



RADIUS Server Load Balancing

First Published: March 20, 2006
Last Updated: November 17, 2006

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.

Finding Feature Information in This Module

Your Cisco IOS software release may not support all of the features documented in this module. To reach links to specific feature documentation in this module and to see a list of the releases in which each feature is supported, use the [“Feature Information for RADIUS Server Load Balancing” section on page 38](#).

Finding Support Information for Platforms and Cisco IOS and Catalyst OS Software Images

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

Contents

- [Prerequisites for RADIUS Server Load Balancing, page 2](#)
- [Restrictions for RADIUS Server Load Balancing, page 2](#)
- [Information About RADIUS Server Load Balancing, page 2](#)
- [How to Configure RADIUS Server Load Balancing, page 4](#)
- [Configuration Examples for RADIUS Server Load Balancing, page 8](#)
- [Additional References, page 16](#)
- [Command Reference, page 17](#)
- [Feature Information for RADIUS Server Load Balancing, page 38](#)



Corporate Headquarters
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

© 2006 Cisco Systems, Inc. All rights reserved.

Prerequisites for RADIUS Server Load Balancing

- AAA must be configured on your RADIUS server.
- RADIUS must be configured for functions such as authentication, accounting, or static route download.
- AAA RADIUS server groups must be established.

Restrictions for RADIUS Server Load Balancing

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

Information About RADIUS Server Load Balancing

To configure the RADIUS Server Load Balancing feature, you must understand the following concepts:

- [How RADIUS Server Load Balancing Works, page 2](#)
- [How Transactions Are Load-Balanced Across RADIUS Server Groups, page 3](#)
- [RADIUS Server Status and Automated Testing, page 3](#)

How RADIUS Server Load Balancing Works

Load balancing distributes batches of transactions to servers within a server group. It 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:

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

Batch size is a user configured parameter. Changes in 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. It is recommended that the default batch size, 25, be used because it is optimal for high throughput, without adversely impacting CPU load.

**Note**

There is no set number for large or small batch sizes. As a frame of reference, a batch size greater than 50 is considered large and a batch size less than 25 is considered small.

**Note**

If you have ten or more servers in a server group, it is recommended that a high batch size be set in order to reduce CPU load.

How Transactions Are Load-Balanced Across RADIUS Server Groups

You can configure load balancing either per named RADIUS server group or for the global RADIUS server group. This server group must be referred to as “radius” in the AAA method lists. All public servers that are part of this server group will then be load balanced.

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

The preferred server is used unless one of the following states is true:

- The **ignore-preferred-server** keyword 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 server cost. If the want server is not available, the transaction fails.

You may want to use the **ignore-preferred-server** keyword 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 those records are stored on separate servers.

Also, if you have a configuration where your authentication servers are a superset of your accounting servers, then the preferred server will not be used.

RADIUS Server Status and Automated Testing

RADIUS server load balancing takes server status into account when assigning batches. Only servers that are verified alive are sent transaction batches. It is recommended that you test the status 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 is in quarantine. A server is in quarantine until it is verified alive by the RADIUS automated tester functionality.

The RADIUS automated tester uses the following steps to determine if a server is alive and available to process transactions:

- A request is sent periodically to the server for a test user ID.
- If an Access-Reject message is returned from the server, the server is alive.
- If no message is returned from the server, it is not alive; that is, the server is either dead or quarantined.

If transactions have been sent to a server that is not responding, before it is marked dead, that transaction is failed over to the next available server. It is recommended that the retry reorder mode for failed transactions be used.

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

**Caution**

It is recommended that a test user, one that is not defined on the RADIUS server, be used for RADIUS server automated testing to protect against security issues that may arise if the test user is not correctly configured.

**Note**

If you want to check load balancing transactions at a specific point in time, you can use the **test aaa group** command.

How to Configure RADIUS Server Load Balancing

This section contains the following procedures that allow you to configure load balancing:

- [Enabling Load Balancing for Named RADIUS Server Group, page 4](#)
- [Enabling Load Balancing for Global RADIUS Server Group, page 5](#)
- [Troubleshooting RADIUS Server Load Balancing, page 6](#)

Enabling Load Balancing for Named RADIUS Server Group

Use the following task to enable RADIUS server load balancing for a named server group.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **radius-server host** {*hostname* | *ip-address*} [**test username** *user-name*] [**auth-port** *port-number*] [**ignore-auth-port**] [**acct-port** *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**]

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.

	Command or Action	Purpose
Step 3	<pre>radius-server host {hostname ip-address} [test username user-name] [auth-port port-number] [ignore-auth-port] [acct-port port-number] [ignore-acct-port] [idle-time seconds]</pre> <p>Example: Router(config)# radius-server host 192.0.2.1 test username test1 idle-time 1</p>	<p>Enables RADIUS automated testing.</p> <ul style="list-style-type: none"> • The test username keyword must be used to enable RADIUS automated testing, followed by the value for the <i>user-name</i> argument. • By default, auth-port is tested using port 1645. • Use ignore-auth-port to turn off testing of the authentication port. • By default, acct-port is tested using port 1645. • Use ignore-acct-port to turn off testing of the accounting port. • By default, the idle-time is 3600 seconds. The range is 1 – 35791.
Step 4	<pre>aaa group server radius group-name</pre> <p>Example: Router(config)# aaa group server radius rad-sg</p>	<p>Enters server group configuration mode.</p>
Step 5	<pre>load-balance method least-outstanding [batch-size number] [ignore-preferred-server]</pre> <p>Example: Router(config-sg)# load-balance method least-outstanding batch-size 30</p>	<p>Enables least-outstanding load balancing for a server group.</p> <ul style="list-style-type: none"> • By default, the batch-size is set to 25. A range of 1 – 2147483647 may be used. • By default, the preferred server is enabled. • If you want to disable the preferred-server setting, use the keyword ignore-preferred-server.

Enabling Load Balancing for Global RADIUS Server Group

Use the following task to enable RADIUS server load balancing for the global RADIUS server group. This is the group referred to as “radius” in the AAA method lists.

SUMMARY STEPS

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

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	radius-server host {hostname ip-address} [test username user-name] [auth-port port-number] [ignore-auth-port] [acct-port port-number] [ignore-acct-port] [idle-time seconds] Example: Router(config)# radius-server host 192.0.2.1 test username test1 idle-time 1	Enables RADIUS automated testing. <ul style="list-style-type: none"> The test username keyword must be used to enable RADIUS automated testing, followed by the value for the <i>user-name</i> argument. By default, auth-port is tested using port 1645. Use ignore-auth-port to turn off testing of the authentication port. By default, acct-port is tested using port 1645. Use ignore-acct-port to turn off testing of the accounting port. By default, the idle-time is 3600 seconds. The range is 1 – 35791.
Step 4	radius-server load-balance method least-outstanding [batch-size number] [ignore-preferred-server] Example: Router(config)# radius-server load-balance method least-outstanding	Enables least-outstanding load balancing for the global RADIUS server group. <ul style="list-style-type: none"> By default, the batch-size is set to 25. A range of 1 – 2147483647 may be used. By default, the preferred server is enabled. If you want to disable the preferred server setting, use the ignore-preferred-server keyword.

Troubleshooting RADIUS Server Load Balancing

After configuring RADIUS server load balancing, you may monitor the idle timer, dead timer, load balancing server selection, or issue a manual test command to verify server status.

For troubleshooting RADIUS server load balancing you can use the following commands as appropriate.

- The **debug aaa test** command can be used to determine when the idle timer or dead timer has expired, when test packets are sent, the status of the server, or to verify server state.
- The **debug aaa sg-server selection** command can be used to examine which server is being selected for load balancing.
- The **test aaa group** command can be used to manually verify RADIUS load-balanced server status.

SUMMARY STEPS

1. **debug aaa test**
2. **debug aaa sg-server selection**
3. **test aaa group *group-name* *username* *password* *new-code***

DETAILED STEPS

Step 1 The idle timer is used to check the server status and is updated with or without any incoming requests. It is useful to monitor the idle timer to determine if there are nonresponsive servers and to keep your RADIUS server status updated in order to efficiently utilize your available resources. For instance, an updated idle timer would help ensure that incoming requests are being 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 can help you determine how often the server selection changes. This is effective in analyzing if there is a bottleneck, a large number of queued up requests, or if only specific servers are processing incoming requests.

For example, the following debug output shows when the idle-timer has expired:

```
Router# 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 For example, the following debug output shows 5 access requests being sent to a server group with a batch size of 3:

```
Router# 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** The following example 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 a AAA packet generated by the **test aaa group** command.

```
Router# 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 [ailure]
00:06:07: RADIUS(00000000): Received from id 1645/1
00:06:07: RADIUS/DECODE: Reply-Message fragments, 22, total 22 bytes
Router#

```

Configuration Examples for RADIUS Server Load Balancing

This section provides the following RADIUS server load balancing configuration examples:

- [Global RADIUS Server Group: Examples, page 8](#)
- [Named RADIUS Server Group: Examples, page 11](#)
- [Idle Timer Monitoring: Examples, page 13](#)
- [Preferred Server with the Same Authentication and Authorization Server: Example](#)
- [Preferred Server with Different Authentication and Authorization Servers: Example](#)
- [Preferred Server with Overlapping Authentication and Authorization Servers: Example](#)
- [Preferred Server with Authentication Servers As a Subset of Authorization Servers: Example](#)
- [Preferred Server with Authentication Servers As a Superset of Authorization Servers: Example](#)

Global RADIUS Server Group: Examples

The following example shows how to enable load balancing for global RADIUS server groups. It is shown in three parts: the current configuration of RADIUS command output, debug output, and AAA server status information. You can use the delimiting characters to display only the relevant parts of the configuration.

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

The following shows the relevant RADIUS configuration.

```
Router# 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
```

The lines in the current configuration of 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 the AAA server once the client is authenticated and after the disconnect using the keyword **start-stop**.
- 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 key identified.
- The **radius-server load-balance** command enables load balancing for the global radius server groups with the batch size specified.

Debug Output for Global RADIUS Server Group Example

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

```
Router# show debug
```

General OS:

AAA server group server selection debugging is on

#

<sending 10 pppoe requests>

Router#

*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
.
.
.

```

Server Status Information for Global RADIUS Server Group Example

The output below shows the AAA server status for the global RADIUS server group configuration example.

Router# **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 output shows the status of two RADIUS servers. Both servers are up and, in the last 2 minutes, have successfully processed:

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

Named RADIUS Server Group: Examples

The following example shows load balancing enabled for a named RADIUS server group. It is shown in three parts: the current configuration of RADIUS command output, debug output, and AAA server status information.

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

The following shows the relevant RADIUS configuration.

```
Router# 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 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 the 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 the sending of all accounting requests to the AAA server once the client is authenticated and after the disconnect using the **start-stop** keyword.

Debug Output for Named RADIUS Server Group Example

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

```
Router#

*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.
.
.
.

```

Server Status Information for Named RADIUS Server Group Example

The output below shows the AAA server status for the named RADIUS server group configuration example.

```
Router# 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 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.

Idle Timer Monitoring: Examples

The following example shows idle timer and related server state for load balancing enabled for a named RADIUS server group. It is shown in two parts: the current configuration of RADIUS command output and debug output.

Server Configuration and Enabling Load Balancing for Idle Timer Monitoring Example

The following shows the relevant RADIUS configuration.

```

Router# 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 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 the 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.

Debug Output for Idle Timer Monitoring Example

The debug output below shows the 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.

```

Router#

*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.
.
.
.

```

Preferred Server with the Same Authentication and Authorization Server: Example

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

```

Once 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 will be load balanced based on sessions rather than transactions.

Preferred Server with Different Authentication and Authorization Servers: Example

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 will never be found for accounting transactions, therefore, authentication and accounting servers will be load balanced based on transactions. Start and stop records will be sent to the same server for a session.

Preferred Server with Overlapping Authentication and Authorization Servers: Example

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 will be directed towards server 209.165.201.1. Therefore, one-third of all accounting transactions will also be directed towards server 209.165.201.1. The remaining two-thirds accounting transactions will be load balanced equally between servers 209.165.201.1 and 209.165.201.2. The server 209.165.201.1 will receive fewer authentication transactions since server 209.165.201.1 will have outstanding accounting transactions.

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

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 will be sent to server 209.165.200.225 and the other half to server 209.165.200.226. Servers 209.165.200.225 and 209.165.200.226 will be the preferred servers for authentication and accounting transaction, therefore there will be an equal distribution of authentication and accounting transactions across servers 209.165.200.225 and 209.165.200.226. Server 209.165.201.1 will be relatively unused.

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

The following example shows an authentication server group that uses servers 209.165.200.225 and 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 will be assigned to each server in the authorization server group. As accounting transactions are generated for more sessions, the accounting transactions will only be sent to servers 209.165.200.225 and 209.165.200.226, since 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. The transaction requests authenticated by server 209.165.201.1, will not have any preferred server setting and will be 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

The following sections provide references related to the RADIUS Server Load Balancing feature.

Related Documents

Related Topic	Document Title
AAA and RADIUS	“ Authentication, Authorization, and Accounting (AAA) ” section in the <i>Cisco IOS Security Configuration Guide</i> , Release 12.4
AAA Server Groups	“ AAA Server Groups ” chapter in the <i>Cisco IOS Security Configuration Guide</i> , Release 12.4
RADIUS Configuration	“ Configuring RADIUS ” chapter in the <i>Cisco IOS Security Configuration Guide</i> , Release 12.4
Failover retry reorder mode	“ RADIUS Server Reorder on Failure ” section in the <i>Cisco IOS Security Configuration Guide</i> , Release 12.4

Standards

Standards	Title
None	—

MIBs

MIBs	MIBs Link
<ul style="list-style-type: none">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
The Cisco Technical Support & Documentation website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, tools, and technical documentation. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Command Reference

This section documents modified commands only.

- [debug aaa test](#)
- [debug aaa sg-server selection](#)
- [load-balance \(server-group\)](#)
- [radius-server host](#)
- [radius-server load-balance](#)
- [test aaa group](#)

debug aaa sg-server selection

To obtain information about why the RADIUS and TACACS+ server group system in a router is choosing a particular server, use the **debug aaa sg-server selection** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

debug aaa sg-server selection

no debug aaa sg-server selection

Syntax Description This command has no arguments or keywords.

Command Defaults Debugging is not turned on.

Command Modes Privileged EXEC

Command History

Release	Modification
12.3(1)	This command was introduced.
12.2(28)SB	This command was extended for RADIUS server load balancing to show which server is selected on the basis of a load balancing algorithm.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Examples

The following example shows that debugging has been set to display information about server selection:

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

The following two debug outputs display the behavior of RADIUS transactions within a server group with the server-reorder-on-failure feature configured.

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 attempted only once before failover to the next configured server), and the transmissions per transaction are set to 4 (the transmissions will stop on the third failover). The third server in the server group (192.0.2.118) 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: 192.0.2.4
```

```

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 192.0.2.130 for Radius-Server 192.0.2.1
00:38:59: RADIUS(0000000F) : Send Access-Request to 192.0.2.1:1645 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 "username"
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 "192.0.2.23"
00:39:00: RADIUS: NAS-IP-Address [4] 6 192.0.2.130
00:39:02: RADIUS: Fail-over to (192.0.2.2:1645,1646) for id 21645/11
00:39:02: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.2
00:39:04: RADIUS: Fail-over to (192.0.2.118:1645,1646) for id 21645/11
00:39:04: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server
192.0.2.118
00:39:05: RADIUS: Received from id 21645/11 192.0.2.118:1645, 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 192.0.2.1 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: 192.0.2.4
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 192.0.2.130 for Radius-Server 192.0.2.118
00:43:40: RADIUS(00000012) : Send Access-Request to 192.0.2.118:1645 id 21645/14, len 78
00:43:40: RADIUS: authenticator B8 0A 51 3A AF A6 0018 -B3 2E 94 5E 07 0B 2A
00:43:40: RADIUS: User-Name [1] 7 "username"
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 "192.0.2.23"
00:43:40: RADIUS: NAS-IP-Address [4] 6 192.0.2.130
00:43:42: RADIUS: Fail-over to (192.0.2.1:1645,1646) for id 21645/14
00:43:42: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.1
00:43:44: RADIUS: Fail-over to (192.0.2.2:1645,1646) for id 21645/14
00:43:44: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.2
00:43:46: RADIUS: Fail-over to (192.0.2.118:1645,1646) for id 21645/14
00:43:46: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.118
00:43:48: RADIUS: Fail-over to (192.0.2.1:1645,1646) for id 21645/14
00:43:48: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.1
00:43:50: RADIUS: Fail-over to (192.0.2.2:1645,1646) for id 21645/14
00:43:50: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.2
00:43:52: RADIUS: Fail-over to (192.0.2.118:1645,1646) for id 21645/14
00:43:52: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.118
00:43:54: RADIUS: Fail-over to (192.0.2.1:1645,1646) for id 21645/14
00:43:54: RADIUS/ENCODE: Best Local IP-Address 192.0.2.130 for Radius-Server 192.0.2.1
00:43:56: RADIUS: No response from (192.0.2.1:1645,1646) for id 21645/14
00:43:56: RADIUS/DECODE: parse response no app start; FAIL

```

debug aaa sg-server selection

```
00:43:56: RADIUS/DECODE: parse response;FAIL
```

The field descriptions are self-explanatory.

Debug 3

In the following sample output, the RADIUS server load balancing feature is enabled with a batch size of 3. The server selection, based on the load balancing algorithm, is shown as five access-requests that are being sent to the server group.

```
Router# 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.
```

The field descriptions are self-explanatory.

Related Commands

Command	Description
load-balance	Enables RADIUS server load balancing for named RADIUS server groups.
radius-server load-balance	Enables RADIUS server load balancing for the global RADIUS server group.
radius-server retry method reorder	Specifies the reordering of RADIUS traffic retries among a server group.
radius-server transaction max-tries	Specifies the maximum number of transmissions per transaction that may be retried on a RADIUS server.
test aaa group	Tests RADIUS load balancing server response manually.

debug aaa test

To show when the idle timer or dead timer has expired, when test packets are being sent, server response status, and the server state for RADIUS server load balancing, use the **debug aaa test** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

debug aaa test

no debug aaa test

Syntax Description This command has no arguments or keywords.

Command Defaults Debugging is not enabled.

Command Modes Privileged EXEC


Command History	Release	Modification
	12.2(28)SB	This command was introduced.
	12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Examples In the following sample output, the RADIUS server load balancing feature is enabled. The idle timer has expired.

```
Router# debug aaa test
```

```
Router#
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.
```

Related Commands	Command	Description
	load-balance	Enables RADIUS server load balancing for named RADIUS server groups.
	radius-server host	Enables RADIUS automated testing for load balancing.

 debug aaa test

Command	Description
radius-server load-balance	Enables RADIUS server load balancing for the global RADIUS server group.
test aaa group	Tests RADIUS load balancing server response manually.

load-balance (server-group)

To enable RADIUS server load balancing for a named RADIUS server group, use the **load-balance** command in server group configuration mode. To disable named RADIUS server load balancing, use the **no** form of this command.

load-balance method least-outstanding [*batch-size number*] [*ignore-preferred-server*]

no load-balance

Syntax Description	
method least-outstanding	Enables least outstanding mode for load balancing.
batch-size	(Optional) The number of transactions to be assigned per batch.
<i>number</i>	(Optional) The number of transactions in a batch. <ul style="list-style-type: none"> The default is 25. The range is 1–2147483647. <p>Note Batch size may impact throughput and CPU load. It is recommended that the default batch size, 25, be used because it is optimal for high throughput, without adversely impacting CPU load.</p>
ignore-preferred-server	(Optional) Indicates if a transaction associated with a single authentication, authorization, and accounting (AAA) session should attempt to use the same server or not. <ul style="list-style-type: none"> If set, preferred server setting will not be used. Default is to use the preferred server.

Command Defaults If this command is not configured, named RADIUS server load balancing will not occur.

Command Modes Server group configuration

Command History	Release	Modification
	12.2(28)SB	This command was introduced.
	12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Examples The following example shows load balancing enabled for a named RADIUS server group. It is shown in three parts: the current configuration of RADIUS command output, debug output, and AAA server status information.

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

The following shows the relevant RADIUS configuration:

```
Router# 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 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 the 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 the sending of all accounting requests to the AAA server after the client is authenticated and after the disconnect using the start-stop keyword.

Debug Output for Named RADIUS Server Group Example

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

```

Router#
*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.
.
.
.
```

Server Status Information for Named RADIUS Server Group Example

The output below shows the AAA server status for the named RADIUS server group configuration example.

Router# **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
Router#
```

The 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.

Related Commands


Command	Description
debug aaa sg-server selection	Shows why the RADIUS and TACACS+ server group system in a router is selecting a particular server.
debug aaa test	Shows when the idle timer or dead timer has expired for RADIUS load balancing.
radius-server host	Enables RADIUS automated testing for load balancing.
radius-server load-balance	Enables RADIUS server load balancing for the global RADIUS server group.
test aaa group	Tests RADIUS load balancing server response manually.

radius-server host

To specify a RADIUS server host, use the **radius-server host** command in global configuration mode. To delete the specified RADIUS host, use the **no** form of this command.

```
radius-server host {hostname | ip-address} [test username user-name] [auth-port port-number]
[ignore-auth-port] [acct-port port-number] [ignore-acct-port] [timeout seconds]
[retransmit retries] [key string] [alias {hostname | ip-address}] [idle-time seconds]
```

```
no radius-server host {hostname | ip-address}
```

Syntax Description	
<i>hostname</i>	Domain Name System (DNS) name of the RADIUS server host.
<i>ip-address</i>	IP address of the RADIUS server host.
test username	(Optional) Turns on the automated testing feature for RADIUS server load balancing.
<i>user-name</i>	(Optional) Test user ID username. <ul style="list-style-type: none"> Must be used if the test username keyword is used.
<div>  Caution </div> It is recommended that a test user, one that is not defined on the RADIUS server, be used for RADIUS server automated testing to protect against security issues that may arise if the test user is not correctly configured.	
auth-port	(Optional) Specifies the UDP destination port for authentication requests.
<i>port-number</i>	(Optional) Port number for authentication requests; the host is not used for authentication if set to 0. If unspecified, the port number defaults to 1645.
ignore-auth-port	(Optional) Turns off the automated testing feature for RADIUS server load balancing on the authentication port.
acct-port	(Optional) Specifies the UDP destination port for accounting requests.
<i>port-number</i>	(Optional) Port number for accounting requests; the host is not used for accounting if set to 0. If unspecified, the port number defaults to 1646.
ignore-acct-port	(Optional) Turns off the automated testing feature for RADIUS server load balancing on the accounting port.
timeout	(Optional) The time interval (in seconds) that the router waits for the RADIUS server to reply before retransmitting. This setting overrides the global value of the radius-server timeout command. If no timeout value is specified, the global value is used. Enter a value in the range 1 to 1000.
<i>seconds</i>	(Optional) Specifies the timeout value. Enter a value in the range 1 to 1000. If no timeout value is specified, the global value is used.
retransmit	(Optional) The number of times a RADIUS request is re-sent to a server, if that server is not responding or responding slowly. This setting overrides the global setting of the radius-server retransmit command.
<i>retries</i>	(Optional) Specifies the retransmit value. Enter a value in the range 1 to 100. If no retransmit value is specified, the global value is used.

key	<p>(Optional) Specifies the authentication and encryption key used between the router and the RADIUS daemon running on this RADIUS server. This key overrides the global setting of the radius-server key command. If no key string is specified, the global value is used.</p> <p>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. This is because the leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in the key, do not enclose the key in quotation marks unless the quotation marks themselves are part of the key.</p>
<i>string</i>	(Optional) Specifies the authentication and encryption key for all RADIUS communications between the router and the RADIUS server. This key must match the encryption used on the RADIUS daemon. All 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.
alias	(Optional) Allows up to eight aliases per line for any given RADIUS server.
idle-time	(Optional) Specifies the time the server remains idle before it is quarantined and test packets are sent out.
<i>seconds</i>	<p>(Optional) Length of idle time.</p> <ul style="list-style-type: none"> Default is 3600 seconds (1 hour). <p>The valid range is 1–35791 seconds.</p>

Defaults

No RADIUS host is specified; use global **radius-server** command values.

RADIUS server load balancing automated testing is disabled by default.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.
12.0(5)T	This command was modified to add options for configuring timeout, retransmission, and key values per RADIUS server.
12.1(3)T	The alias keyword was added on the Cisco AS5300 and AS5800 universal access servers.
12.2(28)SB	The following keywords and arguments were added for configuring RADIUS server load balancing automated testing functionality: test username user-name , ignore-auth-port , ignore-acct-port , and idle-time seconds .
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Usage Guidelines

You can use multiple **radius-server host** commands to specify multiple hosts. The software searches for hosts in the order in which you specify them.

If no host-specific timeout, retransmit, or key values are specified, the global values apply to each host.

RADIUS Server Automated Testing

When using the **radius-server host** command to enable automated testing for RADIUS server load balancing:

The authentication port is checked by default. If not specified, the default port of 1645 is used. If you wish to not check the authentication port, the **ignore-auth-port** keyword must be specified.

The accounting port is checked by default. If not specified, the default port of 1645 is used. If you wish to not check the accounting port, the **ignore-acct-port** keyword must be specified.

Examples

The following example specifies *host1* as the RADIUS server and uses default ports for both accounting and authentication:

```
radius-server host host1
```

The following example specifies port 1612 as the destination port for authentication requests and port 1616 as the destination port for accounting requests on the RADIUS host named *host1*:

```
radius-server host host1 auth-port 1612 acct-port 1616
```

Because entering a line resets all the port numbers, you must specify a host and configure accounting and authentication ports on a single line.

The following example specifies the host with IP address 192.0.2.46 as the RADIUS server, uses ports 1612 and 1616 as the authorization and accounting ports, sets the timeout value to 6, sets the retransmit value to 5, and sets “rad123” as the encryption key, matching the key on the RADIUS server:

```
radius-server host 192.0.2.46 auth-port 1612 acct-port 1616 timeout 6 retransmit 5 key  
rad123
```

To use separate servers for accounting and authentication, use the zero port value as appropriate.

The following example specifies that RADIUS server *host1* be used for accounting but not for authentication, and that RADIUS server *host2* be used for authentication but not for accounting:

```
radius-server host host1.example.com auth-port 0  
radius-server host host2.example.com acct-port 0
```

The following example specifies four aliases on the RADIUS server with IP address 192.0.2.1:

```
radius-server host 192.0.2.1 acct-port 1645 auth-port 1646  
radius-server host 192.0.2.1 alias 192.0.2.2 192.0.2.3 192.0.2.4
```

The following example shows how to enable RADIUS server automated testing for load balancing with the authorization and accounting ports specified:

```
radius-server host 192.0.2.176 test username test1 auth-port 1645 acct-port 1646
```

Related Commands	Command	Description
	aaa accounting	Enables AAA accounting of requested services for billing or security purposes.
	aaa authentication ppp	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
	aaa authorization	Sets parameters that restrict network access to a user.
	debug aaa test	Shows when the idle-timer or dead-timer has expired for RADIUS server load balancing.
	load-balance	Enables RADIUS server load balancing for named RADIUS server groups.
	ppp	Starts an asynchronous connection using PPP.
	ppp authentication	Enables CHAP or PAP or both and specifies the order in which CHAP and PAP authentication are selected on the interface.
	radius-server key	Sets the authentication and encryption key for all RADIUS communications between the router and the RADIUS daemon.
	radius-server load-balance	Enables RADIUS server load balancing for the global RADIUS server group.
	radius-server retransmit	Specifies how many times the Cisco IOS software searches the list of RADIUS server hosts before giving up.
	radius-server timeout	Sets the interval a router waits for a server host to reply.
	test aaa group	Tests RADIUS load balancing server response manually.
	username	Establishes a username-based authentication system, such as PPP CHAP and PAP.

radius-server load-balance

To enable RADIUS server load balancing for the global RADIUS server group referred to as “radius” in the authentication, authorization and accounting (AAA) method lists, use the **radius-server load-balance** command in global configuration mode. To disable RADIUS server load balancing, use the **no** form of this command.

radius-server load-balance method least-outstanding [*batch-size number*]
[*ignore-preferred-server*]

no radius-server load-balance

Syntax Description	
method least-outstanding	Enables least outstanding mode for load balancing.
batch-size	(Optional) The number of transactions to be assigned per batch.
<i>number</i>	(Optional) The number of transactions in a batch. <ul style="list-style-type: none"> The default is 25. The range is 1–2147483647. <p>Note Batch size may impact throughput and CPU load. It is recommended that the default batch size, 25, be used because it is optimal for high throughput, without adversely impacting CPU load.</p>
ignore-preferred-server	(Optional) Indicates if a transaction associated with a single AAA session should attempt to use the same server or not. <ul style="list-style-type: none"> If set, preferred server setting will not be used. Default is to use the preferred server.

Command Defaults If this command is not configured, global RADIUS server load balancing will not occur.

Command Modes Global configuration

Command History	Release	Modification
	12.2(28)SB	This command was introduced.
	12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Examples The following example shows how to enable load balancing for global RADIUS server groups. It is shown in three parts: the current configuration of RADIUS command output, debug output, and AAA server status information. You can use the delimiting characters to display only the relevant parts of the configuration.

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

The following shows the relevant RADIUS configuration:

```
Router# show running-config | inc 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
```

The lines in the current configuration of 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 the AAA server after the client is authenticated and after the disconnect using the keyword start-stop.
- 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 key identified.
- The **radius-server load-balance** command enables load balancing for the global RADIUS server groups with the batch size specified.

Debug Output for Global RADIUS Server Group Example

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

```
Router# show debug
```

General OS:

AAA server group server selection debugging is on

```
Router#
```

```
<sending 10 pppoe requests>
```

```
Router#
```

```
*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
*Feb 28 13:40:32.199:AAA/SG/SERVER_SELECT(0000001A):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 13:40:32.203:AAA/SG/SERVER_SELECT(0000001A):Server (192.0.2.238:2015,2016) now
being used as preferred server
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT(0000001B):No preferred server available.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:[3] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT(0000001B):Server (192.0.2.238:2015,2016) now
being used as preferred server
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT(0000001C):No preferred server available.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:[2] transactions remaining in batch. Reusing
server.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT(0000001C):Server (192.0.2.238:2015,2016) now
being used as preferred server
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT(0000001D):No preferred server available.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:Obtaining least loaded server.
*Feb 28 13:40:32.203:AAA/SG/SERVER_SELECT:[1] transactions remaining in batch. Reusing
server
.
.
.

```

Server Status Information for Global RADIUS Server Group Example

The output below shows the AAA server status for the global RADIUS server group configuration example.

Router# **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
Router#

```

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

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

Related Commands

Command	Description
debug aaa sg-server selection	Shows why the RADIUS and TACACS+ server group system in a router is selecting a particular server.
debug aaa test	Shows when the idle timer or dead timer has expired for RADIUS server load balancing.
load-balance	Enables RADIUS server load balancing for named RADIUS server groups.
radius-server host	Enables RADIUS automated testing for load balancing.
test aaa group	Tests RADIUS load balancing server response manually.

test aaa group

To associate a dialed number identification service (DNIS) or calling line identification (CLID) user profile with the record that is sent to the RADIUS server or to manually test load balancing server status, use the **test aaa group** command in privileged EXEC mode.


DNIS and CLID User Profile

```
test aaa group {group-name | radius} username password new-code [profile profile-name]
```

RADIUS Server Load Balancing Manual Testing

```
test aaa group group-name [server ip-address] [auth-port port-number] [acct-port port-number]  
username password new-code [count n] [rate m] [blocked {yes | no}]
```

Syntax Description

<i>group-name</i>	Subset of RADIUS servers that are used as defined by the server group <i>group-name</i> .
radius	Uses RADIUS servers for authentication.
<i>username</i>	Specifies a name for the user.
<div style="display: flex; align-items: center;">  <div> <p>Caution</p> <p>If you use this command to manually test RADIUS load balancing server state, it is recommended that a test user, one that is not defined on the RADIUS server, be used to protect against security issues that may arise if the test user is not correctly configured.</p> </div> </div>	
<i>password</i>	Character string that specifies the password.
new-code	The code path through the new code, which supports a CLID or DNIS user profile association with a RADIUS server.
profile <i>profile-name</i>	(Optional) Identifies the user profile specified in the aaa user profile command. To associate a user profile with the RADIUS server, the user profile name must be identified.
server <i>ip-address</i>	(Optional) For RADIUS server load balancing, specifies which server in the server group the test packets will be sent to.
auth-port	(Optional) Specifies the User Datagram Protocol (UDP) destination port for authentication requests.
<i>port-number</i>	(Optional) Port number for authentication requests; the host is not used for authentication if set to 0. If unspecified, the port number defaults to 1646.
acct-port	(Optional) Specifies the UDP destination port for accounting requests.
<i>port-number</i>	(Optional) Port number for accounting requests; the host is not used for accounting if set to 0. If unspecified, the port number defaults to 1646.
count <i>n</i>	(Optional) Specifies how many authentication and accounting requests are to be sent to the server for each port. <ul style="list-style-type: none"> • Default is 1. • Range for <i>n</i> is 1 – 50000.

rate <i>m</i>	(Optional) Specifies how many requests per second will be sent to the server. <ul style="list-style-type: none"> • Default is 10 requests per second. • Range for <i>m</i> is 1 – 1000.
blocked { yes no }	(Optional) Specifies if the request will be sent in blocking or nonblocking mode. If blocked keyword is not used: <ul style="list-style-type: none"> • Default is blocking mode if one request is sent. • Default is nonblocking mode if more than one request is sent.

Command Defaults**DNIS and CLID User Profile**

If this command is not enabled, DNIS or CLID attribute values will not be sent to the RADIUS server.

RADIUS Server Load Balancing Manual Testing

RADIUS server load balancing server status manual testing will not occur.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(4)T	This command was introduced.
12.2(28)SB	The following keywords and arguments were added for configuring RADIUS load balancing manual testing functionality: server <i>ip-address</i> , auth-port <i>port-number</i> , acct-port <i>port-number</i> , count <i>n</i> , rate <i>m</i> , blocked .
12.4(11)T	This command was integrated into Cisco IOS Release 12.4(11)T.

Usage Guidelines

The **test aaa group** command can be used to

- Associate a DNIS or CLID named user profile with the record that is sent to the RADIUS server, which can then access DNIS or CLID information when the server receives a RADIUS record.
- Verify RADIUS load balancing server status.

**Note**

The **test aaa group** command does not work with TACACS+.

The following example shows how to configure a dnis = dnisvalue user profile named "prfl1" and associate it with a **test aaa group** command:

```
aaa user profile prfl1
  aaa attribute dnis
  aaa attribute dnis dnisvalue
  no aaa attribute clid
! Attribute not found.
  aaa attribute clid clidvalue
  no aaa attribute clid
exit
!
```

! Associate the dn timer profile with the test aaa group command.
 test aaa group radius user1 pass new-code profile prfl1

The following example 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 a AAA packet generated by the **test aaa group** command.

Router# **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 ]
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
```

Related Commands

Command	Description
aaa attribute	Adds DNIS or CLID attribute values to a user profile.
aaa user profile	Creates a AAA user profile.
load-balance	Enables RADIUS server load balancing for RADIUS-named server groups.
radius-server host	Enables RADIUS automated testing for load balancing.
radius-server load-balance	Enables RADIUS server load balancing for the global RADIUS server group.

Feature Information for RADIUS Server Load Balancing

Table 1 lists the release history for this feature.

Not all commands may be available in your Cisco IOS software release. For release information about a specific command, see the command reference documentation.

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which Cisco IOS and Catalyst OS software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to <http://www.cisco.com/go/cfn>. An account on Cisco.com is not required.



Note

Table 1 lists only the Cisco IOS software release that introduced support for a given feature in a given Cisco IOS software release train. Unless noted otherwise, subsequent releases of that Cisco IOS software release train also support that feature.

Table 1 Feature Information for RADIUS Server Load Balancing

Feature Name	Releases	Feature Information
RADIUS Server Load Balancing	12.2(28)SB 12.4(11)T	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.

CCVP, the Cisco logo, and Welcome to the Human Network are trademarks of Cisco Systems, Inc.; Changing the Way We Work, Live, Play, and Learn is a service mark of Cisco Systems, Inc.; and Access Registrar, Aironet, Catalyst, CCDA, CCDP, CCIE, CCIP, CCNA, CCNP, CCSP, Cisco, the Cisco Certified Internetwork Expert logo, Cisco IOS, Cisco Press, Cisco Systems, Cisco Systems Capital, the Cisco Systems logo, Cisco Unity, Enterprise/Solver, EtherChannel, EtherFast, EtherSwitch, Fast Step, Follow Me Browsing, FormShare, GigaDrive, HomeLink, Internet Quotient, IOS, iPhone, IP/TV, iQ Expertise, the iQ logo, iQ Net Readiness Scorecard, iQuick Study, LightStream, Linksys, MeetingPlace, MGX, Networkers, Networking Academy, Network Registrar, PIX, ProConnect, ScriptShare, SMARTnet, StackWise, The Fastest Way to Increase Your Internet Quotient, and TransPath are registered trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries.

All other trademarks mentioned in this document or Website 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. (0711R)

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

© 2006 Cisco Systems, Inc. All rights reserved.