUS server host.

- The **radius-server key** command defines the shared secret text string between the network access server and the RADIUS server host.
- The **aaa authentication ppp dialins group radius local** command defines the authentication method list “dialins,” which specifies that RADIUS authentication and then (if the RADIUS server does not respond) local authentication is used on serial lines using PPP.
- The **aaa authorization network default group radius local** command is used to assign an address and other network parameters to the RADIUS user.
- The **aaa accounting network default start-stop group radius** command tracks PPP usage.
- The **aaa authentication login admins local** command defines another method list, “admins,” for login authentication.
- The **login authentication admins** command applies the “admins” method list for login authentication.
- The **ppp authentication pap dialins** command applies the “dialins” method list to the lines specified.

Example: Vendor-Proprietary RADIUS Configuration

The following example shows a general configuration using vendor-proprietary RADIUS with the AAA command set:



Note

To configure an IPv4 or IPv6 RADIUS server, use the commands as mentioned below:

- If you have configured an IPv4 RADIUS server, you can use either the **radius-server host** command or the **radius server name** command.
- If you have configured an IPv6 RADIUS server, use the **radius server name** command.

For more information about the **radius server** command, see *Cisco IOS Security Command Reference: Commands M to R*.

```
radius server myserver
radius server address ipv4 192.0.2.2
radius server non-standard
radius server key 7 anykey
radius-server configure-nas
username root password ALongPassword
aaa authentication ppp dialins group radius local
aaa authorization network default group radius local
aaa accounting network default start-stop group radius
aaa authentication login admins local
aaa authorization exec default local
```

The lines in this RADIUS authentication, authorization, and accounting configuration example are defined as follows:

- The **radius server name non-standard** command defines the name of the RADIUS server host and identifies that this RADIUS host uses a vendor-proprietary version of RADIUS.
- The **radius server name key** command defines the shared secret text string between the network access server and the RADIUS server host.
- The **radius-server configure-nas** command defines that the Cisco device or access server queries the RADIUS server for static routes and IP pool definitions when the device first starts up.

- The **aaa authentication ppp dialins group radius local** command defines the authentication method list “dialins,” which specifies that RADIUS authentication and then (if the RADIUS server does not respond) local authentication is used on serial lines using PPP.
- The **aaa authorization network default group radius local** command assigns an address and other network parameters to the RADIUS user.
- The **aaa accounting network default start-stop group radius** command tracks PPP usage.
- The **aaa authentication login admins local** command defines another method list, “admins,” for login authentication.

Example: RADIUS Server with Server-Specific Values

The following example shows how to configure server-specific timeout, retransmit, and key values for the RADIUS server with IP address 172.31.39.46:

```
radius-server host 172.31.39.46 timeout 6 retransmit 5 key rad123
```

Example: Device-to-RADIUS Server Communication

The following example shows how to configure two RADIUS servers with specific timeout, retransmit, and key values. In this example, the **aaa new-model** command enables AAA services on the device, and specific AAA commands define the AAA services. The **radius-server retransmit** command changes the global retransmission value to 4 for all RADIUS servers. The **radius-server host** command configures specific timeout, retransmission, and key values for the RADIUS server hosts with IP addresses 172.16.1.1 and 172.29.39.46.

```
! Enable AAA services on the device and define those services.
aaa new-model
aaa authentication login default group radius
aaa authentication login console-login none
aaa authentication ppp default group radius
aaa authorization network default group radius
aaa accounting exec default start-stop group radius
aaa accounting network default start-stop group radius
enable password tryit1
!
! Change the global retransmission value for all RADIUS servers.
radius-server retransmit 4
!
! Configure per-server specific timeout, retransmission, and key values.
! Change the default auth-port and acct-port values.
radius-server host 172.16.1.1 auth-port 1612 acct-port 1616 timeout 3 retransmit 3 key
radkey
!
! Configure per-server specific timeout and key values. This server uses the global
! retransmission value.
radius-server host 172.29.39.46 timeout 6 key rad123
```

Example: Multiple RADIUS Server Entries for the Same Server IP Address

The following example shows how to configure the network access server to recognize several RADIUS host entries with the same IP address. Two different host entries on the same RADIUS server are configured for

the same services—authentication and accounting. The second host entry configured acts as failover backup to the first one. (The RADIUS host entries are tried in the order they are configured.)

```
! This command enables AAA.
aaa new-model
! The next command configures default RADIUS parameters.
aaa authentication ppp default group radius
! The next set of commands configures multiple host entries for the same IP address.
radius-server host 172.20.0.1 auth-port 1000 acct-port 1001
radius-server host 172.20.0.1 auth-port 2000 acct-port 2000
```

Examples: AAA Server Groups

The following example shows how to create server group radgroup1 with three different RADIUS server members, each using the default authentication port (1645) and accounting port (1646):

```
aaa group server radius radgroup1
 server 172.16.1.11
 server 172.17.1.21
 server 172.18.1.31
```

The following example shows how to create server group radgroup2 with three RADIUS server members, each with the same IP address but with unique authentication and accounting ports:

```
aaa group server radius radgroup2
 server 172.16.1.1 auth-port 1000 acct-port 1001
 server 172.16.1.1 auth-port 2000 acct-port 2001
 server 172.16.1.1 auth-port 3000 acct-port 3001
```

Example: Multiple RADIUS Server Entries Using AAA Server Groups

The following example shows how to configure the network access server to recognize two different RADIUS server groups. One of these groups, group1, has two different host entries on the same RADIUS server configured for the same services. The second host entry configured acts as failover backup to the first one. Each group is individually configured for the deadline; the deadline for group 1 is one minute, and the deadline for group 2 is two minutes.



Note

In cases where both global commands and **server** commands are used, the **server** command takes precedence over the global command.

```
! This command enables AAA.
aaa new-model
! The next command configures default RADIUS parameters.
aaa authentication ppp default group group1
! The following commands define the group1 RADIUS server group and associate servers
! with it and configures a deadline of one minute.
aaa group server radius group1
 server 10.1.1.1 auth-port 1645 acct-port 1646
 server 10.2.2.2 auth-port 2000 acct-port 2001
 deadline 1
! The following commands define the group2 RADIUS server group and associate servers
! with it and configures a deadline of two minutes.
aaa group server radius group2
 server 10.2.2.2 auth-port 2000 acct-port 2001
 server 10.3.3.3 auth-port 1645 acct-port 1646
 deadline 2
! The following set of commands configures the RADIUS attributes for each host entry
```

```

! associated with one of the defined server groups.
radius-server host 10.1.1.1 auth-port 1645 acct-port 1646
radius-server host 10.2.2.2 auth-port 2000 acct-port 2001
radius-server host 10.3.3.3 auth-port 1645 acct-port 1646

```

Example: AAA Server Group Selection Based on DNIS

The following example shows how to select RADIUS server groups based on DNIS to provide specific AAA services:

```

! This command enables AAA.
aaa new-model
!
! The following set of commands configures the RADIUS attributes for each server
! that will be associated with one of the defined server groups.
radius-server host 172.16.0.1 auth-port 1645 acct-port 1646 key cisco1
radius-server host 172.17.0.1 auth-port 1645 acct-port 1646 key cisco2
radius-server host 172.18.0.1 auth-port 1645 acct-port 1646 key cisco3
radius-server host 172.19.0.1 auth-port 1645 acct-port 1646 key cisco4
radius-server host 172.20.0.1 auth-port 1645 acct-port 1646 key cisco5
! The following commands define the sg1 RADIUS server group and associate servers
! with it.
aaa group server radius sg1
  server 172.16.0.1
  server 172.17.0.1
! The following commands define the sg2 RADIUS server group and associate a server
! with it.
aaa group server radius sg2
  server 172.18.0.1
! The following commands define the sg3 RADIUS server group and associate a server
! with it.
aaa group server radius sg3
  server 172.19.0.1
! The following commands define the default-group RADIUS server group and associate
! a server with it.
aaa group server radius default-group
  server 172.20.0.1
! The next set of commands configures default-group RADIUS server group parameters.
aaa authentication ppp default group default-group
aaa accounting network default start-stop group default-group
!
! The next set of commands enables DNIS mapping and maps DNIS numbers to the defined
! RADIUS server groups. In this configuration, all PPP connection requests using
! DNIS 7777 are sent to the sg1 server group. The accounting records for these
! connections (specifically, start-stop records) are handled by the sg2 server group.
! Calls with a DNIS of 8888 use server group sg3 for authentication and server group
! default-group for accounting. Calls with a DNIS of 9999 use server group
! default-group for authentication and server group sg3 for accounting records
! (stop records only). All other calls with DNIS other than the ones defined use the
! server group default-group for both authentication and stop-start accounting records.
aaa dnis map enable
aaa dnis map 7777 authentication ppp group sg1
aaa dnis map 7777 accounting network start-stop group sg2
aaa dnis map 8888 authentication ppp group sg3
aaa dnis map 9999 accounting network stop-only group sg3

```

Examples: AAA Preauthentication

The following is a simple configuration that specifies that the DNIS number be used for preauthentication:

```

aaa preauthentication
  group radius
  dnis required

```

The following example shows a configuration that specifies that both the DNIS number and the CLID number be used for preauthentication. DNIS preauthentication is performed first, followed by CLID preauthentication.

```
aaa preauthentication
 group radius
 dnis required
 clid required
```

The following example specifies that preauthentication be performed on all DNIS numbers except the two DNIS numbers specified in the DNIS group called "dnis-group1":

```
aaa preauthentication
 group radius
 dnis required
 dnis bypass dnis-group1
dialer dnis group dnis-group1
 number 12345
 number 12346
```

The following is a sample AAA configuration with DNIS preauthentication:

```
aaa new-model
aaa authentication login CONSOLE none
aaa authentication login RADIUS_LIST group radius
aaa authentication login TAC_PLUS group tacacs+ enable
aaa authentication login V.120 none
aaa authentication enable default enable group tacacs+
aaa authentication ppp RADIUS_LIST if-needed group radius
aaa authorization exec RADIUS_LIST group radius if-authenticated
aaa authorization exec V.120 none
aaa authorization network default group radius if-authenticated
aaa authorization network RADIUS_LIST if-authenticated group radius
aaa authorization network V.120 group radius if-authenticated
aaa accounting suppress null-username
aaa accounting exec default start-stop group radius
aaa accounting commands 0 default start-stop group radius
aaa accounting network default start-stop group radius
aaa accounting connection default start-stop group radius
aaa accounting system default start-stop group radius
aaa preauthentication
 dnis password Cisco-DNIS
aaa nas port extended
!
radius-server configure-nas
radius-server host 10.0.0.0 auth-port 1645 acct-port 1646 non-standard
radius-server host 10.255.255.255 auth-port 1645 acct-port 1646 non-standard
radius-server retransmit 2
radius-server deadtime 1
radius-server attribute nas-port format c
radius-server unique-ident 18
radius-server key MyKey
```



Note To configure preauthentication, you must also set up preauthentication profiles on the RADIUS server.

Example RADIUS User Profile with RADIUS Tunneling Attributes

The following example shows a RADIUS user profile (Merit Daemon format) that includes RADIUS tunneling attributes. This entry supports two tunnels, one for L2F and the other for L2TP. The tag entries with :1 support L2F tunnels, and the tag entries with :2 support L2TP tunnels.

```
cisco.com Password = "PASSWORD3", Service-Type = Outbound
Service-Type = Outbound,
Tunnel-Type = :1:L2F,
```

```

Tunnel-Medium-Type = :1:IP,
Tunnel-Client-Endpoint = :1:"10.0.0.2",
Tunnel-Server-Endpoint = :1:"10.0.0.3",
Tunnel-Client-Auth-Id = :1:"l2f-cli-auth-id",
Tunnel-Server-Auth-Id = :1:"l2f-svr-auth-id",
Tunnel-Assignment-Id = :1:"l2f-assignment-id",
Cisco-Avpair = "vpdn:nas-password=l2f-cli-pass",
Cisco-Avpair = "vpdn:gw-password=l2f-svr-pass",
Tunnel-Preference = :1:1,
Tunnel-Type = :2:L2TP,
Tunnel-Medium-Type = :2:IP,
Tunnel-Client-Endpoint = :2:"10.0.0.2",
Tunnel-Server-Endpoint = :2:"10.0.0.3",
Tunnel-Client-Auth-Id = :2:"l2tp-cli-auth-id",
Tunnel-Server-Auth-Id = :2:"l2tp-svr-auth-id",
Tunnel-Assignment-Id = :2:"l2tp-assignment-id",
Cisco-Avpair = "vpdn:l2tp-tunnel-password=l2tp-tnl-pass",
Tunnel-Preference = :2:2

```

Examples: Guard Timer for ISDN and CAS

The following example shows an ISDN guard timer that is set at 8000 milliseconds. A call is rejected if the RADIUS server does not respond to a preauthentication request when the timer expires.

```

interface serial 1/0/0:23
 isdn guard-timer 8000 on-expiry reject
aaa preauthentication
 group radius
 dnis required

```

The following example shows a CAS guard timer that is set at 20,000 milliseconds. A call is accepted if the RADIUS server does not respond to a preauthentication request when the timer expires.

```

controller T1 0
 framing esf
 clock source line primary
 linecode b8zs
 ds0-group 0 timeslots 1-24 type e&m-fgb dtmf dnis
 cas-custom 0
 call guard-timer 20000 on-expiry accept
aaa preauthentication
 group radius
 dnis required

```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases
AAA and RADIUS commands	<i>Cisco IOS Security Command Reference</i>
RADIUS attributes	<i>RADIUS Attributes Configuration Guide</i> (part of the Securing User Services Configuration Library)

Related Topic	Document Title
AAA	<i>Authentication, Authorization, and Accounting Configuration Guide</i> (part of the Securing User Services Configuration Library)
L2TP, VPN, or VPDN	<i>Dial Technologies Configuration Guide</i> and <i>VPDN Configuration Guide</i>
Modem configuration and management	<i>Dial Technologies Configuration Guide</i>
RADIUS port identification for PPP	<i>Wide-Area Networking Configuration Guide</i>

RFCs

RFC	Title
RFC 2138	<i>Remote Authentication Dial-In User Service (RADIUS)</i>
RFC 2139	<i>RADIUS Accounting</i>
RFC 2865	<i>RADIUS</i>
RFC 2867	<i>RADIUS Accounting Modifications for Tunnel Protocol Support</i>
RFC 2868	<i>RADIUS Attributes for Tunnel Protocol Support</i>

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring RADIUS

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 4: Feature Information for Configuring RADIUS

Feature Name	Releases	Feature Information
Configuring RADIUS	11.1 12.1(5)T 12.2(13)T 12.2(27)SBA 12.2(33)SRC 15.4(1)S	The RADIUS security system is a distributed client/server system that secures networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco devices and send authentication requests to a central RADIUS server that contains all user authentication and network service access information. In Cisco IOS Release 15.4(1)S, support was added for the Cisco ASR 901S Router.
RADIUS Statistics via SNMP	15.1(1)S 15.1(1)SY 15.1(4)M	This feature provides statistics related to RADIUS traffic and private RADIUS servers. The following commands were introduced or modified: show aaa servers , show radius statistics .



CHAPTER 2

Framed-Route in RADIUS Accounting

Framed-Routing indicates the routing method to a user on a network and is used only in Access-Accept packets. The Framed-Route in RADIUS Accounting feature provides for the presence of Framed-Route (RADIUS attribute 22) information in RADIUS Accounting-Request accounting records. The Framed-Route information is returned to the RADIUS server in the Accounting-Request packets. The Framed-Route information can be used to verify that a per-user route or routes have been applied for a particular static IP customer on the network access server (NAS).

- [Finding Feature Information, page 39](#)
- [Prerequisites for Framed-Route in RADIUS Accounting, page 39](#)
- [Information About Framed-Route in RADIUS Accounting, page 40](#)
- [How to Monitor Framed-Route in RADIUS Accounting, page 40](#)
- [Additional References, page 41](#)
- [Feature Information for Framed-Route in RADIUS Accounting, page 43](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Framed-Route in RADIUS Accounting

Be familiar with configuring authentication, authorization, and accounting (AAA), RADIUS servers, and RADIUS attribute screening.

Information About Framed-Route in RADIUS Accounting

Framed-Route Attribute 22

Framed-Route, attribute 22 as defined in Internet Engineering Task Force (IETF) standard RFC 2865, provides for routing information to be configured for the user on the NAS. The Framed-Route attribute information is usually sent from the RADIUS server to the NAS in Access-Accept packets. The attribute can appear multiple times.

Framed-Route in RADIUS Accounting Packets

The Framed-Route attribute information in RADIUS accounting packets shows per-user routes that have been applied for a particular static IP customer on the NAS. The Framed-Route attribute information is currently sent in Access-Accept packets. Effective with Cisco IOS Release 12.3(4)T, the Framed-Route attribute information is also sent in Accounting-Request packets if it was provided in the Access-Accept packets and was applied successfully. Zero or more instances of the Framed-Route attribute may be present in the Accounting-Request packets.



Note

If there is more than one Framed-Route attribute in an Access-Accept packet, there can also be more than one Framed-Route attribute in the Accounting-Request packet.

The Framed-Route information is returned in Stop and Interim accounting records and in Start accounting records when accounting Delay-Start is configured.

No configuration is required to have the Framed-Route attribute information returned in the RADIUS accounting packets.

How to Monitor Framed-Route in RADIUS Accounting

Use the **debug radius** command to monitor whether Framed-Route (attribute 22) information is being sent in RADIUS Accounting-Request packets.

In the following example, the **debug radius** command is used to verify that Framed-Route (attribute 22) information is being sent in the Accounting-Request packets (see the line 00:06:23: RADIUS: Framed-Route [22] 26 "10.80.0.1 255.255.255.255 10.60.0.1 100").



Note

With CSCtz66183, the Service-Type AV pair (Attribute 6) is not displayed in the Accounting-Request records.

```
Device# debug radius
00:06:23: RADIUS:  Send to unknown id 0 10.1.0.2:1645, Access-Request, len 126
00:06:23: RADIUS:  authenticator 40 28 A8 BC 76 D4 AA 88 - 5A E9 C5 55 0E 50 84 37
00:06:23: RADIUS:  Framed-Protocol      [7]   6   PPP                               [1]
00:06:23: RADIUS:  User-Name            [1]  14  "nari@trw1001"
```

```

00:06:23: RADIUS: CHAP-Password [3] 19 *
00:06:23: RADIUS: NAS-Port [5] 6 1
00:06:23: RADIUS: Vendor, Cisco [26] 33
00:06:23: RADIUS: Cisco AVpair [1] 27 "interface=Virtual-Access1"
00:06:23: RADIUS: NAS-Port-Type [61] 6 Virtual [5]
00:06:23: RADIUS: Service-Type [6] 6 Framed [2]
00:06:23: RADIUS: NAS-IP-Address [4] 6 12.1.0.1
00:06:23: RADIUS: Acct-Session-Id [44] 10 "00000002"
00:06:23: RADIUS: Received from id 0 10.1.0.2:1645, Access-Accept, len 103
00:06:23: RADIUS: authenticator 5D 2D 9F 25 11 15 45 B2 - 54 BB 7F EB CE 79 20 3B
00:06:23: RADIUS: Vendor, Cisco [26] 33
00:06:23: RADIUS: Cisco AVpair [1] 27 "interface=Virtual-Access1"
00:06:23: RADIUS: Service-Type [6] 6 Framed [2]
00:06:23: RADIUS: Framed-Protocol [7] 6 PPP [1]
00:06:23: RADIUS: Framed-IP-Netmask [9] 6 255.255.255.255
00:06:23: RADIUS: Framed-IP-Address [8] 6 10.60.0.1
00:06:23: RADIUS: Framed-Route [22] 26 "10.80.0.1 255.255.255.255 10.60.0.1 100"
<=====
00:06:23: RADIUS: Received from id 2
00:06:24: %LINEPROTO-5-UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
00:06:25: AAA/AUTHOR: Processing PerUser AV route
00:06:25: V11 AAA/PERUSER/ROUTE: route string: IP route 10.80.0.1 255.255.255.255 10.60.0.1
100
00:06:25: RADIUS/ENCODE(00000002): Unsupported AAA attribute timezone
00:06:25: RADIUS(00000002): sending
00:06:25: RADIUS: Send to unknown id 1 10.1.0.2:1646, Accounting-Request, len 278
00:06:25: RADIUS: authenticator E0 CC 99 EB 49 18 B9 78 - 4A 09 60 0F 4E 92 24 C6
00:06:25: RADIUS: Acct-Session-Id [44] 10 "00000002"
00:06:25: RADIUS: Tunnel-Server-Endpoi[67] 12 00:"10.1.1.1"
00:06:25: RADIUS: Tunnel-Client-Endpoi[66] 12 00:"10.1.1.2"
00:06:25: RADIUS: Tunnel-Assignment-Id[82] 15 00:"from_isdn101"
00:06:25: RADIUS: Tunnel-Type [64] 6 00:L2TP [3]
00:06:25: RADIUS: Acct-Tunnel-Connecti[68] 12 "2056100083"
00:06:25: RADIUS: Tunnel-Client-Auth-I[90] 10 00:"isdn101"
00:06:25: RADIUS: Tunnel-Server-Auth-I[91] 6 00:"lns"
00:06:25: RADIUS: Framed-Protocol [7] 6 PPP [1]
00:06:25: RADIUS: Framed-Route [22] 39 "10.80.0.1 255.255.255.255 10.60.0.1 100"
<=====
00:06:25: RADIUS: Framed-IP-Address [8] 6 10.60.0.1
00:06:25: RADIUS: Vendor, Cisco [26] 35
00:06:25: RADIUS: Cisco AVpair [1] 29 "connect-progress=LAN Ses Up"
00:06:25: RADIUS: Authentic [45] 6 RADIUS [1]
00:06:25: RADIUS: User-Name [1] 14 "username1@example.com"
00:06:25: RADIUS: Acct-Status-Type [40] 6 Start [1]
00:06:25: RADIUS: NAS-Port [5] 6 1
00:06:25: RADIUS: Vendor, Cisco [26] 33
00:06:25: RADIUS: Cisco AVpair [1] 27 "interface=Virtual-Access1"
00:06:25: RADIUS: NAS-Port-Type [61] 6 Virtual [5]
00:06:25: RADIUS: Service-Type [6] 6 Framed [2]
00:06:25: RADIUS: NAS-IP-Address [4] 6 10.1.0.1
00:06:25: RADIUS: Acct-Delay-Time [41] 6 0

```

Additional References

The following sections provide references related to the Framed-Route in RADIUS Accounting feature.

Related Documents

Related Topic	Document Title
RADIUS	"Configuring RADIUS" module.

Standards

Standard	Title
None.	--

MIBs

MIB	MIBs Link
None.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2865	Remote Authentication Dial In User Service (RADIUS)
RFC 3575	IANA Considerations for RADIUS (Remote Authentication Dial In User Service)

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for Framed-Route in RADIUS Accounting

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 5: Feature Information for Framed-Route in RADIUS Accounting

Feature Name	Releases	Feature Information
Framed-Route in RADIUS Accounting	12.3(4)T 12.2(28)SB 12.2(33)SRC	<p>The Framed-Route in RADIUS Accounting feature provides for the presence of Framed-Route (RADIUS attribute 22) information in RADIUS Accounting-Request accounting records.</p> <p>This feature was introduced in Cisco IOS Release 12.3(4)T.</p> <p>This feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>This feature was integrated into Cisco IOS Release 12.2(33)SRC.</p>



RFC-2867 RADIUS Tunnel Accounting

The RFC-2867 RADIUS Tunnel Accounting introduces six new RADIUS accounting types that are used with the RADIUS accounting attribute Acct-Status-Type (attribute 40), which indicates whether an accounting request marks the beginning of user service (start) or the end (stop).

This feature also introduces two virtual private virtual private dialup network (VPDN) commands that help users better troubleshoot VPDN session events.

Without RADIUS tunnel accounting support, VPDN with network accounting, which allows users to determine tunnel-link status changes, did not report all possible attributes to the accounting record file. Now that all possible attributes can be displayed, users can better verify accounting records with their Internet Service Providers (ISPs).

- [Finding Feature Information, page 45](#)
- [Restrictions for RFC-2867 RADIUS Tunnel Accounting, page 46](#)
- [Information About RFC-2867 RADIUS Tunnel Accounting, page 46](#)
- [How to Configure RADIUS Tunnel Accounting, page 52](#)
- [Configuration Examples for RADIUS Tunnel Accounting, page 55](#)
- [Additional References, page 58](#)
- [Feature Information for RFC-2867 RADIUS Tunnel Accounting, page 59](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for RFC-2867 RADIUS Tunnel Accounting

RADIUS tunnel accounting works only with L2TP tunnel support.

Information About RFC-2867 RADIUS Tunnel Accounting

RADIUS Attributes Support for RADIUS Tunnel Accounting

The table below outlines the new RADIUS accounting types that are designed to support the provision of compulsory tunneling in dialup networks; that is, these attribute types allow you to better track tunnel status changes.



Note

The accounting types are divided into two separate tunnel types so users can decide if they want tunnel type, tunnel-link type, or both types of accounting.

Table 6: RADIUS Accounting Types for the Acct-Status-Type Attribute

Type-Name	Number	Description	Additional Attributes ¹
Tunnel-Start	9	Marks the beginning of a tunnel setup with another node.	<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • Acct-Delay-Time (41)--from AAA • Event-Timestamp (55)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client

Type-Name	Number	Description	Additional Attributes ¹
Tunnel-Stop	10	Marks the end of a tunnel connection to or from another node.	<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • Acct-Delay-Time (41)--from AAA • Acct-Input-Octets (42)--from AAA • Acct-Output-Octets (43)--from AAA • Acct-Session-Id (44)--from AAA • Acct-Session-Time (46)--from AAA • Acct-Input-Packets (47)--from AAA • Acct-Output-Packets (48)--from AAA • Acct-Terminate-Cause (49)--from AAA • Acct-Multi-Session-Id (51)--from AAA • Event-Timestamp (55)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client • Acct-Tunnel-Packets-Lost (86)--from client

Type-Name	Number	Description	Additional Attributes ¹
Tunnel-Reject	11	Marks the rejection of a tunnel setup with another node.	<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • Acct-Delay-Time (41)--from AAA • Acct-Terminate-Cause (49)--from client • Event-Timestamp (55)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client

Type-Name	Number	Description	Additional Attributes ¹
Tunnel-Link-Start	12	Marks the creation of a tunnel link. Only some tunnel types (Layer 2 Transport Protocol [L2TP]) support the multiple links per tunnel; this value should be included only in accounting packets for tunnel types that support multiple links per tunnel.	<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • NAS-Port (5)--from AAA • Acct-Delay-Time (41)--from AAA • Event-Timestamp (55)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client

Type-Name	Number	Description	Additional Attributes ¹
Tunnel-Link-Stop	13	Marks the end of a tunnel link. Only some tunnel types (L2TP) support the multiple links per tunnel; this value should be included only in accounting packets for tunnel types that support multiple links per tunnel.	

Type-Name	Number	Description	Additional Attributes ¹
			<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • NAS-Port (5)--from AAA • Acct-Delay-Time (41)--from AAA • Acct-Input-Octets (42)--from AAA • Acct-Output-Octets (43)--from AAA • Acct-Session-Id (44)--from AAA • Acct-Session-Time (46)--from AAA • Acct-Input-Packets (47)--from AAA • Acct-Output-Packets (48)--from AAA • Acct-Terminate-Cause (49)--from AAA • Acct-Multi-Session-Id (51)--from AAA • Event-Timestamp (55)--from AAA • NAS-Port-Type (61)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client • Acct-Tunnel-Packets-Lost

Type-Name	Number	Description	Additional Attributes ¹
			(86)--from client
Tunnel-Link-Reject	14	Marks the rejection of a tunnel setup for a new link in an existing tunnel. Only some tunnel types (L2TP) support the multiple links per tunnel; this value should be included only in accounting packets for tunnel types that support multiple links per tunnel.	<ul style="list-style-type: none"> • User-Name (1)--from client • NAS-IP-Address (4)--from AAA • Acct-Delay-Time (41)--from AAA • Acct-Terminate-Cause (49)--from AAA • Event-Timestamp (55)--from AAA • Tunnel-Type (64)--from client • Tunnel-Medium-Type (65)--from client • Tunnel-Client-Endpoint (66)--from client • Tunnel-Server-Endpoint (67)--from client • Acct-Tunnel-Connection (68)--from client

¹ If the specified tunnel type is used, these attributes should also be included in the accounting request packet.

How to Configure RADIUS Tunnel Accounting

Enabling Tunnel Type Accounting Records

Use this task to configure your LAC to send tunnel and tunnel-link accounting records to be sent to the RADIUS server.

Two new command line interfaces (CLIs)--vpdn session accounting network(tunnel-link-type records)and vpdn tunnel accounting network(tunnel-type records)--are supported to help identify the following events:

- A VPDN tunnel is brought up or destroyed
- A request to create a VPDN tunnel is rejected
- A user session within a VPDN tunnel is brought up or brought down

- A user session create request is rejected

**Note**

The first two events are tunnel-type accounting records: authentication, authorization, and accounting (AAA) sends Tunnel-Start, Tunnel-Stop, or Tunnel-Reject accounting records to the RADIUS server. The next two events are tunnel-link-type accounting records: AAA sends Tunnel-Link-Start, Tunnel-Link-Stop, or Tunnel-Link-Reject accounting records to the RADIUS server.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Router(config)# **aaa accounting network default** *list-name* {**start-stop** | **stop-only** | **wait-start** | **none** **group** *groupname*
4. Router(config)# **vpdn enable**
5. Router(config)# **vpdn tunnel accounting network** *list-name*
6. Router(config)# **vpdn session accounting network** *list-name*

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	Router(config)# aaa accounting network default <i>list-name</i> { start-stop stop-only wait-start none group <i>groupname</i>	Enables network accounting. <ul style="list-style-type: none"> • default --If the default network accounting method-list is configured and no additional accounting configurations are enabled on the interface, network accounting is enabled by default. <p>If either the vpdn session accounting network command or the vpdn tunnel accounting network command is linked to the default method-list, all tunnel and tunnel-link accounting records are enabled for those sessions.</p> <ul style="list-style-type: none"> • <i>list-name</i> --The <i>list-name</i> defined in the aaa accounting command must be the same as the <i>list-name</i> defined in the VPDN command; otherwise, accounting will not occur.

	Command or Action	Purpose
Step 4	Router(config)# vpdn enable	Enables virtual private dialup networking on the router and informs the router to look for tunnel definitions in a local database and on a remote authorization server (if applicable).
Step 5	Router(config)# vpdn tunnel accounting network <i>list-name</i>	Enables Tunnel-Start, Tunnel-Stop, and Tunnel-Reject accounting records. <ul style="list-style-type: none"> • <i>list-name</i> --The <i>list-name</i> must match the <i>list-name</i> defined in the aaa accounting command; otherwise, network accounting will not occur.
Step 6	Router(config)# vpdn session accounting network <i>list-name</i>	Enables Tunnel-Link-Start, Tunnel-Link-Stop, and Tunnel-Link-Reject accounting records. <ul style="list-style-type: none"> • <i>list-name</i> --The <i>list-name</i> must match the <i>list-name</i> defined in the aaa accounting command; otherwise, network accounting will not occur.

What To Do Next

After you have enabled RADIUS tunnel accounting, you can verify your configuration via the following optional task “Verifying RADIUS Tunnel Accounting.”

Verifying RADIUS Tunnel Accounting

Use either one or both of the following optional steps to verify your RADIUS tunnel accounting configuration.

SUMMARY STEPS

1. **enable**
2. Router# **show accounting**
3. Router# **show vpdn [session] [tunnel]**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> <code>enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	Router# show accounting	Displays the active accountable events on the network and helps collect information in the event of a data loss on the accounting server.

	Command or Action	Purpose
Step 3	Router# show vpdn [session] [tunnel]	<p>Displays information about active L2TP tunnel and message identifiers in a VPDN.</p> <ul style="list-style-type: none"> • session --Displays a summary of the status of all active tunnels. • tunnel --Displays information about all active L2TP tunnels in summary-style format.

Configuration Examples for RADIUS Tunnel Accounting

Configuring RADIUS Tunnel Accounting on LAC Example

The following example shows how to configure your L2TP access concentrator (LAC) to send tunnel and tunnel-link accounting records to the RADIUS server:

```

aaa new-model
!
!
aaa authentication ppp default group radius
aaa authorization network default local
aaa accounting network m1 start-stop group radius
aaa accounting network m2 stop-only group radius
aaa session-id common
enable secret 5 $1$IDjH$iL7puCja1RMlyOM.JAeuf/
enable password lab
!
username ISP_LAC password 0 tunnelpass
!
!
resource-pool disable
!
!
ip subnet-zero
ip cef
no ip domain-lookup
ip host dirt 171.69.1.129
!
vpdn enable
vpdn tunnel accounting network m1
vpdn session accounting network m1
vpdn search-order domain dnis
!
vpdn-group 1
 request-dialin
  protocol l2tp
  domain cisco.com
  initiate-to ip 10.1.26.71
  local name ISP_LAC
!
isdn switch-type primary-5ess
!
!
fax interface-type fax-mail
mta receive maximum-recipients 0
!

```

```

controller T1 7/4
  framing esf
  linecode b8zs
  pri-group timeslots 1-24
  !
  !
  !
interface FastEthernet0/0
  ip address 10.1.27.74 255.255.255.0
  no ip mroute-cache
  duplex half
  speed auto
  no cdp enable
  !
interface FastEthernet0/1
  no ip address
  no ip mroute-cache
  shutdown
  duplex auto
  speed auto
  no cdp enable
  !
interface Serial7/4:23
  ip address 60.0.0.2 255.255.255.0
  encapsulation ppp
  dialer string 2000
  dialer-group 1
  isdn switch-type primary-5ess
  ppp authentication chap
  !
interface Group-Async0
  no ip address
  shutdown
  group-range 1/00 3/107
  !
ip default-gateway 10.1.27.254
ip classless
ip route 0.0.0.0 0.0.0.0 10.1.27.254
no ip http server
ip pim bidir-enable
  !
  !
dialer-list 1 protocol ip permit
no cdp run
  !
  !
radius-server host 172.19.192.26 auth-port 1645 acct-port 1646 key rad123
radius-server retransmit 3
call rsvp-sync
  !

```

Configuring RADIUS Tunnel Accounting on LNS Example

The following example shows how to configure your L2TP network server (LNS) to send tunnel and tunnel-link accounting records to the RADIUS server:

```

aaa new-model
  !
  !
aaa accounting network m1 start-stop group radius
aaa accounting network m2 stop-only group radius
aaa session-id common
enable secret 5 $1$ftf.$wE6Q5Yv6hmQiwL9pizPCg1
  !
username ENT_LNS password 0 tunnelpass
username user1@cisco.com password 0 lab
username user2@cisco.com password 0 lab
spe 1/0 1/7
  firmware location system:/ucode/mica_port_firmware

```

```
spe 2/0 2/9
  firmware location system:/ucode/mica_port_firmware
  !
  !
  resource-pool disable
  clock timezone est 2
  !
  ip subnet-zero
  no ip domain-lookup
  ip host CALLGEN-SECURITY-V2 64.24.80.28 3.47.0.0
  ip host dirt 171.69.1.129
  !
  vpdn enable
  vpdn tunnel accounting network m1
  vpdn session accounting network m1
  !
  vpdn-group 1
  accept-dialin
    protocol l2tp
    virtual-template 1
    terminate-from hostname ISP_LAC
    local name ENT_LNS
  !
  isdn switch-type primary-5ess
  !
  !
  !
  !
  !
  !
  !
  fax interface-type modem
  mta receive maximum-recipients 0
  !
  interface Loopback0
    ip address 70.0.0.101 255.255.255.0
  !
  interface Loopback1
    ip address 80.0.0.101 255.255.255.0
  !
  interface Ethernet0
    ip address 10.1.26.71 255.255.255.0
    no ip mroute-cache
    no cdp enable
  !
  interface Virtual-Template1
    ip unnumbered Loopback0
    peer default ip address pool vpdn-pool1
    ppp authentication chap
  !
  interface Virtual-Template2
    ip unnumbered Loopback1
    peer default ip address pool vpdn-pool2
    ppp authentication chap
  !
  interface FastEthernet0
    no ip address
    no ip mroute-cache
    shutdown
    duplex auto
    speed auto
    no cdp enable
  !
  ip local pool vpdn-pool1 70.0.0.1 70.0.0.100
  ip local pool vpdn-pool2 80.0.0.1 80.0.0.100
  ip default-gateway 10.1.26.254
  ip classless
  ip route 0.0.0.0 0.0.0.0 10.1.26.254
  ip route 90.1.1.2 255.255.255.255 10.1.26.254
  no ip http server
  ip pim bidir-enable
  !
  !
```

```
dialer-list 1 protocol ip permit
no cdp run
!
!
radius-server host 172.19.192.80 auth-port 1645 acct-port 1646 key rad123
radius-server retransmit 3
call rsvp-sync
```

Additional References

The following sections provide references related to RFC-2867 RADIUS Tunnel Accounting.

Related Documents

Related Topic	Document Title
RADIUS attributes	“ RADIUS Attributes ” feature module.
VPDN	<i>Cisco IOS VPDN Configuration Guide , Release 12.4T.</i>
Network accounting	“ Configuring Accounting ” feature module.

Standards

Standards	Title
None	--

MIBs

MIBs	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
RFC 2867	<i>RADIUS Accounting Modifications for Tunnel Protocol Support</i>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Feature Information for RFC-2867 RADIUS Tunnel Accounting

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 7: Feature Information for RFC-2867 RADIUS Tunnel Accounting

Feature Name	Releases	Feature Information
RFC-2867 RADIUS Tunnel Accounting	12.2(15)B 12.3(4)T	<p>The RFC-2867 RADIUS Tunnel Accounting introduces six new RADIUS accounting types that are used with the RADIUS accounting attribute Acct-Status-Type (attribute 40), which indicates whether an accounting request marks the beginning of user service (start) or the end (stop).</p> <p>This feature also introduces two virtual private virtual private dialup network (VPDN) commands that help users better troubleshoot VPDN session events.</p> <p>In 12.2(15)B, this feature was introduced on the Cisco 6400 series, Cisco 7200 series, and the Cisco 7400 series routers.</p> <p>This feature was integrated into Cisco IOS Release 12.3(4)T.</p> <p>The following commands were introduced or modified: aaa accounting, vpdn session accounting network, vpdn tunnel accounting network.</p>



CHAPTER

4

RADIUS Centralized Filter Management

The RADIUS Centralized Filter Management feature introduces a filter-server to simplify ACL configuration and management. This filter-server serves as a centralized RADIUS repository and administration point, which users can centrally manage and configure access control list (ACL) filters.

- [Finding Feature Information, page 61](#)
- [Prerequisites for RADIUS Centralized Filter Management, page 61](#)
- [Restrictions for RADIUS Centralized Filter Management, page 62](#)
- [Information About RADIUS Centralized Filter Management, page 62](#)
- [How to Configure Centralized Filter Management for RADIUS, page 63](#)
- [Configuration Examples for RADIUS Centralized Filter Management, page 66](#)
- [Additional References, page 67](#)
- [Feature Information for RADIUS Centralized Filter Management, page 69](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Centralized Filter Management

- You may need to add a dictionary file to your server if it does not support the new RADIUS VSAs. For a sample dictionary and vendors file, see the section “RADIUS Dictionary and Vendors File Example” later in this document.

If you need to add a dictionary file, ensure that your RADIUS server is nonstandard and that it can send the newly introduced VSAs.

- You want to set up RADIUS network authentication so a remote user can dial in and get IP connectivity.

Restrictions for RADIUS Centralized Filter Management

Multiple method lists are not supported in this feature; only a single global filter method list can be configured.

Information About RADIUS Centralized Filter Management

Before the RADIUS Centralized Filter Management feature, wholesale providers (who provide premium charges for customer services such as access control lists [ACLs]) were unable to prevent customers from applying exhaustive ACLs, which could impact router performance and other customers. This feature introduces a centralized administration point--a filter server--for ACL management. The filter server acts as a centralized RADIUS repository for ACL configuration.

Whether or not the RADIUS server that is used as the filter server is the same server that is used for access authentication, the network access server (NAS) will initiate a second access request to the filter server. If configured, the NAS will use the filter-ID name as the authentication username and the filter server password for the second access request. The RADIUS server will attempt to authenticate the filter-ID name, returning any required filtering configuration in the access-accept response.

Because downloading ACLs is time consuming, a local cache is maintained on the NAS. If an ACL name exists on the local cache, that configuration will be used without consulting the filter server.



Note

An appropriately configured cache should minimize delays; however, the first dialin user to require a filter will always experience a longer delay because the ACL configuration is retrieved for the first time.

Cache Management

A global filter cache is maintained on the NAS of recently downloaded ACLs; thus, users no longer have to repeatedly request the same ACL configuration information from a potentially overloaded RADIUS server. Users are required to flush the cache when the following criteria have been met:

- After an entry becomes associated with a newly active call, the idle timer that is associated with that entry will be reset, if configured to do so.
- After the idle-time stamp of an entry expires, the entry will be removed.
- After the global cache of entries reaches a specified maximum number, the entry whose idle-timer is closest to the idle time limit will be removed.

A single timer is responsible for managing all cache entries. The timer is started after the first cache entry is created, and it runs periodically until reboot. The period of the timer will correspond to the minimum granularity offered when configuring cache idle timers, which is one expiration per minute. A single timer prevents users from having to manage individual timers per cache entry.

**Note**

The single timer introduces a lack of precision in timer expiration. There is an average error of approximately 50 percent of the timer granularity. Although decreasing the timer granularity will decrease the average error, the decreased timer granularity will negatively impact performance. Because precise timing is not required for cache management, the error delay should be acceptable.

New Vendor-Specific Attribute Support

This feature introduces support for three new vendor-specific attributes (VSAs), which can be divided into the following two categories:

- User profile extensions
 - Filter-Required (50)--Specifies whether the call should be permitted if the specified filter is not found. If present, this attribute will be applied after any authentication, authorization, and accounting (AAA) filter method-list.
- Pseudo-user profile extensions
 - Cache-Refresh (56)--Specifies whether cache entries should be refreshed each time an entry is referenced by a new session. This attribute corresponds to the **cache refresh** command.
 - Cache-Time (57)--Specifies the idle time out, in minutes, for cache entries. This attribute corresponds to the **cache clear age** command.

**Note**

All RADIUS attributes will override any command-line interface (CLI) configurations.

How to Configure Centralized Filter Management for RADIUS

Configuring the RADIUS ACL Filter Server

To enable the RADIUS ACL filter server, use the following command in global configuration mode:

Command	Purpose
<pre>Router(config)# aaa authorization cache filterserver default <i>methodlist[methodlist2...]</i></pre>	<p>Enables AAA authorization caches and the downloading of an ACL configuration from a RADIUS filter server.</p> <ul style="list-style-type: none"> • default --The default authorization list. • <i>methodlist [methodlist2...]</i>--One of the keywords listed on the password command page.

Configuring the Filter Cache

Follow the steps in this section to configure the AAA filter cache.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Router(config)# **aaa cache filter**
4. Router(config-aaa-filter)# **password 0 7} password**
5. Router(config-aaa-filter)# **cache disable**
6. Router(config-aaa-filter)# **cache clear age minutes**
7. Router(config-aaa-filter)# **cache refresh**
8. Router(config-aaa-filter)# **cache max number**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	Router(config)# aaa cache filter	Enables filter cache configuration and enters AAA filter configuration mode.
Step 4	Router(config-aaa-filter)# password 0 7} password	(Optional) Specifies the optional password that is to be used for filter server authentication requests. 0 --Specifies that an unencrypted password will follow. 7 --Specifies that a hidden password will follow. <i>password</i> --The unencrypted (clear text) password. Note If a password is not specified, the default password ("cisco") is enabled.
Step 5	Router(config-aaa-filter)# cache disable	(Optional) Disables the cache.
Step 6	Router(config-aaa-filter)# cache clear age minutes	(Optional) Specifies, in minutes, when cache entries expire and the cache is cleared.

	Command or Action	Purpose
		<p><i>minutes</i> --Any value between 0 to 4294967295.</p> <p>Note If a time is not specified, the default (1400 minutes [1 day]) is enabled.</p>
Step 7	Router(config-aaa-filter)# cache refresh	(Optional) Refreshes a cache entry when a new session begins. This command is enabled by default. To disable this functionality, use the no cache refresh command.
Step 8	Router(config-aaa-filter)# cache max number	<p>(Optional) Limits the absolute number of entries the cache can maintain for a particular server.</p> <p><i>number</i> --The maximum number of entries the cache can contain. Any value between 0 to 4294967295.</p> <p>Note If a number is not specified, the default (100 entries) is enabled.</p>

Verifying the Filter Cache

To display the cache status, use the **show aaa cache filterserver** EXEC command. The following is sample output for the **show aaa cache filterserver** command:

```
Router# show aaa cache filterserver
Filter      Server      Age Expires Refresh Access-Control-Lists
-----
aol         10.2.3.4    0    1440    100 ip in icmp drop
           ip out icmp drop
           ip out forward tcp dstip 1.2.3...
msn         10.3.3.4    N/A   Never   2 ip in tcp drop
msn2        10.4.3.4    N/A   Never   2 ip in tcp drop
vone        10.5.3.4    N/A   Never   0 ip in tcp drop
```



Note The **show aaa cache filterserver** command shows how many times a particular filter has been referenced or refreshed. This function may be used in administration to determine which filters are actually being used.

Troubleshooting Tips

To help troubleshoot your filter cache configurations, use the privileged EXEC **debug aaa cache filterserver** command. To view sample output for the **debug aaa cache filterserver** command, refer to the section “Debug Output Example” later in this document.

Monitoring and Maintaining the Filter Cache

To monitor and maintain filter caches, use at least one of the following EXEC commands:

Command	Purpose
Router# clear aaa cache filterserver acl <i>[filter-name]</i>	Clears the cache status for a particular filter or all filters.
Router# show aaa cache filterserver	Displays the cache status.

Configuration Examples for RADIUS Centralized Filter Management

NAS Configuration Example

The following example shows how to configure the NAS for cache filtering. In this example, the server group “mygroup” is contacted first. If there is no response, the default RADIUS server will then be contacted. If there still is no response, the local filters are contacted. Finally, the call is accepted if the filter cannot be resolved.

```
aaa authorization cache filterserver group mygroup group radius local none
!
aaa group server radius mygroup
  server 10.2.3.4
  server 10.2.3.5
!
radius-server host 10.1.3.4
!
aaa cache filter
  password mycisco
  no cache refresh
  cache max 100
!
```

RADIUS Server Configuration Example

The following example is a sample RADIUS configuration that is for a remote user “user1” dialing into the NAS:

```
myfilter Password = "cisco"
Service-Type = Outbound,
Ascend:Ascend-Call-Filter = "ip in drop srcip 10.0.0.1/32 dstip 10.0.0.10/32 icmp",
Ascend:Ascend-Call-Filter = "ip in drop srcip 10.0.0.1/32 dstip 10.0.0.10/32 tcp dstport =
telnet",
Ascend:Ascend-Cache-Refresh = Refresh-No,
Ascend:Ascend-Cache-Time = 15
user1 Password = "cisco"
Service-Type = Framed,
```

```
Filter-Id = "myfilter",
Ascend:Ascend-Filter-Required = Filter-Required-Yes,
```

RADIUS Dictionary and Vendors File Example

The following example is a sample RADIUS dictionary file for the new VSAs. In this example, the dictionary file is for a Merit server.

```
dictionary file:
Ascend.attr Ascend-Filter-Required 50 integer (*, 0, NOENCAPS)
Ascend.attr Ascend-Cache-Refresh 56 integer (*, 0, NOENCAPS)
Ascend.attr Ascend-Cache-Time 57 integer (*, 0, NOENCAPS)
Ascend.value Ascend-Cache-Refresh Refresh-No 0
Ascend.value Ascend-Cache-Refresh Refresh-Yes 1
Ascend.value Ascend-Filter-Required Filter-Required-No 0
Ascend.value Ascend-Filter-Required Filter-Required-Yes 1
vendors file:
50 50
56 56
57 57
```

Debug Output Example

The following is sample output from the `debug aaa cache filterserver` command:

```
Router# debug aaa cache filterserver

AAA/FLTSV: need "myfilter" (fetch), call 0x612DAC64
AAA/FLTSV: send req, call 0x612DAC50
AAA/FLTSV: method SERVER_GROUP myradius
AAA/FLTSV: rcv reply, call 0x612DAC50 (PASS)
AAA/FLTSV: create cache
AAA/FLTSV: add attr "call-inacl"
AAA/FLTSV: add attr "call-inacl"
AAA/FLTSV: add attr "call-inacl"
AAA/FLTSV: skip attr "filter-cache-refresh"
AAA/FLTSV: skip attr "filter-cache-time"
AAA/CACHE: set "AAA filtserv cache" entry "myfilter" refresh? no
AAA/CACHE: set "AAA filtserv cache" entry "myfilter" cachetime 15
AAA/FLTSV: add attr to list "call-inacl" call 0x612DAC64
AAA/FLTSV: add attr to list "call-inacl" call 0x612DAC64
AAA/FLTSV: add attr to list "call-inacl" call 0x612DAC64
AAA/FLTSV: PASS call 0x612DAC64
AAA/CACHE: timer "AAA filtserv cache", next in 10 secs (0 entries)
AAA/CACHE: timer "AAA filtserv cache", next in 10 secs (1 entry)
AAA/CACHE: destroy "AAA filtserv cache" entry "myfilter"
AAA/CACHE: timer "AAA filtserv cache", next in 10 secs (0 entries)
```

Additional References

The following sections provide references related to RADIUS Centralized Filter Management.

Related Documents

Related Topic	Document Title
Configuring Authorization	"Configuring Authorization" feature module.

Related Topic	Document Title
Configuring RADIUS	“ Configuring RADIUS ” feature module
Authorization Commands	<i>Cisco IOS Security Command Reference</i>

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Centralized Filter Management

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 8: Feature Information for RADIUS Centralized Filter Management

Feature Name	Releases	Feature Information
RADIUS Centralized Filter Management	12.2(13)T 12.2(28)SB 12.2(33)SRC 1	<p>The RADIUS Centralized Filter Management feature introduces a filter-server to simplify ACL configuration and management. This filter-server serves as a centralized RADIUS repository and administration point, which users can centrally manage and configure access control list (ACL) filters.</p> <p>This feature was introduced in Cisco IOS Release 12.2(13)T.</p> <p>This feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>This feature was integrated into Cisco IOS Release 12.2(33)SRC.</p> <p>The following commands were introduced or modified by this feature: aaa authorization cache filterserver, aaa cache filter, cache clear age, cache disable, cache refresh, clear aaa cache filterserver acl, debug aaa cache filterserver, password, show aaa cache filterserver.</p>



RADIUS Debug Enhancements

This document describes the Remote Authentication Dial-In User Services (RADIUS) Debug Enhancements feature.

- [Finding Feature Information, page 71](#)
- [Prerequisites for RADIUS Debug Enhancements, page 71](#)
- [Restrictions for RADIUS Debug Enhancements, page 72](#)
- [Information About RADIUS Debug Enhancements, page 72](#)
- [How to Enable RADIUS Debug Parameters, page 72](#)
- [Configuration Examples for RADIUS Debug Enhancements, page 74](#)
- [Additional References, page 76](#)
- [Feature Information for RADIUS Debug Enhancements, page 77](#)
- [Glossary, page 77](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Debug Enhancements

- Establish a working IP network. For more information about configuring IP refer to the Configuring IPv4 Addresses module.
- Configure the gateway as a RADIUS client. Refer to the section “Configuring the Voice Gateway as a RADIUS Client” section in the CDR Accounting for Cisco IOS Voice Gateways document.

- Be familiar with IETF RFC 2138.

Restrictions for RADIUS Debug Enhancements

Only Internet Engineering Task Force (IETF) attributes and Cisco vendor-specific attributes (VSAs) used in voice applications are supported. For unsupported attributes, “undebuggable” is displayed.

Information About RADIUS Debug Enhancements

RADIUS Overview

RADIUS is a distributed client/server system that provides the following functionality:

- Secures networks against unauthorized access.
- Enables authorization of specific service limits.
- Provides accounting information so that services can be billed.

In the Cisco implementation, RADIUS clients run on Cisco routers and send authentication requests to a central RADIUS server that contains all user authentication and network service access information.

Benefits of RADIUS Debug Enhancements

The **debug radius** command displays information associated with RADIUS. Prior to the RADIUS Debug Enhancements feature, **debug radius** output was available only in an expanded, hexadecimal string format, resulting in displays that were difficult to interpret and analyze. Moreover, attribute value displays were truncated, particularly for VSAs.

This feature provides enhanced RADIUS display including the following:

- Packet dump in a more readable, user-friendly ASCII format than before.
- Complete display of attribute values without truncation.
- Ability to select a brief RADIUS debug output display.
- Allows a compact debugging output option that is useful for high-traffic, operational environments.

How to Enable RADIUS Debug Parameters

Enabling RADIUS Debug Parameters

Perform this task to enable RADIUS debug parameters. By default, event logging is enabled.



Note Prior to Cisco IOS Release 12.2(11)T, the **debug radius** command enabled truncated debugging output in hexadecimal notation, rather than ASCII.

SUMMARY STEPS

1. **enable**
2. **debug radius** [accounting | authentication| brief | elog | failover| retransmit| verbose]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	debug radius [accounting authentication brief elog failover retransmit verbose] Example: Router# debug radius accounting	Enables debugging for the specified parameters associated with RADIUS configuration.

Verifying RADIUS Debug Parameters

Perform this task to verify RADIUS debug parameters.

SUMMARY STEPS

1. **enable**
2. **show debug**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	show debug Example: Router# show debug	Displays debug information.

Configuration Examples for RADIUS Debug Enhancements

Enabling RADIUS Debug Parameters Example

The following example shows how to enable debugging of RADIUS accounting collection.

```
Router> enable
Router# debug radius accounting
Radius protocol debugging is on
Radius protocol brief debugging is off
Radius protocol verbose debugging is off
Radius packet hex dump debugging is off
Radius packet protocol (authentication) debugging is off
Radius packet protocol (accounting) debugging is on
Radius packet retransmission debugging is off
Radius server fail-over debugging is off
Radius elog debugging is off
```



Note

The sample output above displays information that is found inside a RADIUS protocol message. For more information about RADIUS protocol messages, see IETF RFC 2138.

Verifying RADIUS Debug Parameters Example

The following example shows how to verify RADIUS debug parameters.

```
Router> enable
Router# show debug
00:02:50: RADIUS: ustruct sharecount=3
00:02:50: Radius: radius_port_info() success=0 radius_nas_port=1
00:02:50: RADIUS: Initial Transmit ISDN 0:D:23 id 0 10.0.0.0:1824, Accounting-Request, len
358
00:02:50: RADIUS: NAS-IP-Address [4] 6 10.0.0.1
00:02:50: RADIUS: Vendor, Cisco [26] 19 VT=02 TL=13 ISDN 0:D:23
00:02:50: RADIUS: NAS-Port-Type [61] 6 Async
00:02:50: RADIUS: User-Name [1] 12 "4085274206"
00:02:50: RADIUS: Called-Station-Id [30] 7 "52981"
00:02:50: RADIUS: Calling-Station-Id [31] 12 "4085554206"
00:02:50: RADIUS: Acct-Status-Type [40] 6 Start
00:02:50: RADIUS: Service-Type [6] 6 Login
00:02:50: RADIUS: Vendor, Cisco [26] 27 VT=33 TL=21 h323-gw-id=5300_43.
00:02:50: RADIUS: Vendor, Cisco [26] 55 VT=01 TL=49 h323-incoming-conf-id=8F3A3163 B4980003
0 29BD0
```

```

00:02:50: RADIUS: Vendor, Cisco [26] 31 VT=26 TL=25 h323-call-origin=answer
00:02:50: RADIUS: Vendor, Cisco [26] 32 VT=27 TL=26 h323-call-type=Telephony
00:02:50: RADIUS: Vendor, Cisco [26] 57 VT=25 TL=51 h323-setup-time=*16:02:48.681 PST Fri
Dec 31 1999
00:02:50: RADIUS: Vendor, Cisco [26] 46 VT=24 TL=40 h323-conf-id=8F3A3163 B4980003 029BD0
00:02:50: RADIUS: Acct-Session-Id [44] 10 "00000002"
00:02:50: RADIUS: Delay-Time [41] 6 0
00:02:51: RADIUS: Received from id 0 10.0.0.0:1824, Accounting-response, len 20
00:02:51: %ISDN-6-CONNECT: Interface Serial0:22 is now connected to 4085554206
00:03:01: RADIUS: ustruct sharecount=3
00:03:01: Radius: radius_port_info() success=0 radius_nas_port=1
00:03:01: RADIUS: Initial Transmit ISDN 0:D:23 id 1 1.7.157.1:1823, Access-Request, len 171

00:03:01: RADIUS: NAS-IP-Address [4] 6 10.0.0.1
00:03:01: RADIUS: Vendor, Cisco [26] 19 VT=02 TL=13 ISDN 0:D:23
00:03:01: RADIUS: NAS-Port-Type [61] 6 Async
00:03:01: RADIUS: User-Name [1] 8 "123456"
00:03:01: RADIUS: Vendor, Cisco [26] 46 VT=24 TL=40 h323-conf-id=8F3A3163 B4980003 0 29BD0

00:03:01: RADIUS: Calling-Station-Id [31] 12 "4085274206"
00:03:01: RADIUS: User-Password [2] 18 *
00:03:01: RADIUS: Vendor, Cisco [26] 36 VT=01 TL=30 h323-ivr-out=transactionID:0
00:03:01: RADIUS: Received from id 1 1.7.157.1:1823, Access-Accept, len 115
00:03:01: RADIUS: Service-Type [6] 6 Login
00:03:01: RADIUS: Vendor, Cisco [26] 29 VT=101 TL=23 h323-credit-amount=45
00:03:01: RADIUS: Vendor, Cisco [26] 27 VT=102 TL=21 h323-credit-time=33
00:03:01: RADIUS: Vendor, Cisco [26] 26 VT=103 TL=20 h323-return-code=0
00:03:01: RADIUS: Class [25] 7 6C6F63616C
00:03:01: RADIUS: saved authorization data for user 62321E14 at 6233D258
00:03:13: %ISDN-6-DISCONNECT: Interface Serial0:22 disconnected from 4085274206, call lasted
22 seconds
00:03:13: RADIUS: ustruct sharecount=2
00:03:13: Radius: radius_port_info() success=0 radius_nas_port=1
00:03:13: RADIUS: Sent class "local" at 6233D2C4 from user 62321E14
00:03:13: RADIUS: Initial Transmit ISDN 0:D:23 id 2 10.0.0.0:1824, Accounting-Request, len
775
00:03:13: RADIUS: NAS-IP-Address [4] 6 10.0.0.1
00:03:13: RADIUS: Vendor, Cisco [26] 19 VT=02 TL=13 ISDN 0:D:23
00:03:13: RADIUS: NAS-Port-Type [61] 6 Async
00:03:13: RADIUS: User-Name [1] 8 "123456"
00:03:13: RADIUS: Called-Station-Id [30] 7 "52981"
00:03:13: RADIUS: Calling-Station-Id [31] 12 "4085554206"
00:03:13: RADIUS: Acct-Status-Type [40] 6 Stop
00:03:13: RADIUS: Class [25] 7 6C6F63616C
00:03:13: RADIUS: Undebuggable [45] 6 00000001
00:03:13: RADIUS: Service-Type [6] 6 Login
00:03:13: RADIUS: Vendor, Cisco [26] 27 VT=33 TL=21 h323-gw-id=5300_43.
00:03:13: RADIUS: Vendor, Cisco [26] 55 VT=01 TL=49 h323-incoming-conf-id=8F3A3163 B4980003
0 29BD0
00:03:13: RADIUS: Vendor, Cisco [26] 31 VT=26 TL=25 h323-call-origin=answer
00:03:13: RADIUS: Vendor, Cisco [26] 32 VT=27 TL=26 h323-call-type=Telephony
00:03:13: RADIUS: Vendor, Cisco [26] 57 VT=25 TL=51 h323-setup-time=*16:02:48.681 PST Fri
Dec 31 1999
00:03:13: RADIUS: Vendor, Cisco [26] 59 VT=28 TL=53 h323-connect-time=*16:02:48.946
PST Fri Dec 31 1999
00:03:13: RADIUS: Vendor, Cisco [26] 62 VT=29 TL=56 h323-disconnect-time=*16:03:11.306
PST Fri Dec 31 1999
00:03:13: RADIUS: Vendor, Cisco [26] 32 VT=30 TL=26 h323-disconnect-cause=10
00:03:13: RADIUS: Vendor, Cisco [26] 28 VT=31 TL=22 h323-voice-quality=0
00:03:13: RADIUS: Vendor, Cisco [26] 46 VT=24 TL=40 h323-conf-id=8F3A3163 B4980003 0 29BD0
00:03:13: RADIUS: Acct-Session-Id [44] 10 "00000002"
00:03:13: RADIUS: Acct-Input-Octets [42] 6 0
00:03:13: RADIUS: Acct-Output-Octets [43] 6 88000
00:03:13: RADIUS: Acct-Input-Packets [47] 6 0
00:03:13: RADIUS: Acct-Output-Packets [48] 6 550
00:03:13: RADIUS: Acct-Session-Time [46] 6 22
00:03:13: RADIUS: Vendor, Cisco [26] 30 VT=01 TL=24 subscriber=RegularLine
00:03:13: RADIUS: Vendor, Cisco [26] 35 VT=01 TL=29 h323-ivr-out=Tariff:Unknown
00:03:13: RADIUS: Vendor, Cisco [26] 22 VT=01 TL=16 pre-bytes-in=0
00:03:13: RADIUS: Vendor, Cisco [26] 23 VT=01 TL=17 pre-bytes-out=0
00:03:13: RADIUS: Vendor, Cisco [26] 21 VT=01 TL=15 pre-paks-in=0
00:03:13: RADIUS: Vendor, Cisco [26] 22 VT=01 TL=16 pre-paks-out=0
00:03:13: RADIUS: Vendor, Cisco [26] 22 VT=01 TL=16 nas-rx-speed=0

```

```
00:03:13: RADIUS: Vendor, Cisco [26] 22 VT=01 TL=16 nas-tx-speed=0
00:03:13: RADIUS: Delay-Time [41] 6 0
00:03:13: RADIUS: Received from id 2 10.0.0.0:1824, Accounting-response, len 20
```

Additional References

The following sections provide references related to the RADIUS Debug Enhancements feature.

Related Documents

Related Topic	Document Title
Configuring RADIUS	"Configuring RADIUS" module.
Debug commands: complete command syntax, defaults, command mode, command history, usage guidelines, and examples	<i>Cisco IOS Debug Command Reference</i>

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2138	Remote Authentication Dial In User Service (RADIUS)

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/techsupport</p>

Feature Information for RADIUS Debug Enhancements

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 9: Feature Information for RADIUS Debug Enhancements

Feature Name	Releases	Feature Information
RADIUS Debug Enhancements	12.2(11)T	<p>This feature provides enhancements to the existing functionality of RADIUS debug parameters.</p> <p>The following commands were introduced or modified: debug radius and show debug.</p>

Glossary

AAA--authentication, authorization, and accounting. Pronounced "triple A."

ASCII --American Standard Code for Information Interchange. 8-bit code for character representation (7 bits plus parity).

attribute --Form of information items provided by the X.500 Directory Service. The directory information base consists of entries, each containing one or more attributes. Each attribute consists of a type identifier together with one or more values.

IETF--Internet Engineering Task Force. Task force consisting of over 80 working groups responsible for developing Internet standards. The IETF operates under the auspices of ISOC.

RADIUS --Remote Authentication Dial-In User Service. Database for authenticating modem and ISDN connections and for tracking connection time.

VoIP --Voice over IP. The capability to carry normal telephony-style voice over an IP-based internet with POTS-like functionality, reliability, and voice quality. VoIP enables a router to carry voice traffic (for example, telephone calls and faxes) over an IP network. In VoIP, the DSP segments the voice signal into frames, which then are coupled in groups of two and stored in voice packets. These voice packets are transported using IP in compliance with ITU-T specification H.323.

VSA --vendor-specific attribute. An attribute that has been implemented by a particular vendor. It uses the attribute Vendor-Specific to encapsulate the resulting AV pair: essentially, Vendor-Specific = protocol:attribute = value.



RADIUS Logical Line ID

The RADIUS Logical Line ID feature, also known as the Logical Line Identification (LLID) Blocking feature enables administrators to track their customers on the basis of the physical lines on which customer calls originate. Administrators use a virtual port that does not change as customers move from one physical line to another. This virtual port facilitates the maintenance of the administrator's customer profile database and allows the administrator to do additional security checks on customers.

- [Finding Feature Information, page 79](#)
- [Prerequisites for RADIUS Logical Line ID, page 80](#)
- [Restrictions for RADIUS Logical Line ID, page 80](#)
- [Information About RADIUS Logical Line ID, page 80](#)
- [How to Configure RADIUS Logical Line ID, page 81](#)
- [Configuration Examples for RADIUS Logical Line ID, page 83](#)
- [Additional References, page 84](#)
- [Feature Information for RADIUS Logical Line ID, page 86](#)
- [Glossary, page 87](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Logical Line ID

Although this feature can be used with any RADIUS server, some RADIUS servers may require modifications to their dictionary files to allow the Calling-Station-ID attribute to be returned in Access-Accept messages. For example, the Merit RADIUS server does not support LLID downloading unless you modify its dictionary as follows: "ATTRIBUTE Calling-Station-Id 31 string (*, *)"

Restrictions for RADIUS Logical Line ID

The RADIUS Logical Line ID feature supports RADIUS only. TACACS+ is not supported.

This feature can be applied only toward PPP over Ethernet over ATM (PPPoEoATM) and PPP over Ethernet over VLAN (PPPoEoVLAN) (Dot1Q) calls; no other calls, such as ISDN, can be used.

Information About RADIUS Logical Line ID

LLID is an alphanumeric string (which must be a minimum of one character and a maximum of 253 characters) that is a logical identification of a subscriber line. LLID is maintained in a customer profile database on a RADIUS server. When the customer profile database receives a preauthorization request from the access router, the RADIUS server sends the LLID to the router as the Calling-Station-ID attribute (attribute 31).

The Layer 2 Tunneling Protocol (L2TP) access concentrator (LAC) sends a preauthorization request to the customer profile database when the LAC is configured for preauthorization. Configure the LAC for preauthorization using the **subscriber access** command.



Note

Downloading the LLID is referred to as "preauthorization" because it occurs before either service (domain) authorization or user authentication and authorization occur.

The customer profile database on the RADIUS server consists of user profiles for each physical network access server (NAS) port that is connected to the router. Each user profile contains a profile matched to a username (attribute 1) representing the physical port on the router. When the router is configured for preauthorization, it queries the customer profile database using a username representative of the physical NAS port making the connection to the router. When a match is found in the customer profile database, the customer profile database returns an Access-Accept message containing the LLID in the user profile. The LLID is defined in the Access-Accept record as the Calling-Station-ID attribute.

The preauthorization process can also provide the real username being used for authentication to the RADIUS server. Because the physical NAS port information is being used as the username (attribute 1), RADIUS attribute 77 (Connect-Info) can be configured to contain the authentication username. This configuration allows the RADIUS server to provide additional validation on the authorization request if it chooses, such as analyzing the username for privacy rules, before returning an LLID back to the router.

How to Configure RADIUS Logical Line ID

Configuring Preauthorization

To download the LLID and configure the LAC for preauthorization, perform the following steps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip radius source-interface** *interface-name*
4. **subscriber access** {pppoe | pppoa} **pre-authorize nas-port-id** [default | *list-name*][send username]

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	ip radius source-interface <i>interface-name</i> Example: <pre> Router (config)# ip radius source-interface Loopback1 </pre>	Specifies the IP address portion of the username for the preauthorization request.
Step 4	subscriber access {pppoe pppoa} pre-authorize nas-port-id [default <i>list-name</i>][send username] Example: <pre> Subscriber-Access-Config# subscriber access pppoe pre-authorize nas-port-id default </pre>	Enables the LLID to be downloaded so the router can be configured for preauthorization. The send username option specifies that you include the authentication username of the session inside the Connect-Info (attribute 77) in the Access-Request message.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router (config)# subscriber access pppoe pre-authorize nas-port-id mlist_llid send username</pre>	

Configuring the LLID in a RADIUS User Profile

To configure the user profile for preauthorization, add a NAS port user to the customer profile database and add RADIUS Internet Engineering Task Force (IETF) attribute 31 (Calling-Station-ID) to the user profile.

SUMMARY STEPS

1. `UserName=nas_port: ip-address:slot/module/port/vpi.vci`
2. `User-Name=nas-port: ip-address:slot/module/port/vlan-id`
3. `Calling-Station-Id = "string (*,*)"`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>UserName=nas_port: ip-address:slot/module/port/vpi.vci</code>	(Optional) Adds a PPPoE over ATM NAS port user.
Step 2	<code>User-Name=nas-port: ip-address:slot/module/port/vlan-id</code>	(Optional) Adds a PPPoE over VLAN NAS port user.
Step 3	<code>Calling-Station-Id = "string (*,*)"</code>	<p>Adds attribute 31 to the user profile.</p> <ul style="list-style-type: none"> • <code>String--</code> One or more octets, containing the phone number from which the user placed the call.

Verifying Logical Line ID

To verify feature functionality, perform the following steps.

SUMMARY STEPS

1. `enable`
2. `debug radius`

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	debug radius Example: Router# debug radius	Checks to see that RADIUS attribute 31 is the LLID in the Accounting-Request on LAC and in the Access-Request and Accounting-Request on the LNS.

Configuration Examples for RADIUS Logical Line ID

LAC for Preauthorization Configuration Example

The following example shows how to configure your LAC for preauthorization by downloading the LLID:

```

aaa new-model
aaa group server radius sg_llid
  server 172.31.164.106 auth-port 1645 acct-port 1646
aaa group server radius sg_water
  server 172.31.164.106 auth-port 1645 acct-port 1646
aaa authentication ppp default group radius
aaa authorization config-commands
aaa authorization network default group sg_water
aaa authorization network mlist_llid group sg_llid
aaa session-id common
!
username s7200_2 password 0 lab
username s5300 password 0 lab
username sg_water password 0 lab
vpdn enable
!
vpdn-group 2
  request-dialin
  protocol l2tp
  domain water.com
  domain water.com#184
  initiate-to ip 10.1.1.1
  local name s7200_2
  l2tp attribute clid mask-method right * 255 match #184
!
vpdn-group 3
  accept dialin
  protocol pppoe
  virtual-template 1
!
!
Enable the LLID to be downloaded.
subscriber access pppoe pre-authorize nas-port-id mlist_llid send username
!

```

```

interface Loopback0
 ip address 10.1.1.2 255.255.255.0
!
interface Loopback1
 ip address 10.1.1.1 255.255.255.0
!
interface Ethernet1/0
 ip address 10.1.1.8 255.255.255.0 secondary
 ip address 10.0.58.111 255.255.255.0
 no cdp enable
!
interface ATM4/0
 no ip address
 no atm ilmi-keepalive
!
interface ATM4/0.1 point-to-point
 pvc 1/100
 encapsulation aal5snap
 protocol pppoe
!
interface virtual-template1
 no ip unnumbered Loopback0
 no peer default ip address
 ppp authentication chap
!
radius-server host 172.31.164.120 auth-port 1645 acct-port 1646 key rad123
radius-server host 172.31.164.106 auth-port 1645 acct-port 1646 key rad123
ip radius source-interface Loopback1

```

RADIUS User Profile for LLID Example

The following example shows how to configure the user profile for LLID querying for PPPoEoVLAN and PPPoEoATM and how to add attribute 31:

```

pppoeovlan
-----
nas-port:10.1.0.3:6/0/0/0 Password = "cisco",
 Service-Type = Outbound,
 Calling-Station-ID = "cat-example"
pppoeoa
-----
nas-port:10.1.0.3:6/0/0/1.100 Password = "cisco",
 Service-Type = Outbound,
 Calling-Station-ID = "cat-example"

```

Additional References

The following sections provide references related to RADIUS Logical Line ID.

Related Documents

Related Topic	Document Title
AAA authentication	“Configuring AAA Preauthentication ” section in the “ Configuring RADIUS ” module.
Attribute screening for access requests	“RADIUS Attribute Screening” section in the in the “ Configuring RADIUS ” module .

Related Topic	Document Title
Broadband access: PPP and routed bridge encapsulation	<i>Cisco IOS Broadband Access Aggregation and DSL Configuration Guide</i> , Release 12.4T
Dial technologies	<i>Cisco IOS Dial Technologies Configuration Guide</i> , Release 12.4T

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Logical Line ID

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 10: Feature Information for RADIUS Logical Line ID

Feature Name	Releases	Feature Information
RADIUS Logical Line ID	12.2(13)T 12.2(15)B 12.3(14)YM1 12.4(2)T 12.3(14)YM2 12.2(28)SB 12.2(31)SB2 12.2(33)SRC	<p>The RADIUS Logical Line ID feature, also known as the Logical Line Identification (LLID) Blocking feature enables administrators to track their customers on the basis of the physical lines on which customer calls originate.</p> <p>This feature was introduced in Cisco IOS Release 12.2(13)T.</p> <p>This feature was integrated into Cisco IOS Release 12.2(15)B.</p> <p>This feature was integrated into Cisco IOS Release 12.3(14)YM1, and the send username keyword was added to the subscriber access command.</p> <p>This feature was integrated into Cisco IOS Release 12.4(2)T.</p> <p>This feature was integrated into Cisco IOS Release 12.3(14)YM2.</p> <p>This feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>This feature was integrated into Cisco IOS Release 12.2(31)SB2.</p> <p>This feature was integrated into Cisco IOS Release 12.2(33)SRC.</p> <p>The subscriber access command was introduced by this feature.</p>

Glossary

LLID Blocking --A feature that enables administrators to track their customers on the basis of the physical lines on which the calls of the customers originate. Also known as RADIUS Logical Line ID.

RADIUS Logical Line ID --A feature that enables administrators to track their customers on the basis of the physical lines on which the calls of the customers originate. Also known as LLID Blocking.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental. © 2002, 2003, 2005-2009 Cisco Systems, Inc. All rights reserved.



RADIUS Route Download

The RADIUS Route Download feature allows users to configure their network access server (NAS) to direct RADIUS authorization. Users configure a separate named method list (in addition to the default method list) for static route download requests sent by their NAS to authorization, authentication, and accounting (AAA) servers.

Before this feature, RADIUS authorization for static route download requests was sent only to AAA servers specified by the default method list.

This feature extends the functionality of the **aaa route download** command to allow users to specify the name of the method list that will be used to direct static route download requests to the AAA servers. The **aaa route download** command may be used to specify a separate method list for downloading static routes. This method list can be added by using the **aaa authorization configuration** command.

- [Finding Feature Information, page 89](#)
- [Prerequisites for RADIUS Route Download, page 90](#)
- [How to Configure RADIUS Route Download, page 90](#)
- [Configuration Examples for RADIUS Route Download, page 91](#)
- [Additional References, page 91](#)
- [Feature Information for RADIUS Route Download, page 92](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Route Download

AAA network security must be enabled before you perform the tasks in this feature.

How to Configure RADIUS Route Download

Configuring RADIUS Route Download

To configure the NAS to send static route download requests to the servers specified by a named method list, use the following commands in global configuration mode:

SUMMARY STEPS

1. Router(config)# **aaa authorization configuration** *method-name* [**radius** | **tacacs+** | **group** *group-name*]
2. Router(config)# **aaa route download** [*time*] [**authorization** *method-list*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config)# aaa authorization configuration <i>method-name</i> [radius tacacs+ group <i>group-name</i>]	Downloads static route configuration information from the AAA server using RADIUS.
Step 2	Router(config)# aaa route download [<i>time</i>] [authorization <i>method-list</i>]	Enables the static route download feature. Use the authorization <i>method-list</i> attributes to specify a named method list to which RADIUS authorization requests for static route downloads are sent.

Verifying RADIUS Route Download

To verify the routes that are installed, use the **show ip route** command in EXEC mode.

To display information that is associated with RADIUS, use the **debug radius** command in privileged EXEC mode.

Configuration Examples for RADIUS Route Download

RADIUS Route Download Configuration Example

The following example shows how to configure the NAS to send static route download requests to the servers specified by the method list named "list1":

```
aaa new-model
aaa group server radius rad1
server 10.2.2.2 auth-port 1645 acct-port 1646
!
aaa group server tacacs+ tacl
server 172.17.3.3
!
aaa authorization configuration default group radius
aaa authorization configuration list1 group rad1 group tacl
aaa route download 1 authorization list1
tacacs-server host 172.17.3.3
tacacs-server key cisco
tacacs-server administration
!
radius-server host 10.2.2.2 auth-port 1645 acct-port 1646
radius-server key cisco
```

Additional References

The following sections provide references related to RADIUS Route Download.

Related Documents

Related Topic	Document Title
Configuring Large-Scale Dial-Out	<i>Cisco IOS Dial Technologies Command Reference</i>
Cisco IOS Dial Technologies	

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Route Download

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 11: Feature Information for RADIUS Route Download

Feature Name	Releases	Feature Information
RADIUS Route Download	12.2(8)T 12.2(28)SB 12.2(33)SRC	<p>The RADIUS Route Download feature allows users to configure their network access server (NAS) to direct RADIUS authorization. Users configure a separate named method list (in addition to the default method list) for static route download requests sent by their NAS to authorization, authentication, and accounting (AAA) servers.</p> <p>The aaa route download command was introduced by this feature.</p>



CHAPTER 8

RADIUS Server Load Balancing

The RADIUS Server Load Balancing feature distributes authentication, authorization, and accounting (AAA) authentication and accounting transactions across RADIUS servers in a server group. These servers can share the AAA transaction load and thereby respond faster to incoming requests.

This module describes the RADIUS Server Load Balancing feature.

- [Finding Feature Information, page 95](#)
- [Prerequisites for RADIUS Server Load Balancing, page 95](#)
- [Restrictions for RADIUS Server Load Balancing, page 96](#)
- [Information About RADIUS Server Load Balancing, page 96](#)
- [How to Configure RADIUS Server Load Balancing, page 98](#)
- [Configuration Examples for RADIUS Server Load Balancing, page 102](#)
- [Additional References for RADIUS Server Load Balancing, page 113](#)
- [Feature Information for RADIUS Server Load Balancing, page 114](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Server Load Balancing

- Authentication, authorization, and accounting (AAA) must be configured on the RADIUS server.
- AAA RADIUS server groups must be configured.

- RADIUS must be configured for functions such as authentication, accounting, or static route download.

Restrictions for RADIUS Server Load Balancing

- Incoming RADIUS requests, such as Packet of Disconnect (POD) requests, are not supported.
- Load balancing is not supported on proxy RADIUS servers and for private server groups.

Information About RADIUS Server Load Balancing

RADIUS Server Load Balancing Overview

Load balancing distributes batches of transactions to RADIUS servers within a server group. Load balancing assigns each batch of transactions to the server with the lowest number of outstanding transactions in its queue. The process of assigning a batch of transactions is as follows:

- 1 The first transaction is received for a new batch.
- 2 All server transaction queues are checked.
- 3 The server with the lowest number of outstanding transactions is identified.
- 4 The identified server is assigned the next batch of transactions.

The batch size is a user-configured parameter. Changes in the batch size may impact CPU load and network throughput. As batch size increases, CPU load decreases and network throughput increases. However, if a large batch size is used, all available server resources may not be fully utilized. As batch size decreases, CPU load increases and network throughput decreases.



Note

There is no set number for large or small batch sizes. A batch with more than 50 transactions is considered large and a batch with fewer than 25 transactions is considered small.



Note

If a server group contains ten or more servers, we recommend that you set a high batch size to reduce CPU load.

Transaction Load Balancing Across RADIUS Server Groups

You can configure load balancing either per-named RADIUS server group or for the global RADIUS server group. The load balancing server group must be referred to as “radius” in the authentication, authorization, and accounting (AAA) method lists. All public servers that are part of the RADIUS server group are then load balanced.

You can configure authentication and accounting to use the same RADIUS server or different servers. In some cases, the same server can be used for preauthentication, authentication, or accounting transactions for a session. The preferred server, which is an internal setting and is set as the default, informs AAA to use the same server for the start and stop record for a session regardless of the server cost. When using the preferred server setting, ensure that the server that is used for the initial transaction (for example, authentication), the preferred server, is part of any other server group that is used for a subsequent transaction (for example, accounting).

The preferred server is not used if one of the following criteria is true:

- The **load-balance method least-outstanding ignore-preferred-server** command is used.
- The preferred server is dead.
- The preferred server is in quarantine.
- The want server flag has been set, overriding the preferred server setting.

The want server flag, an internal setting, is used when the same server must be used for all stages of a multistage transaction regardless of the server cost. If the want server is not available, the transaction fails.

You can use the **load-balance method least-outstanding ignore-preferred-server** command if you have either of the following configurations:

- Dedicated authentication server and a separate dedicated accounting server
- Network where you can track all call record statistics and call record details, including start and stop records and records that are stored on separate servers

If you have a configuration where authentication servers are a superset of accounting servers, the preferred server is not used.

RADIUS Server Status and Automated Testing

The RADIUS Server Load Balancing feature considers the server status when assigning batches. Transaction batches are sent only to live servers. We recommend that you test the status of all RADIUS load-balanced servers, including low usage servers (for example, backup servers).

Transactions are not sent to a server that is marked dead. A server is marked dead until its timer expires, at which time it moves to quarantine state. A server is in quarantine until it is verified alive by the RADIUS automated tester functionality.

To determine if a server is alive and available to process transactions, the RADIUS automated tester sends a request periodically to the server for a test user ID. If the server returns an Access-Reject message, the server is alive; otherwise the server is either dead or quarantined.

A transaction sent to an unresponsive server is failed over to the next available server before the unresponsive server is marked dead. We recommend that you use the retry reorder mode for failed transactions.

When using the RADIUS automated tester, verify that the authentication, authorization, and accounting (AAA) servers are responding to the test packets that are sent by the network access server (NAS). If the servers are not configured correctly, packets may be dropped and the server erroneously marked dead.

**Caution**

We recommend that you use a test user that is not defined on the RADIUS server for the RADIUS server automated testing to protect against security issues that may arise if the test user is not correctly configured.

**Note**

Use the `test aaa group` command to check load-balancing transactions.

How to Configure RADIUS Server Load Balancing

Enabling Load Balancing for a Named RADIUS Server Group

SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `radius-server host {hostname | ip-address} [test username name] [auth-port number] [ignore-auth-port] [acct-port number] [ignore-acct-port] [idle-time seconds]`
4. `aaa group server radius group-name`
5. `load-balance method least-outstanding [batch-size number] [ignore-preferred-server]`
6. `end`

DETAILED STEPS

	Command or Action	Purpose
Step 1	<code>enable</code> Example: Device> <code>enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<code>configure terminal</code> Example: Device# <code>configure terminal</code>	Enters global configuration mode.
Step 3	<code>radius-server host {hostname ip-address} [test username name] [auth-port number] [ignore-auth-port] [acct-port number] [ignore-acct-port] [idle-time seconds]</code> Example: Device(config)# <code>radius-server host 192.0.2.1 test username test1 idle-time 1</code>	Enables RADIUS automated testing.

	Command or Action	Purpose
Step 4	aaa group server radius <i>group-name</i> Example: Device(config)# aaa group server radius rad-sg	Enters server group configuration mode.
Step 5	load-balance method least-outstanding [batch-size <i>number</i>] [ignore-preferred-server] Example: Device(config-sg)# load-balance method least-outstanding batch-size 30	Enables the least-outstanding load balancing for a named server group.
Step 6	end Example: Device(config-sg)# end	Exits server group configuration mode and enters privileged EXEC mode.

Enabling Load Balancing for a Global RADIUS Server Group

The global RADIUS server group is referred to as “radius” in the authentication, authorization, and accounting (AAA) method lists.

SUMMARY STEPS

1. enable
2. configure terminal
3. radius-server host {*hostname* | *ip-address*} [test username *name*] [auth-port *number*] [ignore-auth-port] [acct-port *number*] [ignore-acct-port] [idle-time *seconds*]
4. radius-server load-balance method least-outstanding [batch-size *number*] [ignore-preferred-server]
5. load-balance method least-outstanding [batch-size *number*] [ignore-preferred-server]
6. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	radius-server host <i>{hostname ip-address}</i> [test username name] [auth-port number] [ignore-auth-port] [acct-port number] [ignore-acct-port] [idle-time seconds] Example: Device(config)# radius-server host 192.0.2.1 test username test1 idle-time 1	Enables RADIUS automated testing.
Step 4	radius-server load-balance method least-outstanding [batch-size number] [ignore-preferred-server] Example: Device(config)# radius-server load-balance method least-outstanding	Enables the least-outstanding load balancing for the global RADIUS server group and enters server group configuration mode. <ul style="list-style-type: none"> • The default batch size is 25. The batch size range is from 1 to 2147483647.
Step 5	load-balance method least-outstanding [batch-size number] [ignore-preferred-server] Example: Device(config-sg)# load-balance method least-outstanding batch-size 5	Enables least-outstanding load balancing for a global named server group.
Step 6	end Example: Device(config-sg)# end	Exits server group configuration mode and enters privileged EXEC mode.

Troubleshooting RADIUS Server Load Balancing

After configuring the RADIUS Server Load Balancing feature, you can monitor the idle timer, dead timer, and load balancing server selection or verify the server status by using a manual test command.

SUMMARY STEPS

1. Use the **debug aaa test** command to determine when an idle timer or dead timer has expired, when test packets are sent, the status of the server, or to verify the server state.
2. Use the **debug aaa sg-server selection** command to determine the server that is selected for load balancing.
3. Use the **test aaa group** command to manually verify the RADIUS load-balanced server status.

DETAILED STEPS

Step 1 Use the **debug aaa test** command to determine when an idle timer or dead timer has expired, when test packets are sent, the status of the server, or to verify the server state.

The idle timer is used to check the server status and is updated with or without any incoming requests. Monitoring the idle timer helps to determine if there are nonresponsive servers and to keep the RADIUS server status updated to efficiently utilize available resources. For instance, an updated idle timer would help ensure that incoming requests are sent to servers that are alive.

The dead timer is used either to determine that a server is dead or to update a dead server's status appropriately.

Monitoring server selection helps to determine how often the server selection changes. Server selection is effective in analyzing if there are any bottlenecks, a large number of queued requests, or if only specific servers are processing incoming requests.

The following sample output from the **debug aaa test** command shows when the idle timer expired:

Example:

```
Device# debug aaa test
```

```
Jul 16 00:07:01: AAA/SG/TEST: Server (192.0.2.245:1700,1701) quarantined.
Jul 16 00:07:01: AAA/SG/TEST: Sending test request(s) to server (192.0.2.245:1700,1701)
Jul 16 00:07:01: AAA/SG/TEST: Sending 1 Access-Requests, 1 Accounting-Requests in current batch.
Jul 16 00:07:01: AAA/SG/TEST(Req#: 1): Sending test AAA Access-Request.
Jul 16 00:07:01: AAA/SG/TEST(Req#: 1): Sending test AAA Accounting-Request.
Jul 16 00:07:01: AAA/SG/TEST: Obtained Test response from server (192.0.2.245:1700,1701)
Jul 16 00:07:01: AAA/SG/TEST: Obtained Test response from server (192.0.2.245:1700,1701)
Jul 16 00:07:01: AAA/SG/TEST: Necessary responses received from server (192.0.2.245:1700,1701)
Jul 16 00:07:01: AAA/SG/TEST: Server (192.0.2.245:1700,1701) marked ALIVE. Idle timer set for 60
sec(s).
Jul 16 00:07:01: AAA/SG/TEST: Server (192.0.2.245:1700,1701) removed from quarantine.
```

Step 2 Use the **debug aaa sg-server selection** command to determine the server that is selected for load balancing.

The following sample output from the **debug aaa sg-server selection** command shows five access requests being sent to a server group with a batch size of three:

Example:

```
Device# debug aaa sg-server selection
```

```
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: [3] transactions remaining in batch. Reusing server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: [2] transactions remaining in batch. Reusing server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: [1] transactions remaining in batch. Reusing server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: No more transactions in batch. Obtaining a new server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining a new least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Server[0] load: 3
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Server[1] load: 0
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Server[2] load: 0
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Selected Server[1] with load 0
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: [3] transactions remaining in batch.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: Obtaining least loaded server.
Jul 16 03:15:05: AAA/SG/SERVER_SELECT: [2] transactions remaining in batch. Reusing server.
```

Step 3 Use the **test aaa group** command to manually verify the RADIUS load-balanced server status.

The following sample output shows the response from a load-balanced RADIUS server that is alive when the username "test" does not match a user profile. The server is verified alive when it issues an Access-Reject response to an authentication, authorization, and accounting (AAA) packet generated using the `test aaa group` command.

Example:

```
Device# test aaa group SG1 test lab new-code

00:06:07: RADIUS/ENCODE(00000000):Orig. component type = INVALID
00:06:07: RADIUS/ENCODE(00000000): dropping service type, "radius-server attribute 6 on-for-login-auth"
is off
00:06:07: RADIUS(00000000): Config NAS IP: 192.0.2.4
00:06:07: RADIUS(00000000): sending
00:06:07: RADIUS/ENCODE: Best Local IP-Address 192.0.2.141 for Radius-Server 192.0.2.176
00:06:07: RADIUS(00000000): Send Access-Request to 192.0.2.176:1645 id 1645/1, len 50
00:06:07: RADIUS: authenticator CA DB F4 9B 7B 66 C8 A9 - D1 99 4E 8E A4 46 99 B4
00:06:07: RADIUS: User-Password [2] 18 *
00:06:07: RADIUS: User-Name [1] 6 "test"
00:06:07: RADIUS: NAS-IP-Address [4] 6 192.0.2.141
00:06:07: RADIUS: Received from id 1645/1 192.0.2.176:1645, Access-Reject, len 44
00:06:07: RADIUS: authenticator 2F 69 84 3E F0 4E F1 62 - AB B8 75 5B 38 82 49 C3
00:06:07: RADIUS: Reply-Message [18] 24
00:06:07: RADIUS: 41 75 74 68 65 6E 74 69 63 61 74 69 6F 6E 20 66 [Authentication f]
00:06:07: RADIUS: 61 69 6C 75 72 65 [failure]
00:06:07: RADIUS(00000000): Received from id 1645/1
00:06:07: RADIUS/DECODE: Reply-Message fragments, 22, total 22 bytes
```

Configuration Examples for RADIUS Server Load Balancing

Example: Enabling Load Balancing for a Global RADIUS Server Group

The following examples show how to enable load balancing for global RADIUS server groups. These examples are shown in three parts: the current configuration of the RADIUS command output, debug output, and authentication, authorization, and accounting (AAA) server status information. You can use delimiting characters to display relevant parts of the configuration.

The following example shows the relevant RADIUS configuration:

```
Device# show running-config | include radius

aaa authentication ppp default group radius
aaa accounting network default start-stop group radius
radius-server host 192.0.2.238 auth-port 2095 acct-port 2096 key cisco
radius-server host 192.0.2.238 auth-port 2015 acct-port 2016 key cisco
radius-server load-balance method least-outstanding batch-size 5
```

Lines in the current configuration of the preceding RADIUS command output are defined as follows:

- The `aaa authentication ppp` command authenticates all PPP users using RADIUS.
- The `aaa accounting` command enables the sending of all accounting requests to an AAA server when the client is authenticated and then disconnected through use of the `start-stop` keyword.
- The `radius-server host` command defines the IP address of the RADIUS server host with the authorization and accounting ports specified and the authentication and encryption keys identified.

- The **radius-server load-balance** command enables load balancing for global RADIUS server groups with the batch size specified.

The **show debug** sample output below shows the selection of the preferred server and the processing of requests for the configuration:

```
Device# show debug

General OS:
  AAA server group server selection debugging is on
#
<sending 10 pppoe requests>
Device#
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000014):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[0] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Selected Server[0] with load 0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000014):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000015):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000015):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000016):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[3] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000016):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000017):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[2] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000017):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000018):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[1] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000018):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000019):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[0] load:5
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Selected Server[1] with load 0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000019):Server (192.0.2.238:2015,2016) now being
used as preferred server.
```

The following sample output from the **show aaa servers** command shows the AAA server status for the global RADIUS server group configuration:

The sample output shows the status of two RADIUS servers. Both servers are up and successfully processed in the last 2 minutes:

- Five out of six authentication requests

Example: Enabling Load Balancing for a Global RADIUS Server Group

- Five out of five accounting requests

```
Device# show aaa servers

RADIUS:id 4, priority 1, host 192.0.2.238, auth-port 2095, acct-port 2096
  State:current UP, duration 3175s, previous duration 0s
  Dead:total time 0s, count 0
  Quarantined:No
  Authen:request 6, timeouts 1
    Response:unexpected 1, server error 0, incorrect 0, time 1841ms
    Transaction:success 5, failure 0
  Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Account:request 5, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 3303ms
    Transaction:success 5, failure 0
  Elapsed time since counters last cleared:2m
RADIUS:id 5, priority 2, host 192.0.2.238, auth-port 2015, acct-port 2016
  State:current UP, duration 3175s, previous duration 0s
  Dead:total time 0s, count 0
  Quarantined:No
  Authen:request 6, timeouts 1
    Response:unexpected 1, server error 0, incorrect 0, time 1955ms
    Transaction:success 5, failure 0
  Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Account:request 5, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 3247ms
    Transaction:success 5, failure 0
  Elapsed time since counters last cleared:2m
```

Example: Server Configuration and Enabling Load Balancing for Global RADIUS Server Group

The following example shows the relevant RADIUS configuration:

```
Device# show running-config | include radius

aaa authentication ppp default group radius
aaa accounting network default start-stop group radius
radius-server host 192.0.2.238 auth-port 2095 acct-port 2096 key cisco
radius-server host 192.0.2.238 auth-port 2015 acct-port 2016 key cisco
radius-server load-balance method least-outstanding batch-size 5
```

Lines in the current configuration of the RADIUS command output above are defined as follows:

- The **aaa authentication ppp** command authenticates all PPP users using RADIUS.
- The **aaa accounting** command enables the sending of all accounting requests to an authentication, authorization, and accounting (AAA) server when the client is authenticated and then disconnected by using the **start-stop** keyword .
- The **radius-server host** command defines the IP address of the RADIUS server host with the authorization and accounting ports specified and the authentication and encryption keys identified.
- The **radius-server load-balance** command enables load balancing for global RADIUS server groups with the batch size specified.

Example: Debug Output for Global RADIUS Server Group

The **debug** command output below shows the selection of the preferred server and the processing of requests for the configuration.

```
Device# show debug

General OS:
  AAA server group server selection debugging is on
#
<sending 10 pppoe requests>
Device#
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000014):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[0] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Selected Server[0] with load 0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000014):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000015):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000015):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000016):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[3] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000016):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000017):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[2] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000017):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000018):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[1] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000018):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000019):No preferred server available.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Server[0] load:5
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:Selected Server[1] with load 0
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(00000019):Server (192.0.2.238:2015,2016) now being
used as preferred server.
```

Example: Server Status Information for Global RADIUS Server Group

The following sample output from the **show aaa server** command shows the AAA server status for the global RADIUS server group configuration:

```
Device# show aaa server

RADIUS:id 4, priority 1, host 192.0.2.238, auth-port 2095, acct-port 2096
State:current UP, duration 3175s, previous duration 0s
```

```

Dead:total time 0s, count 0
Quarantined:No
Authen:request 6, timeouts 1
    Response:unexpected 1, server error 0, incorrect 0, time 1841ms
    Transaction:success 5, failure 0
Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
Account:request 5, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 3303ms
    Transaction:success 5, failure 0
Elapsed time since counters last cleared:2m
RADIUS:id 5, priority 2, host 192.0.2.238, auth-port 2015, acct-port 2016
State:current UP, duration 3175s, previous duration 0s
Dead:total time 0s, count 0
Quarantined:No
Authen:request 6, timeouts 1
    Response:unexpected 1, server error 0, incorrect 0, time 1955ms
    Transaction:success 5, failure 0
Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
Account:request 5, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 3247ms
    Transaction:success 5, failure 0
Elapsed time since counters last cleared:2m

```

The sample output shows the status of two RADIUS servers. Both servers are up and successfully processed in the last 2 minutes:

- 5 out of 6 authentication requests
- 5 out of 5 accounting requests

Example: Enabling Load Balancing for a Named RADIUS Server Group

The following examples show load balancing enabled for a named RADIUS server group. These examples are shown in three parts: the current configuration of the RADIUS command output, debug output, and authentication, authorization, and accounting (AAA) server status information.

The following sample output shows the relevant RADIUS configuration:

```

Device# show running-config
.
.
.
aaa group server radius server-group1
  server 192.0.2.238 auth-port 2095 acct-port 2096
  server 192.0.2.238 auth-port 2015 acct-port 2016
  load-balance method least-outstanding batch-size 5
!
aaa authentication ppp default group server-group1
aaa accounting network default start-stop group server-group1
.
.
.

```

The lines in the current configuration of the preceding RADIUS command output are defined as follows:

- The **aaa group server radius** command shows the configuration of a server group with two member servers.
- The **load-balance** command enables load balancing for global RADIUS server groups with the batch size specified.
- The **aaa authentication ppp** command authenticates all PPP users using RADIUS.

- The **aaa accounting** command enables sending of all accounting requests to the AAA server when the client is authenticated and then disconnected using the **start-stop** keyword.

The show debug sample output below shows the selection of the preferred server and the processing of requests for the preceding configuration:

```
Device# show debug
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002C):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Server[0] load:0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Selected Server[0] with load 0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002C):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002D):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002D):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002E):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[3] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002E):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002F):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[2] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002F):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(00000030):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[1] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(00000030):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000031):No preferred server available.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Server[0] load:5
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Selected Server[1] with load 0
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000031):Server (192.0.2.238:2015,2016) now being
used as preferred server
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000032):No preferred server available.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
.
.
.
```

The following sample output from the **show aaa servers** command shows the AAA server status for the named RADIUS server group configuration:

The sample output shows the status of two RADIUS servers. Both servers are alive, and no requests have been processed since the counters were cleared 0 minutes ago.

```
Device# show aaa servers
RADIUS:id 8, priority 1, host 192.0.2.238, auth-port 2095, acct-port 2096
```

Example: Enabling Load Balancing for a Named RADIUS Server Group

```

State:current UP, duration 3781s, previous duration 0s
Dead:total time 0s, count 0
Quarantined:No
Authen:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Author:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Account:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Elapsed time since counters last cleared:0m
RADIUS:id 9, priority 2, host 192.0.2.238, auth-port 2015, acct-port 2016
State:current UP, duration 3781s, previous duration 0s
Dead:total time 0s, count 0
Quarantined:No
Authen:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Author:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Account:request 0, timeouts 0
      Response:unexpected 0, server error 0, incorrect 0, time 0ms
      Transaction:success 0, failure 0
Elapsed time since counters last cleared:0m

```

Example: Server Configuration and Enabling Load Balancing for Named RADIUS Server Group

The following sample output shows the relevant RADIUS configuration:

```

Device# show running-config
.
.
.
aaa group server radius server-group1
  server 192.0.2.238 auth-port 2095 acct-port 2096
  server 192.0.2.238 auth-port 2015 acct-port 2016
  load-balance method least-outstanding batch-size 5
!
aaa authentication ppp default group server-group1
aaa accounting network default start-stop group server-group1
.
.
.

```

The lines in the current configuration of the RADIUS command output above are defined as follows:

- The **aaa group server radius** command shows the configuration of a server group with two member servers.
- The **load-balance** command enables load balancing for global RADIUS server groups with the batch size specified.
- The **aaa authentication ppp** command authenticates all PPP users using RADIUS.
- The **aaa accounting** command enables sending of all accounting requests to the AAA server when the client is authenticated and then disconnected using the **start-stop** keyword.

Example: Debug Output for Named RADIUS Server Group

The debug sample output below shows the selection of preferred server and processing of requests for the configuration above.

```
Device# show debug

*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002C):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Server[0] load:0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Selected Server[0] with load 0
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002C):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002D):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002D):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002E):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[3] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002E):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002F):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[2] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(0000002F):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(00000030):No preferred server available.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT:[1] transactions remaining in batch. Reusing
server.
*Feb 28 13:51:16.019:AAA/SG/SERVER_SELECT(00000030):Server (192.0.2.238:2095,2096) now being
used as preferred server
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000031):No preferred server available.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:No more transactions in batch. Obtaining a new
server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining a new least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Server[1] load:0
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Server[0] load:5
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Selected Server[1] with load 0
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:[5] transactions remaining in batch.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000031):Server (192.0.2.238:2015,2016) now being
used as preferred server
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT(00000032):No preferred server available.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:51:16.023:AAA/SG/SERVER_SELECT:[4] transactions remaining in batch. Reusing
server.
.
.
.
```

Example: Server Status Information for Named RADIUS Server Group

The following sample output from the **show aaa servers** command shows the AAA server status for the named RADIUS server group configuration:

```
Device# show aaa servers
```

```

RADIUS:id 8, priority 1, host 192.0.2.238, auth-port 2095, acct-port 2096
  State:current UP, duration 3781s, previous duration 0s
  Dead:total time 0s, count 0
  Quarantined:No
  Authen:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Account:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Elapsed time since counters last cleared:0m
RADIUS:id 9, priority 2, host 192.0.2.238, auth-port 2015, acct-port 2016
  State:current UP, duration 3781s, previous duration 0s
  Dead:total time 0s, count 0
  Quarantined:No
  Authen:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Author:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Account:request 0, timeouts 0
    Response:unexpected 0, server error 0, incorrect 0, time 0ms
    Transaction:success 0, failure 0
  Elapsed time since counters last cleared:0m

```

The sample output shows the status of two RADIUS servers. Both servers are alive, and no requests have been processed since the counters were cleared 0 minutes ago.

Example: Monitoring Idle Timer

The following example shows idle timer and related server state for load balancing enabled for a named RADIUS server group. The current configuration of the RADIUS command output and debug command output are also displayed.

The following sample output shows the relevant RADIUS configuration:

```

Device# show running-config | include radius

aaa group server radius server-group1
radius-server host 192.0.2.238 auth-port 2095 acct-port 2096 test username junk1 idle-time
 1 key cisco
radius-server host 192.0.2.238 auth-port 2015 acct-port 2016 test username junk1 idle-time
 1 key cisco
radius-server load-balance method least-outstanding batch-size 5

```

The lines in the current configuration of the preceding RADIUS command output are defined as follows:

- The **aaa group server radius** command shows the configuration of a server group.
- The **radius-server host** command defines the IP address of the RADIUS server host with authorization and accounting ports specified and the authentication and encryption key identified.
- The **radius-server load-balance** command enables load balancing for the RADIUS server with the batch size specified.

The **show debug** sample output below shows test requests being sent to servers. The response to the test request sent to the server is received, the server is removed from quarantine as appropriate, the server is marked alive, and then the idle timer is reset.

```

Device# show debug

```



```
*Feb 28 13:52:20.835:AAA/SG/TEST:Server (192.0.2.238:2015,2016) quarantined.
*Feb 28 13:52:20.835:AAA/SG/TEST:Sending test request(s) to server (192.0.2.238:2015,2016)
*Feb 28 13:52:20.835:AAA/SG/TEST:Sending 1 Access-Requests, 1 Accounting-Requests in current
  batch.
*Feb 28 13:52:20.835:AAA/SG/TEST(Req#:1):Sending test AAA Access-Request.
*Feb 28 13:52:20.835:AAA/SG/TEST(Req#:1):Sending test AAA Accounting-Request.
*Feb 28 13:52:21.087:AAA/SG/TEST:Obtained Test response from server (192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Obtained Test response from server (192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Necessary responses received from server
(192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Server (192.0.2.238:2015,2016) marked ALIVE. Idle timer
set for 60 secs(s).
*Feb 28 13:52:22.651:AAA/SG/TEST:Server (192.0.2.238:2015,2016) removed from quarantine.
.
.
.
```

Example: Server Configuration and Enabling Load Balancing for Idle Timer Monitoring

The following sample output shows the relevant RADIUS configuration:

```
Device# show running-config | include radius

aaa group server radius server-group1
radius-server host 192.0.2.238 auth-port 2095 acct-port 2096 test username junk1 idle-time
 1 key cisco
radius-server host 192.0.2.238 auth-port 2015 acct-port 2016 test username junk1 idle-time
 1 key cisco
radius-server load-balance method least-outstanding batch-size 5
```

The lines in the current configuration of the RADIUS command output above are defined as follows:

- The **aaa group server radius** command shows the configuration of a server group.
- The **radius-server host** command defines the IP address of the RADIUS server host with authorization and accounting ports specified and the authentication and encryption key identified.
- The **radius-server load-balance** command enables load balancing for the RADIUS server with the batch size specified.

Example: Debug Output for Idle Timer Monitoring

The **debug** command output below shows test requests being sent to servers. The response to the test request sent to the server is received, the server is removed from quarantine as appropriate, marked alive, and then the idle timer is reset.

```
Device# show debug
*Feb 28 13:52:20.835:AAA/SG/TEST:Server (192.0.2.238:2015,2016) quarantined.
*Feb 28 13:52:20.835:AAA/SG/TEST:Sending test request(s) to server (192.0.2.238:2015,2016)
*Feb 28 13:52:20.835:AAA/SG/TEST:Sending 1 Access-Requests, 1 Accounting-Requests in current
  batch.
*Feb 28 13:52:20.835:AAA/SG/TEST(Req#:1):Sending test AAA Access-Request.
*Feb 28 13:52:20.835:AAA/SG/TEST(Req#:1):Sending test AAA Accounting-Request.
*Feb 28 13:52:21.087:AAA/SG/TEST:Obtained Test response from server (192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Obtained Test response from server (192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Necessary responses received from server
(192.0.2.238:2015,2016)
*Feb 28 13:52:22.651:AAA/SG/TEST:Server (192.0.2.238:2015,2016) marked ALIVE. Idle timer
set for 60 secs(s).
*Feb 28 13:52:22.651:AAA/SG/TEST:Server (192.0.2.238:2015,2016) removed from quarantine.
.
.
.
```

Example: Configuring the Preferred Server with the Same Authentication and Authorization Server

The following example shows an authentication server group and an authorization server group that use the same servers 209.165.200.225 and 209.165.200.226. Both server groups have the preferred server flag enabled.

```
aaa group server radius authentication-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
aaa group server radius accounting-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
```

When a preferred server is selected for a session, all transactions for that session will continue to use the original preferred server. The servers 209.165.200.225 and 209.165.200.226 are load balanced based on sessions rather than transactions.

Example: Configuring the Preferred Server with Different Authentication and Authorization Servers

The following example shows an authentication server group that uses servers 209.165.200.225 and 209.165.200.226 and an authorization server group that uses servers 209.165.201.1 and 209.165.201.2. Both server groups have the preferred server flag enabled.

```
aaa group server radius authentication-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
aaa group server radius accounting-group
  server 209.165.201.1 key radkey3
  server 209.165.201.2 key radkey4
```

The authentication server group and the accounting server group do not share any common servers. A preferred server is never found for accounting transactions; therefore, authentication and accounting servers are load-balanced based on transactions. Start and stop records are sent to the same server for a session.

Example: Configuring the Preferred Server with Overlapping Authentication and Authorization Servers

The following example shows an authentication server group that uses servers 209.165.200.225, 209.165.200.226, and 209.165.201.1 and an accounting server group that uses servers 209.165.201.1 and 209.165.201.2. Both server groups have the preferred server flag enabled.

```
aaa group server radius authentication-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
  server 209.165.201.1 key radkey3
aaa group server radius accounting-group
  server 209.165.201.1 key radkey3
  server 209.165.201.2 key radkey4
```

If all servers have equal transaction processing capability, one-third of all authentication transactions are directed toward the server 209.165.201.1. Therefore, one-third of all accounting transactions are also directed toward the server 209.165.201.1. The remaining two-third of accounting transactions are load balanced equally between servers 209.165.201.1 and 209.165.201.2. The server 209.165.201.1 receives fewer authentication transactions because the server 209.165.201.1 has outstanding accounting transactions.

Example: Configuring the Preferred Server with Authentication Servers As a Subset of Authorization Servers

The following example shows an authentication server group that uses servers 209.165.200.225 and 209.165.200.226 and an authorization server group that uses servers 209.165.200.225, 209.165.200.226, and 209.165.201.1. Both server groups have the preferred server flag enabled.

```
aaa group server radius authentication-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
aaa group server radius accounting-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
  server 209.165.201.1 key radkey3
```

One-half of all authentication transactions are sent to the server 209.165.200.225 and the other half to the server 209.165.200.226. Servers 209.165.200.225 and 209.165.200.226 are preferred servers for authentication and accounting transaction. Therefore, there is an equal distribution of authentication and accounting transactions across servers 209.165.200.225 and 209.165.200.226. The server 209.165.201.1 is relatively unused.

Example: Configuring the Preferred Server with Authentication Servers As a Superset of Authorization Servers

The following example shows an authentication server group that uses servers 209.165.200.225, 209.165.200.226, and 209.165.201.1 and an authorization server group that uses servers 209.165.200.225 and 209.165.200.226. Both server groups have the preferred server flag enabled.

```
aaa group server radius authentication-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
  server 209.165.201.1 key radkey3
aaa group server radius accounting-group
  server 209.165.200.225 key radkey1
  server 209.165.200.226 key radkey2
```

Initially, one-third of authentication transactions are assigned to each server in the authorization server group. As accounting transactions are generated for more sessions, accounting transactions are sent to servers 209.165.200.225 and 209.165.200.226 because the preferred server flag is on. As servers 209.165.200.225 and 209.165.200.226 begin to process more transactions, authentication transactions will start to be sent to server 209.165.201.1. Transaction requests authenticated by server 209.165.201.1 do not have any preferred server setting and are split between servers 209.165.200.225 and 209.165.200.226, which negates the use of the preferred server flag. This configuration should be used cautiously.

Additional References for RADIUS Server Load Balancing

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Command List, All Releases

Related Topic	Document Title
Security commands	<ul style="list-style-type: none"> • Security Command Reference: Commands A to C • Security Command Reference: Commands D to L • Security Command Reference: Commands M to R • Security Command Reference: Commands S to Z
AAA and RADIUS	<i>Authentication, Authorization, and Accounting Configuration Guide</i>
AAA server groups and RADIUS configuration	“Configuring RADIUS” module in the <i>RADIUS Configuration Guide</i>
Failover retry reorder mode	“RADIUS Server Reorder on Failure” module in the <i>RADIUS Configuration Guide</i>

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Server Load Balancing

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 12: Feature Information for RADIUS Server Load Balancing

Feature Name	Releases	Feature Information
RADIUS Server Load Balancing	12.2(28)SB 12.4(11)T 12.2(33)SRC	<p>The RADIUS Server Load Balancing feature distributes authentication, authorization, and accounting (AAA) authentication and accounting transactions across servers in a server group. These servers can then share the transaction load, resulting in faster responses to incoming requests by optimally using available servers.</p> <p>This feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>This feature was integrated into Cisco IOS Release 12.4(11)T.</p> <p>This feature was integrated into Cisco IOS Release 12.2(33)SRC.</p> <p>The following commands were introduced or modified: debug aaa sg-server selection, debug aaa test, load-balance (server-group), radius-server host, radius-server load-balance, test aaa group.</p>
RADIUS Server Load Balancing porting	Cisco IOS XE Release 2.1	This feature was introduced on Cisco ASR 1000 series routers.



RADIUS Support of 56-Bit Acct Session-Id

The RADIUS Support of 56-Bit Acct Session-Id feature introduces a new 32-bit authentication, authorization, and accounting (AAA) variable, `acct-session-id-count`. The first eight bits of the `acct-session-id-count` variable are reserved for the unique identifier variable, a unique number assigned to the accounting session which is preserved between reloads. The `acct-session-id-count` variable is used in addition to the existing 32-bit `acct-session-id` variable, RADIUS attribute 44, providing a total of 56 bits to represent the actual Accounting Session Identifier (ID). Benefits of this feature include the following:

- The 8-bit unique identifier variable allows accounting session IDs to be identified if a reload occurs.
- The additional space provided by the `acct-session-id-count` variable can keep track of `acct-session-id` wrapping when there is a high volume of traffic, such as voice calls. By incrementing each time the `acct-session-id` variable wraps, the `acct-session-id-count` variable preserves accounting information.
- [Finding Feature Information, page 117](#)
- [Prerequisites for RADIUS Support of 56-Bit Acct Session-Id, page 118](#)
- [Information About RADIUS Support of 56-Bit Acct Session-Id, page 118](#)
- [How to Configure RADIUS Support of 56-Bit Acct Session-Id, page 118](#)
- [Configuration Examples for RADIUS Support of 56-Bit Acct Session-Id, page 119](#)
- [Additional References, page 119](#)
- [Feature Information for RADIUS Support of 56-Bit Acct Session-Id, page 121](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Support of 56-Bit Acct Session-Id

AAA accounting must be configured. For more information about configuring AAA accounting, refer to the “Configuring Accounting” chapter in the *Cisco IOS Security Configuration Guide*.

Information About RADIUS Support of 56-Bit Acct Session-Id

Acct-Session-Id Attribute

RADIUS attribute 44, Accounting Session ID, is a unique accounting identifier that makes it easy to match start and stop records in a log file. Accounting session ID numbers restart at 1 each time the router is power-cycled or the software is reloaded. RADIUS attribute 44 is automatically enabled when AAA accounting is configured.

The acct-session-id variable is a 32-bit variable that can take on values from 00000000-FFFFFFFF.

Acct-Session-Id-Count Attribute

The new acct-session-id-count variable is a 32-bit variable. The first eight bits of the variable are reserved for the unique identifier variable, an identifier that allows the RADIUS server to identify an accounting session if a reload occurs. The remaining 24 bits of the acct-session-id-count variable acts as a counter variable. When the first acct-session-id variable is assigned, this counter variable is set to 1. The variable increments by 1 every time the acct-session-id variable wraps, preventing the loss of accounting information.

The acct-session-id-count variable can take on values from ##000000- ##FFFFFF, where ## represents the eight bits that are reserved for the unique identifier variable.

The acct-session-id-count and acct-session-id variables are concatenated before being sent to the RADIUS server, resulting in the acct-session variable being represented as the following:

```
##000000 00000000- ##FFFFFF FFFFFFFF
```

This allows a total of 56 bits to be used for acct-session-id space.

How to Configure RADIUS Support of 56-Bit Acct Session-Id

Configuring RADIUS Support of 56-Bit Acct Session-Id

This task enables the acct-session-id-count variable containing the unique identifier variable.

SUMMARY STEPS

1. **enable**
2. **radius-server unique-ident *id***

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	radius-server unique-ident <i>id</i> Example: Router(config)# radius-server unique-ident 5	Enables the acct-session-id-count variable containing the unique identifier variable. <ul style="list-style-type: none"> • The <i>id</i> argument specifies the unique identifier represented by the first eight bits of the acct-session-id-count variable. Valid values range from 0 to 255.

Configuration Examples for RADIUS Support of 56-Bit Acct Session-Id

Configuring RADIUS Support of 56-Bit Acct Session-Id Example

The following example configures AAA authentication, enables RADIUS attribute 44 in access request packets, and enables the acct-session-id-count variable and sets the unique identifier variable to 5:

```
aaa new-model
aaa authentication ppp default group radius
radius-server host 10.100.1.34
radius-server unique-ident 5
```

Additional References

The following sections provide references related to the RADIUS Support of 56-Bit Acct Session-ID feature.

Related Documents

Related Topic	Document Title
Configuring RADIUS	See the “Configuring RADIUS” feature module.
Configuring accounting	See the “Configuring Accounting” feature module.
AAA RADIUS attributes	See the “RADIUS Attributes Overview and RADIUS IETF Attributes” feature module.

Related Topic	Document Title
RADIUS commands	<i>Cisco IOS Security Command Reference</i>

Standards

Standard	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2139	RADIUS Accounting

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Support of 56-Bit Acct Session-Id

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 13: Feature Information for RADIUS Support of 56-Bit Acct Session-Id

Feature Name	Releases	Feature Information
RADIUS Support of 56-Bit Acct Session-ID	12.3(2)T	<p>The RADIUS Support of 56-Bit Acct Session-Id feature introduces a new 32-bit authentication, authorization, and accounting (AAA) variable, <code>acct-session-id-count</code>.</p> <p>This feature was introduced in Cisco IOS Release 12.3(2)T.</p> <p>The following commands were introduced or modified: radius-server unique-iden.</p>



RADIUS Tunnel Preference for Load Balancing and Fail-Over

The RADIUS Tunnel Preference for Load Balancing and Fail-Over feature provides industry-standard load balancing and fail-over functionality for an Layer 2 Tunnel Protocol network server (LNS), rather than requiring the use of a Cisco proprietary Vendor Specific Attribute (VSA). The feature conforms to the tunnel attributes that are to be used in a multivendor network environment as defined in RFC 2868, thereby eliminating interoperability issues among network access servers (NASs) manufactured by different vendors.

- [Finding Feature Information, page 123](#)
- [Prerequisites, page 124](#)
- [Restrictions, page 124](#)
- [Information About RADIUS Tunnel Preference for Load Balancing and Fail-Over, page 124](#)
- [How RADIUS Tunnel Preference for Load Balancing and Fail-Over is Configured, page 126](#)
- [Configuration Example for RADIUS Tunnel Preference for Load Balancing and Fail-Over, page 126](#)
- [Additional References, page 126](#)
- [Feature Information for RADIUS Tunnel Preference for Load Balancing and Fail-Over, page 128](#)
- [Glossary, page 128](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites

Configuring VPDNs and HGW groups is beyond the scope of this document. See the Related Document section for more information.

Restrictions

The following restrictions and limitations apply to the RADIUS Tunnel Preference for Load Balancing and Fail-Over feature:

- This feature does not support VPDN dial-out networks; it is designed only for dial-in applications.
- The maximum number of LNSs allowed in the network is 1550, which is 50 per tag attribute group and a limit of 31 tags.
- This feature requires a RADIUS server implementation to support RFC 2868.

Information About RADIUS Tunnel Preference for Load Balancing and Fail-Over

The RADIUS Tunnel Preference for Load Balancing and Fail-Over feature provides load balancing and fail-over virtual private dialup network (VPDN) home gateway (HGW) groups in a standardized fashion. This feature introduces new software functionality; no new command is associated with this feature.

Industry-Standard Rather Than Proprietary Attributes

Until Cisco IOS Release 12.2(4)T, load balancing and fail-over functionality for a LNS was provided by the Cisco proprietary VSA. In a multivendor network environment, using VSA on a RADIUS server can cause interoperability issues among NASs manufactured by different vendors. Even though some RADIUS server implementations can send VSAs that the requesting NAS can understand, the user still must maintain different VSAs for the same purpose in a single-service profile.

A consensus regarding the tunnel attributes that are to be used in a multivendor network environment is defined in RFC 2868. In RFC 2868, Tunnel-Server-Endpoint, in conjunction with the Tunnel-Medium-Type, specifies the address to which the NAS should initiate a new session. If multiple Tunnel-Server-Endpoint attributes are defined in one tagged attribute group, they are interpreted as equal-cost load-balancing HGWs.

The Tunnel-Preference attribute defined in RFC 2868 can be used as a measure to form load balancing and fail-over HGW groups. When the Tunnel-Preference values of different tagged attribute groups are the same, the Tunnel-Server-Endpoint of those attribute groups is considered to have the same priority unless otherwise specified. When the Tunnel-Preference values of some attribute groups are higher (they have a lower preference) than other attribute groups, their Tunnel-Server-Endpoint attributes will have higher priority values. When an attribute group has a higher priority value, that attribute group will be used for fail-over in case the attribute groups with lower priority values are unavailable for the connections.

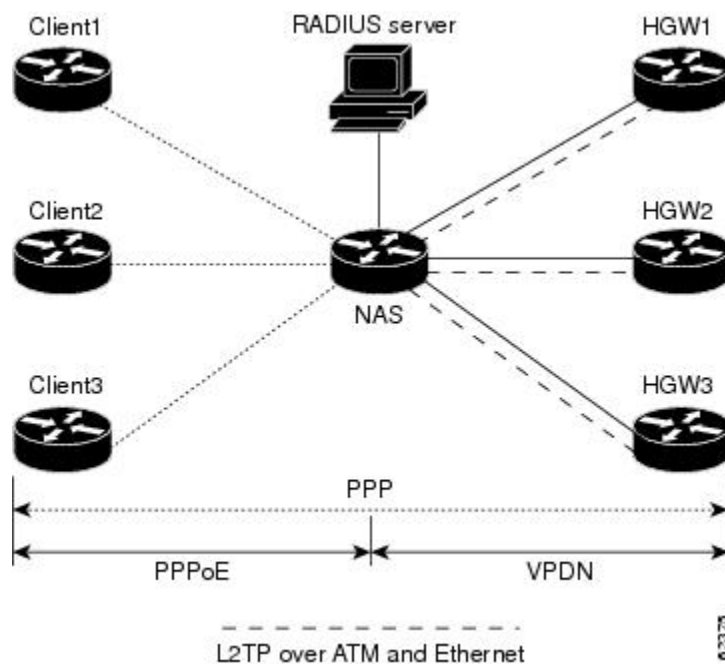
Until Cisco IOS Release 12.2(4)T, a specially formatted string would be transported within a Cisco VSA "vpdn:ip-addresses" string to a NAS for the purpose of HGW load balancing and fail-over. For example, 10.0.0.1 10.0.0.2 10.0.0.3/2.0.0.1 2.0.0.2 would be interpreted as IP addresses 10.0.0.1, 10.0.0.2, and 10.0.0.3

for the first group for load balancing. New sessions are projected to these three addresses based on the least-load-first algorithm. This algorithm uses its local knowledge to select an HGW that has the least load to initiate the new session. In this example, the addresses 2.0.0.1 and 2.0.0.2 in the second group have a lower priority and are applicable only when all HGWs specified in the first group fail to respond to the new connection request, thereby making 2.0.0.1 and 2.0.0.2 the fail-over addresses. See the section [Configuration Example for RADIUS Tunnel Preference for Load Balancing and Fail-Over](#), on page 126 for an example of how to configure these fail-over addresses in a RADIUS tunnel profile.

Load Balancing and Fail-Over in a Multivendor Network

The RADIUS Tunnel Preference for Load Balancing and Fail-Over feature was designed for large multivendor networks that use VPDN Layer 2 tunnels over WAN links such as ATM and Ethernet, such as the configuration shown in the figure below.

Figure 1: Typical Load Balancing and Fail-Over in a Multivendor Network



In the configuration shown in the figure above, the NAS uses tunnel profiles downloaded from the RADIUS server to establish VPDN Layer 2 tunnels for load balancing and fail-over. The Point-to-Point over Ethernet (PPPoE) protocol is used as the client to generate PPP sessions.

Related Features and Technologies

The RADIUS Tunnel Preference for Load Balancing and Fail-Over feature is used in VPDNs. Additionally, familiarity with the following technologies and protocols is recommended:

- ATM
- Ethernet

- L2TP and L2F
- PPP and PPPoE
- RADIUS servers

How RADIUS Tunnel Preference for Load Balancing and Fail-Over is Configured

This feature has no new configuration commands; however, see the next section for an example of how to implement the RADIUS Tunnel Preference for Load Balancing and Fail-Over feature in a RADIUS tunnel profile.

Configuration Example for RADIUS Tunnel Preference for Load Balancing and Fail-Over

The following example shows how to create RADIUS tunnel profiles:

```
net3 Password = "cisco" Service-Type = Outbound
  Tunnel-Type = :0:L2TP,
  Tunnel-Medium-Type = :0:IP,
  Tunnel-Server-Endpoint = :0:"1.1.3.1",
  Tunnel-Assignment-Id = :0:"1",
  Tunnel-Preference = :0:1,
  Tunnel-Password = :0:"welcome"
  Tunnel-Type = :1:L2TP,
  Tunnel-Medium-Type = :1:IP,
  Tunnel-Server-Endpoint = :1:"1.1.5.1",
  Tunnel-Assignment-Id = :1:"1",
  Tunnel-Preference = :1:1,
  Tunnel-Password = :1:"welcome"
  Tunnel-Type = :2:L2TP,
  Tunnel-Medium-Type = :2:IP,
  Tunnel-Server-Endpoint = :2:"1.1.4.1",
  Tunnel-Assignment-Id = :2:"1",
  Tunnel-Preference = :2:1,
  Tunnel-Password = :2:"welcome"
  Tunnel-Type = :3:L2TP,
  Tunnel-Medium-Type = :3:IP,
  Tunnel-Server-Endpoint = :3:"1.1.6.1",
  Tunnel-Assignment-Id = :3:"1",
  Tunnel-Preference = :3:1,
  Tunnel-Password = :3:"welcome"
```

See [Information About RADIUS Tunnel Preference for Load Balancing and Fail-Over](#), on page 124 for more information on how fail-over addresses are selected in these profiles. See the [Configuration Example for RADIUS Tunnel Preference for Load Balancing and Fail-Over](#), on page 126 for documents used create RADIUS tunnel profiles.

Additional References

The following sections provide references related to RADIUS Tunnel Preference for Load Balancing and Fail-Over feature.

Related Documents

Related Topic	Document Title
RADIUS	“ Configuring RADIUS ” module.
RADIUS Attributes	“ RADIUS Attributes Overview and RADIUS IETF Attributes ” module.
Virtual private dialup networks (VPDN) roadmap	<i>Cisco IOS VPDN Configuration Guide</i> , Release 15.0.
Dial Technologies	<i>Cisco IOS Dial Technologies Configuration Guide</i> , Release 12.4T
Broadband Access: PPP and Routed Bridge Encapsulation	<i>Cisco IOS Broadband Access Aggregation and DSL Configuration Guide</i> , Release 12.4T

Standards

Standard	Title
None.	--

MIBs

MIB	MIBs Link
None.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
RFC 2868	RADIUS Attributes for Tunnel Protocol Support

Feature Information for RADIUS Tunnel Preference for Load Balancing and Fail-Over

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 14: Feature Information for RADIUS Tunnel Preference for Load Balancing and Fail-Over

Feature Name	Releases	Feature Information
RADIUS Tunnel Preference for Load Balancing and Fail-Over	12.2(4)T	<p>The RADIUS Tunnel Preference for Load Balancing and Fail-Over feature provides industry-standard load balancing and fail-over functionality for an Layer 2 Tunnel Protocol network server (LNS), rather than requiring the use of a Cisco proprietary Vendor Specific Attribute (VSA). The feature conforms to the tunnel attributes that are to be used in a multivendor network environment as defined in RFC 2868, thereby eliminating interoperability issues among network access servers (NASs) manufactured by different vendors.</p> <p>This feature was introduced in Cisco IOS Release 12.2(4)T.</p>

Glossary

HGW --home gateway. A gateway that terminates Layer 2 tunneling protocols such as L2TP.

home gateway --See HGW.

L2TP --Layer 2 Tunnel Protocol. An Internet Engineering Task Force (IETF) standards track protocol defined in RFC 2661 that provides tunneling of PPP. Based upon the best features of L2F and PPTP, L2TP provides an industry-wide interoperable method of implementing VPDN.

L2TP network server--See LNS.

Layer 2 Tunnel Protocol --See L2TP.

LNS --L2TP network server. A node that acts as one side of an L2TP tunnel endpoint and is a peer to the NAS or L2TP access concentrator (LAC). The LNS is the logical termination point of a PPP session that is

being tunneled from the remote system by the access server. Analogous to the Layer 2 Forwarding (L2F) HGW.

NAS --network access server. Cisco platform or collection of platforms that interfaces between the packet world (the Internet, for example) and the circuit world (the public switched telephone network, for example).

network access server --See NAS.

Request for Comments --See RFCs.

RFCs --Request for Comments. A series of notes about the Internet collected by the Internet Engineering Task Force (IETF). Started in 1969, the IETF is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture. RFCs define many aspects of computer communication, focusing on networking protocols, procedures, programs, and concepts.

virtual private dialup network --See VPDN.

VPDN --virtual private dialup network. Enables IP traffic to travel securely over a public TCP/IP network by encrypting all traffic from one network to another.

Any Internet Protocol (IP) addresses and phone numbers used in this document are not intended to be actual addresses and phone numbers. Any examples, command display output, network topology diagrams, and other figures included in the document are shown for illustrative purposes only. Any use of actual IP addresses or phone numbers in illustrative content is unintentional and coincidental. © 2001-2009 Cisco Systems, Inc. All rights reserved.



RADIUS Server Reorder on Failure

The RADIUS Server Reorder on Failure feature provides for failover to another server in the server group during periods of high load or when server failure occurs. Subsequent to the failure, all RADIUS traffic is directed to the new server. Traffic is switched from the new server to another server in the server group only if the new server also fails. Traffic is not automatically switched back to the first server.

By spreading the RADIUS transactions across multiple servers, authentication and accounting requests are serviced more quickly.

- [Finding Feature Information, page 131](#)
- [Prerequisites for RADIUS Server Reorder on Failure, page 132](#)
- [Restrictions for RADIUS Server Reorder on Failure, page 132](#)
- [Information About RADIUS Server Reorder on Failure, page 132](#)
- [How to Configure RADIUS Server Reorder on Failure, page 133](#)
- [Configuration Examples for RADIUS Server Reorder on Failure, page 137](#)
- [Additional References, page 139](#)
- [Feature Information for RADIUS Server Reorder on Failure, page 140](#)

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see [Bug Search Tool](#) and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for RADIUS Server Reorder on Failure

- Before you can configure your RADIUS server to perform reorder on failure, you must enable authentication, authorization, and accounting (AAA) by using the **aaa new-model** command.
- You must also have RADIUS configured, for functions such as authentication, accounting, or static route download.

Restrictions for RADIUS Server Reorder on Failure

- An additional 4 bytes of memory is required per server group. However, because most server configurations have only a small number of server groups configured, the additional 4 bytes should have a minimal impact on performance.
- Some RADIUS features within the software set may not be capable of using this feature. If a RADIUS feature cannot use the RADIUS Server Reorder on Failure feature, your server behaves as though the reorder feature is not configured.

Information About RADIUS Server Reorder on Failure

RADIUS Server Failure

If the RADIUS Server Reorder on Failure feature is not configured and server failure occurs:

- 1 A new RADIUS transaction has to be performed.
- 2 A RADIUS packet for the transaction is sent to the first server in the group that is not marked dead (as per the configured deadtime) and is retransmitted for the configured number of retransmissions.
- 3 If all of those retransmits time out (as per the configured timeout), the router transmits the packet to the next nondead server in the list for the configured number of retransmissions.
- 4 Step 3 is repeated until the specified maximum number of transmissions per transaction have been made. If the end of the list is reached before the maximum number of transmissions has been reached, the router goes back to the beginning of the list and continue from there.

If at any time during this process, a server meets the dead-server detection criteria (not configurable; it varies depending on the version of software being used), the server is marked as dead for the configured deadtime.

How the RADIUS Server Reorder on Failure Feature Works

If you have configured the RADIUS Server Reorder on Failure feature, the decision about which RADIUS server to use as the initial server is as follows:

- The network access server (NAS) maintains the status of “flagged” server, which is the first server to which a transmission is sent.

- After the transmission is sent to the flagged server, the transmission is sent to the flagged server again for the configured number of retransmissions.
- The NAS then sequentially sends the transmission through the list of nondead servers in the server group, starting with the one listed after the flagged server, until the configured transaction maximum tries is reached or until a response is received.
- At boot time, the flagged server is the first server in the server group list as was established using the **radius-server host** command.
- If the flagged server is marked as dead (even if the dead time is zero), the first nondead server listed after the flagged server becomes the flagged server.
- If the flagged server is the last server in the list, and it is marked as dead, the flagged server becomes the first server in the list that is not marked as dead.
- If all servers are marked as dead, the transaction fails, and no change is made to the flagged server.
- If the flagged server is marked as dead, and the dead timer expires, nothing happens.

**Note**

Some types of transmissions (for example, Challenge Handshake Authentication Protocol [CHAP], Microsoft CHAP [MS-CHAP], and Extensible Authentication Protocol [EAP]) require multiple roundtrips to a single server. For these special transactions, the entire sequence of roundtrips to the server are treated as though they were one transmission.

When RADIUS Servers Are Dead

A server can be marked as dead if the criteria in 1 and 2 are met:

- 1 The server has not responded to at least the configured number of retransmissions as specified by the **radius-server transaction max-tries** command.
- 2 The server has not responded to any request for at least the configured timeout. The server is marked dead only if both criteria (this and the one listed above) are met. The marking of a server as dead, even if the dead time is zero, is significant for the RADIUS server retry method reorder system.

How to Configure RADIUS Server Reorder on Failure

Configuring a RADIUS Server to Reorder on Failure

Perform this task to configure a server in a server group to direct traffic to another server in the server group when the first server fails.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **radius-server retry method reorder**
5. **radius-server retransmit {retries}**
6. **radius-server transaction max-tries { number }**
7. **radius-server host {hostname | ip-address} [key string]**
8. **radius-server host {hostname | ip-address} [key string]**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	aaa new-model Example: Router (config)# aaa new-model	Enables the AAA access control model.
Step 4	radius-server retry method reorder Example: Example: Router (config)# radius-server retry method reorder	Specifies the reordering of RADIUS traffic retries among a server group.
Step 5	radius-server retransmit {retries} Example: Router (config)# radius-server retransmit 1	Specifies the number of times the Cisco IOS software searches the list of RADIUS server hosts before giving up. The <i>retries</i> argument is the maximum number of retransmission attempts. The default is 3 attempts.
Step 6	radius-server transaction max-tries { number }	Specifies the maximum number of transmissions per transaction that may be retried on a RADIUS server.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router (config)# radius-server transaction max-tries 3</pre>	<p>The <i>number</i> argument is the total number of transmissions per transaction. If this command is not configured, the default is eight transmissions.</p> <p>Note This command is global across all RADIUS servers for a given transaction.</p>
Step 7	<p>radius-server host {<i>hostname</i> <i>ip-address</i>} [key <i>string</i>]</p> <p>Example:</p> <pre>Router (config)# radius-server host 10.2.3.4 key radi23</pre>	<p>Specifies a RADIUS server host.</p> <p>Note You can also configure a global key for all RADIUS servers that do not have a per-server key configured by issuing the radius-server key command.</p>
Step 8	<p>radius-server host {<i>hostname</i> <i>ip-address</i>} [key <i>string</i>]</p> <p>Example:</p> <pre>Router (config)# radius-server host 10.5.6.7 key rad234</pre>	<p>Specifies a RADIUS server host.</p> <p>Note At least two servers must be configured.</p>

Monitoring RADIUS Server Reorder on Failure

To monitor the server-reorder-on-failure process on your router, use the following commands:

SUMMARY STEPS

1. enable
2. debug aaa sg-server selection
3. debug radius

DETAILED STEPS

	Command or Action	Purpose
Step 1	<p>enable</p> <p>Example:</p> <pre>Router> enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	debug aaa sg-server selection Example: Router# debug aaa sg-server selection	Displays information about why the RADIUS and TACAC+ server group system in the router is choosing a particular server.
Step 3	debug radius Example: Router# debug radius	Displays information about why the router is choosing a particular RADIUS server.

Example

The following two debug outputs display the behavior of the RADIUS Server Reorder on Failure feature:

Debug 1

In the following sample output, the RADIUS Server Reorder on Failure feature is configured. The server retransmits are set to 0 (so each server is tried just one time before failover to the next configured server), and the transmissions per transaction are set to 4 (the transmissions stop on the third failover). The third server in the server group (10.107.164.118) has accepted the transaction on the third transmission (second failover).

```

00:38:35: %SYS-5-CONFIG-I: Configured from console by console
00:38:53: RADIUS/ENCODE(0000000F) : ask "Username: "
00:38:53: RADIUS/ENCODE (0000000F) : send packet; GET-USER
00:38:58: RADIUS/ENCODE (0000000F) : ask "Password: "
00:38:58: RADIUS/ENCODE(0000000F) : send packet; GET-PASSWORD
00:38:59: RADIUS: AAA Unsupported [152] 4
00:38:59: RADIUS: 7474 [tt]
00:38:59: RADIUS (0000000F) : Storing nasport 2 in rad-db
00:38:59: RADIUS/ENCODE(0000000F) : dropping service type, "radius-server attribute 6
on-for-login-auth" is off
00:38:59: RADIUS (0000000F) : Config NAS IP: 0.0.0.0
00:38:59: RADIUS/ENCODE (0000000F) : acct-session-id: 15
00:38:59: RADIUS (0000000F) : sending
00:38:59: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 192.1.1.1
00:38:59: RADIUS(0000000F) : Send Access-Request to 10.10.10.10:1645 id 21645/11, len 78
00:38:59: RADIUS: authenticator 4481 E6 65 2D 5F 6F 0A -1E F5 81 8F 4E 1478 9C
00:38:59: RADIUS: User-Name [1] 7 "username1"
00:38:59: RADIUS: User-Password [2] 18 *
00:38:59: RADIUS: NAS-Port fsl 6 2
00:~8:59: RADIUS: NAS-Port-Type [61] 6 Virtual [5]
00:38:59: RADIUS: Calling-Station-Id [31] 15 "10.19.192.23"
00:39:00: RADIUS: NAS-IP-Address [4] 6 10.0.1.130
00:39:02: RADIUS: Fail-over to (10.2.2.2:1645,1646) for id 21645/11
00:39:02: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 192.2.2.2
00:39:04: RADIUS: Fail-over to (10.107.164.118:1645,1646) for id 21645/11
00:39:04: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 128.107.164.118
00:39:05: RADIUS: Received from id 21645/11 10.107.164.118:1645, Access-Accept, len 26
00:39:05: RADIUS: authenticator 5609 56 F9 64 4E DF 19- F3 A2 DD 73 EE 3F 9826
00:39:05: RADIUS: Service-Type [6] 6 Login [1]

```

Debug 2

In the following sample output, the RADIUS Server Reorder on Failure feature is configured. The server retransmits are set to 0, and the transmissions per transaction are set to 8. In this transaction, the transmission to server 10.10.10.0 has failed on the eighth transmission.

```
00:42:30: RADIUS(00000011): Received from id 21645/13
00:43:34: RADIUS/ENCODE(00000012) : ask "Username: "
00:43:34: RADIUS/ENCODE(00000012) : send packet; GET-USER
00:43:39: RADIUS/ENCODE(00000012) : ask "Password: "
00:43:39: RADIUS/ENCODE(00000012) : send packet; GET-PASSWORD
00:43:40: RADIUS: AAA Unsupported [152] 4
00:43:40: RADIUS: 7474 [tt]
00:43:40: RADIUS(00000012) : Storing nasport 2 in rad-db
00:43:40: RADIUS/ENCODE(00000012): dropping service type, "radius-server attribute 6
on-for-login-auth" is off
00:43:40: RADIUS(00000012) : Co~fig NAS IP: 0.0.0.0
00:43:40: RADIUS/ENCODE(00000012) : acct-session-id: 18
00:43:40: RADIUS(00000012) : sending
00:43:40: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.107.164.118
00:43:40: RADIUS(00000012) : Send Access-Request to 10.107.164.118:1645 id 21645/14, len
78 00:43:40: RADIUS: authenticator B8 OA 51 3A AF A6 0018 -B3 2E 94 5E 07 OB 2A IF 00:43:40:
RADIUS: User-Name [1] 7 "username1" 00:43:40: RADIUS: User-Password [2] 18 * 00:43:40:
RADIUS: NAS-Port [5] 6 2
00:43:40: RADIUS: NAS-Port-Type [61] 6 Virtual [5] 00:43:40: RADIUS: Calling-Station-Id
[31] 15 "172.19.192.23" 00:43:40: RADIUS: NAS-IP-Address [4] 6 10.0.1.130
00:43:42: RADIUS: Fail-over to (10.10.10.10:1645,1646) for id 21645/14
00:43:42: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.1.1.1 00:43:44:
RADIUS: Fail-over to (10.2.2.2:1645,1646) for id 21645/14
00:43:44: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.2.2.2 00:43:46:
RADIUS: Fail-over to (10.107.164.118:1645,1646) for id 21645/14
00:43:46: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.107.164.118
00:43:48: RADIUS: Fail-over to (10.10.10.10:1645,1646) for id 21645/14
00:43:48: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.1.1.1 00:43:50:
RADIUS: Fail-over to (10.2.2.2:1645,1646) for id 21645/14
00:43:50: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.2.2.2 00:43:52:
RADIUS: Fail-over to (10.107.164.118:1645,1646) for id 21645/14
00:43:52: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.107.164.118
00:43:54: RADIUS: Fail-over to (10.10.10.10:1645,1646) for id 21645/14
00:43:54: RADIUS/ENCODE: Best Local IP-Address 10.0.1.130 for Radius-Server 10.1.1.1 00:43:56:
RADIUS: No response from (10.10.10.10:1645,1646) for id 21645/14 00:43:56: RADIUS/DECODE:
parse response no app start; FAIL 00:43:56: RADIUS/DECODE: parse response; FAIL
```

Configuration Examples for RADIUS Server Reorder on Failure

Configuring a RADIUS Server to Reorder on Failure Example

The following configuration example shows that a RADIUS server is configured to reorder on failure. The maximum number of transmissions per transaction that may be retried on the RADIUS server is six.

```
aaa new-model

radius-server retry method reorder

radius-server retransmit 0

radius-server transaction max-tries 6

radius-server host 10.2.3.4 key rad123

radius-server host 10.5.6.7 key rad123
```

Determining Transmission Order When RADIUS Servers Are Dead

If at boot time you have configured the following:

```
aaa new-model
radius-server retry method reorder
radius-server retransmit 0
radius-server transaction max-tries 6
radius-server host 10.2.3.4
radius-server host 10.5.6.7
```

and both servers are down, but not yet marked dead, for the first transaction you would see the transmissions as follows:

```
10.2.3.4
10.5.6.7
10.2.3.4
10.5.6.7
10.2.3.4
10.5.6.7
```

If you configure the reorder as follows:

```
aaa new-model
radius-server retry method reorder
radius-server retransmit 1
radius-server transaction max-tries 3
radius-server host 10.2.3.4
radius-server host 10.4.5.6
```

and both RADIUS servers are not responding to RADIUS packets but are not yet marked dead (as after the NAS boots), the transmissions for the first transaction are as follows:

```
10.2.3.4
10.2.3.4
10.4.5.6
```

Subsequent transactions may be transmitted according to a different pattern. The transmissions depend on whether the criteria for marking one (or both) servers as dead have been met, and as per the server flagging pattern already described.

If you configure the reorder as follows:

```
aaa new-model
radius-server retry method reorder
radius-server retransmit 1
radius-server max-tries-per-transaction 8
radius-server host 10.1.1.1
radius-server host 10.2.2.2
radius-server host 10.3.3.3
radius-server timeout 3
```

And the RADIUS server 10.1.1.1 is not responding to RADIUS packets but is not yet marked as dead, and the remaining two RADIUS servers are live, you see the following:

For the first transaction:

```
10.1.1.1
10.1.1.1
10.2.2.2
```

For any additional transaction initiated for any transmissions before the server is marked as dead:

```
10.1.1.1
10.1.1.1
10.2.2.2
```

For transactions initiated thereafter:

10.2.2.2

If servers 10.2.2.2 and 10.3.3.3 then go down as well, you see the following transmissions until servers 10.2.2.2 and 10.3.3.3 meet the criteria for being marked as dead:

10.2.2.2

10.2.2.2

10.3.3.3

10.3.3.3

10.1.1.1

10.1.1.1

10.2.2.2

10.2.2.2

The above is followed by the failure of the transmission and by the next method in the method list being used (if any).

If servers 10.2.2.2 and 10.3.3.3 go down but server 10.1.1.1 comes up at the same time, you see the following:

10.2.2.2

10.2.2.2

10.3.3.3

10.3.3.3

10.1.1.1

When servers 10.2.2.2 and 10.3.3.3 are then marked as dead, you see the following:

10.1.1.1

Additional References

Related Documents

Related Topic	Document Title
RADIUS	The chapter “ Configuring RADIUS ” in the <i>Cisco IOS Security Configuration Guide: Securing User Services</i>
AAA and RADIUS commands	<i>Cisco IOS Security Command Reference</i>

Standards

Standards	Title
None	--

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
None	--

Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	http://www.cisco.com/techsupport

Feature Information for RADIUS Server Reorder on Failure

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 15: Feature Information for RADIUS Server Reorder on Failure

Feature Name	Releases	Feature Information
RADIUS Server Reorder on Failure	12.3(1) 12.2(28)SB 12.2(33)SRC	<p>The RADIUS Server Reorder on Failure feature provides for failover to another server in the server group during periods of high load or when server failure occurs.</p> <p>This feature was introduced in 12.3(1).</p> <p>This feature was integrated into Cisco IOS Release 12.2(28)SB.</p> <p>This feature was integrated into Cisco IOS Release 12.2(33)SRC.</p> <p>The following commands were introduced or modified by this feature: debug aaa sg-server selection, radius-server retry method reorder, radius-server transaction max-tries.</p>

