Configuring RADIUS

This chapter describes how to configure the Remote Access Dial-In User Service (RADIUS) protocol on Cisco NX-OS devices.

This chapter includes the following sections:

Finding Feature Information

Your software release might not support all the features documented in this module. For the latest caveats and feature information, see the Bug Search Tool at https://tools.cisco.com/bugsearch/ and the release notes for your 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 "New and Changed Information"chapter or the Feature History table in this chapter.

Information About RADIUS

The RADIUS distributed client/server system allows you to secure networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco NX-OS devices and send authentication and accounting requests to a central RADIUS server that contains all user authentication and network service access information.

RADIUS Network Environments

RADIUS can be implemented in a variety of network environments that require high levels of security while maintaining network access for remote users.

You can use RADIUS in the following network environments that require access security:

- Networks with multiple-vendor network devices, each supporting RADIUS. For example, network devices from several vendors can use a single RADIUS server-based security database.
- Networks already using RADIUS. You can add a Cisco NX-OS device with RADIUS to the network. This action might be the first step when you make a transition to a AAA server.
- Networks that require resource accounting. You can use RADIUS accounting independent of RADIUS authentication or authorization. The RADIUS accounting functions allow data to be sent at the start and end of services, indicating the amount of resources (such as time, packets, bytes, and so on) used during the session. An Internet service provider (ISP) might use a freeware-based version of the RADIUS access control and accounting software to meet special security and billing needs.
- Networks that support authentication profiles. Using the RADIUS server in your network, you can configure AAA authentication and set up per-user profiles. Per-user profiles enable the Cisco NX-OS device to better manage ports using their existing RADIUS solutions and to efficiently manage shared resources to offer different service-level agreements.

RADIUS Operation

When a user attempts to log in and authenticate to a Cisco NX-OS device using RADIUS, the following process occurs:

- The user is prompted for and enters a username and password.
- The username and encrypted password are sent over the network to the RADIUS server.
- The user receives one of the following responses from the RADIUS server:

  ACCEPT
  The user is authenticated.
  REJECT
  The user is not authenticated and is prompted to reenter the username and password, or access is denied.
  CHALLENGE
  A challenge is issued by the RADIUS server. The challenge collects additional data from the user.
  CHANGE PASSWORD
  A request is issued by the RADIUS server, asking the user to select a new password.

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:

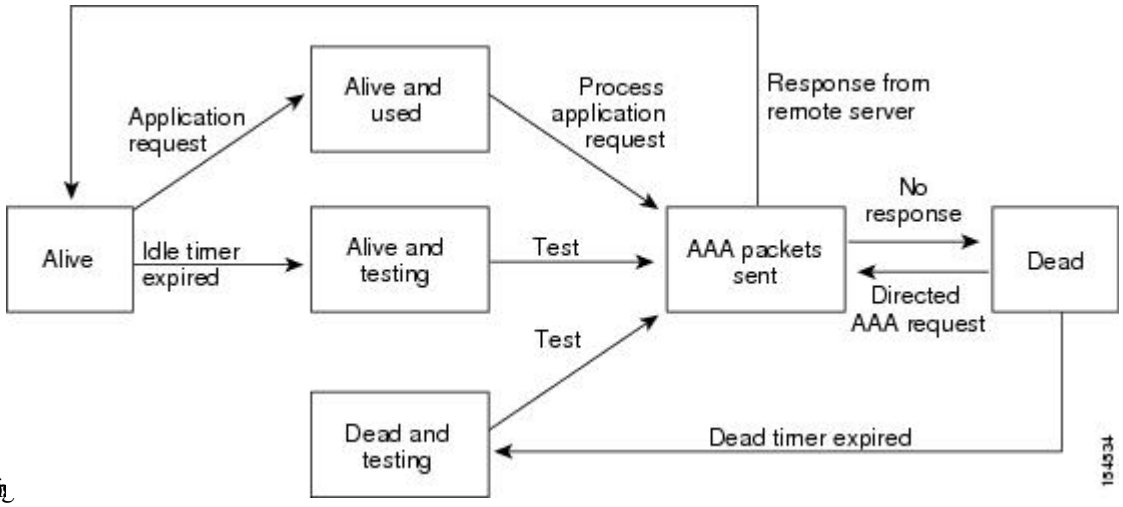
- Services that the user can access, including Telnet, rlogin, or local-area transport (LAT) connections, and Point-to-Point Protocol (PPP), Serial Line Internet Protocol (SLIP), or EXEC services.
- Connection parameters, including the host or client IPv4 or IPv6 address, access list, and user timeouts.

RADIUS Server Monitoring

An unresponsive RADIUS server can cause a delay in processing AAA requests. You can configure the Cisco NX-OS device to periodically monitor a RADIUS server to check whether it is responding (or alive) to save time in processing AAA requests. The Cisco NX-OS device marks unresponsive RADIUS servers as dead and does not send AAA requests to any dead RADIUS servers. The Cisco NX-OS device periodically monitors the dead RADIUS servers and brings them to the alive state once they respond. This monitoring process verifies that a RADIUS server is in a working state before real AAA requests are sent its way. Whenever a RADIUS server changes to the dead or alive state, a Simple Network Management Protocol (SNMP) trap is generated and the Cisco NX-OS device displays an error message that a failure is taking place.

Figure 1: RADIUS Server States

This figure shows the states for RADIUS server



Note The monitoring interval for alive servers and dead servers are different and can be configured by the user. The RADIUS server monitoring is performed by sending a test authentication request to the RADIUS server.

RADIUS Configuration Distribution

Cisco Fabric Services (CFS) allows the Cisco NX-OS device to distribute the RADIUS configuration to other Cisco NX-OS devices in the network. When you enable CFS distribution for a feature on your device, the device belongs to a CFS region containing other devices in the network that you have also enabled for CFS distribution for the feature. CFS distribution for RADIUS is disabled by default.

Note You must explicitly enable CFS for RADIUS on each device to which you want to distribute configuration changes.

After you enable CFS distribution for RADIUS on your Cisco NX-OS device, the first RADIUS configuration command that you enter causes the Cisco NX-OS software to take the following actions:

- Creates a CFS session on your Cisco NX-OS device.

- Locks the RADIUS configuration on all Cisco NX-OS devices in the CFS region with CFS enabled for RADIUS.
- Saves the RADIUS configuration changes in a temporary buffer on the Cisco NX-OS device.

The changes stay in the temporary buffer on the Cisco NX-OS device until you explicitly commit them to be distributed to the devices in the CFS region. When you commit the changes, the Cisco NX-OS software takes the following actions:

- Applies the changes to the running configuration on your Cisco NX-OS device.
- Distributes the updated RADIUS configuration to the other Cisco NX-OS devices in the CFS region.
- Unlocks the RADIUS configuration in the devices in the CFS region.
- Terminates the CFS session.

CFS does not distribute the RADIUS server group configuration or server and global keys. The keys are unique to the Cisco NX-OS device and are not shared with other Cisco NX-OS devices.

For detailed information on CFS, see the *Cisco Nexus 7000 Series NX-OS System Management Configuration Guide*.

Vendor-Specific Attributes

The Internet Engineering Task Force (IETF) draft standard specifies a method for communicating VSAs between the network access server and the RADIUS server. The IETF uses attribute 26. VSAs allow vendors to support their own extended attributes that are not suitable for general use. The Cisco RADIUS implementation supports one vendor-specific option using the format recommended in the specification. The Cisco vendor ID is 9, and the supported option is vendor type 1, which is named cisco-av-pair. The value is a string with the following format:

```
protocol : attribute separator value *
```

The protocol is a Cisco attribute for a particular type of authorization, the separator is = (equal sign) for mandatory attributes, and * (asterisk) indicates optional attributes.

When you use RADIUS servers for authentication on a Cisco NX-OS device, the RADIUS protocol directs the RADIUS server to return user attributes, such as authorization information, with authentication results. This authorization information is specified through VSAs.

The following VSA protocol options are supported by the Cisco NX-OS software:

Shell
Protocol used in access-accept packets to provide user profile information.

Accounting
Protocol used in accounting-request packets. If a value contains any white spaces, you should enclose the value within double quotation marks.

The Cisco NX-OS software supports the following attributes:

roles
Lists all the roles to which the user belongs. The value field is a string that lists the role names delimited by white space. For example, if the user belongs to roles network-operator and vdc-admin, the value field would be network-operator vdc-admin. This subattribute, which the RADIUS server sends in the

VSA portion of the Access-Accept frames, can only be used with the shell protocol value. The following examples show the roles attribute that is supported by the Cisco Access Control Server (ACS):

```
shell:roles=network-operator vdc-admin

shell:roles*"network-operator vdc-admin
```

The following examples show the roles attribute that is supported by FreeRADIUS:

```
Cisco-AVPair = shell:roles=\network-operator vdc-admin\

Cisco-AVPair = shell:roles*\network-operator vdc-admin\
```

Note When you specify a VSA as shell:roles*"network-operator vdc-admin" or "shell:roles*\"network-operator vdc-admin\"", this VSA is flagged as an optional attribute and other Cisco devices ignore this attribute.

accountinginfo
Stores accounting information in addition to the attributes covered by a standard RADIUS accounting protocol. This attribute is sent only in the VSA portion of the Account-Request frames from the RADIUS client on the switch. It can be used only with the accounting protocol data units (PDUs).

Virtualization Support for RADIUS

RADIUS configuration and operation are local to the virtual device context (VDC). For more information on VDCs, see the *Cisco Nexus 7000 Series NX-OS Virtual Device Context Configuration Guide*.

The Cisco NX-OS device uses virtual routing and forwarding instances (VRFs) to access the RADIUS servers. For more information on VRFs, see the *Cisco Nexus 7000 Series NX-OS Unicast Routing Configuration Guide*.

Prerequisites for RADIUS

RADIUS has the following prerequisites:

- Obtain IPv4 or IPv6 addresses or hostnames for the RADIUS servers.
- Obtain keys from the RADIUS servers.
- Ensure that the Cisco NX-OS device is configured as a RADIUS client of the AAA servers.

Guidelines and Limitations for RADIUS

RADIUS has the following guidelines and limitations:

- You can configure a maximum of 64 RADIUS servers on the Cisco NX-OS device.

- If you have a user account configured on the local Cisco NX-OS device that has the same name as a remote user account on an AAA server, the Cisco NX-OS software applies the user roles for the local user account to the remote user, not the user roles configured on the AAA server.

Default Settings for RADIUS

This table lists the default settings for RADIUS parameters.

Table 1: Default RADIUS Parameter Settings

Parameters	Default
Server roles	Authentication and accounting
Dead timer interval	0 minutes
Retransmission count	1
Retransmission timer interval	5 seconds
Authentication port	1812
Accouinting port	1813
Idle timer interval	0 minutes
Periodic server monitoring username	test
Periodic server monitoring password	test

Configuring RADIUS Servers

This section describes how to configure RADIUS servers on a Cisco NX-OS device.

Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

RADIUS Server Configuration Process

1. If needed, enable CFS configuration distribution for RADIUS.
2. Establish the RADIUS server connections to the Cisco NX-OS device.
3. Configure the RADIUS secret keys for the RADIUS servers.
4. If needed, configure RADIUS server groups with subsets of the RADIUS servers for AAA authentication methods.

5. If needed, configure any of the following optional parameters:
   - Dead-time interval
   - RADIUS server specification allowed at user login
   - Timeout interval
   - TCP port
6. (Optional) If RADIUS distribution is enabled, commit the RADIUS configuration to the fabric.

Related Topics

Configuring RADIUS Server Hosts, on page 8
Configuring Global RADIUS Keys, on page 9

Enabling RADIUS Configuration Distribution

Only Cisco NX-OS devices that have distribution enabled for RADIUS can participate in the distribution of the RADIUS configuration changes in the CFS region.

Before you begin

Ensure that CFS distribution is enabled.

SUMMARY STEPS

1. **configure terminal**
2. **radius distribute**
3. **exit**
4. (Optional) **show radius status**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius distribute** **Example:** `switch(config)# radius distribute`	Enable RADIUS configuration distribution. The default is disabled.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

	Command or Action	Purpose
Step 4	(Optional) **show radius status** **Example:** `switch(config)# show radius status`	Displays the RADIUS CFS distribution configuration.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Configuring RADIUS Server Hosts

To access a remote RADIUS server, you must configure the IP address or hostname of a RADIUS server. You can configure up to 64 RADIUS servers.

Note By default, when you configure a RADIUS server IP address or hostname of the Cisco NX-OS device, the RADIUS server is added to the default RADIUS server group. You can also add the RADIUS server to another RADIUS server group.

Before you begin

Ensure that the server is already configured as a member of the server group.

Ensure that the server is configured to authenticate RADIUS traffic.

Ensure that the Cisco NX-OS device is configured as a RADIUS client of the AAA servers.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*}
3. (Optional) **show radius** {**pending** | **pending-diff**}
4. (Optional) **radius commit**
5. **exit**
6. (Optional) **show radius-server**
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

	Command or Action	Purpose
Step 2	**radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **Example:** `switch(config)# radius-server host 10.10.1.1`	Specifies the IPv4 or IPv6 address or hostname for a RADIUS server to use for authentication.
Step 3	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 4	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 5	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 6	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration.
Step 7	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring a Key for a Specific RADIUS Server, on page 11

Configuring Global RADIUS Keys

You can configure RADIUS keys for all servers used by the Cisco NX-OS device. A RADIUS key is a shared secret text string between the Cisco NX-OS device and the RADIUS server hosts.

Note CFS does not distribute RADIUS keys.

Before you begin

Obtain the RADIUS key values for the remote RADIUS servers.

Configure the RADIUS key on the remote RADIUS servers.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server key** [**0** | **7**] *key-value*
3. **exit**
4. (Optional) **show radius-server**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server key** [**0** | **7**] *key-value* **Example:** `switch(config)# radius-server key 0 QsEfThUkO`	Specifies a RADIUS key for all RADIUS servers. You can specify that the *key-value* is in clear text format (**0**) or is type-7 encrypted (**7**). The Cisco NX-OS software encrypts a clear text key before saving it to the running configuration. The default format is clear text. The maximum length is 63 characters. By default, no RADIUS key is configured.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 4	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration. **Note** The RADIUS keys are saved in encrypted form in the running configuration. Use the **show running-config** command to display the encrypted RADIUS keys.
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

AES Password Encryption and Master Encryption Keys
Configuring RADIUS Server Groups, on page 12
RADIUS Configuration Distribution, on page 3

Configuring a Key for a Specific RADIUS Server

You can configure a key on the Cisco NX-OS device for a specific RADIUS server. A RADIUS key is a secret text string shared between the Cisco NX-OS device and a specific RADIUS server.

Before you begin

Configure one or more RADIUS server hosts.

Obtain the key value for the remote RADIUS server.

Configure the key on the RADIUS server.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **key** [**0** | **7**] *key-value*
3. **exit**
4. (Optional) **show radius-server**
5. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **key** [**0** | **7**] *key-value* **Example:** `switch(config)# radius-server host 10.10.1.1 key 0 PlIjUhYg`	Specifies a RADIUS key for a specific RADIUS server. You can specify that the *key-value* is in clear text format (**0**) or is type-7 encrypted (**7**). The Cisco NX-OS software encrypts a clear text key before saving it to the running configuration. The default format is clear text. The maximum length is 63 characters. This RADIUS key is used instead of the global RADIUS key.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 4	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration. **Note** The RADIUS keys are saved in encrypted form in the running configuration. Use the **show running-config** command to display the encrypted RADIUS keys.

	Command or Action	Purpose
Step 5	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

AES Password Encryption and Master Encryption Keys
Configuring RADIUS Server Hosts, on page 8

Configuring RADIUS Server Groups

You can specify one or more remote AAA servers for authentication using server groups. All members of a group must belong to the RADIUS protocol. The servers are tried in the same order in which you configure them. You can configure up to 100 server groups in a VDC.

You can configure these server groups at any time but they only take effect when you apply them to an AAA service.

Note CFS does not distribute RADIUS server group configurations.

Before you begin

Ensure that all servers in the group are RADIUS servers.

SUMMARY STEPS

1. **configure terminal**
2. **aaa group server radius** *group-name*
3. **server** {*ipv4-address* | *ipv6-address* | *host-name*}
4. (Optional) **deadtime** *minutes*
5. (Optional) **server** {*ipv4-address* | *ipv6-address* | *host-name*}
6. (Optional) **use-vrf** *vrf-name*
7. **exit**
8. (Optional) **show radius-server groups** [*group-name*]
9. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

	Command or Action	Purpose

Step 2	**aaa group server radius** *group-name*
	Example:
	`switch(config)# aaa group server radius RadServer`
	`switch(config-radius)#`
		Creates a RADIUS server group and enters the RADIUS server group configuration submode for that group. The *group-name* argument is a case-sensitive alphanumeric string with a maximum length of 127 characters.

Step 3	**server** {*ipv4-address* | *ipv6-address* | *host-name*} **Example:** `switch(config-radius)# server 10.10.1.1`	Configures the RADIUS server as a member of the RADIUS server group. If the specified RADIUS server is not found, configure it using the **radius-server host** command and retry this command.
Step 4	(Optional) **deadtime** *minutes* **Example:** `switch(config-radius)# deadtime 30`	Configures the monitoring dead time. The default is 0 minutes. The range is from 1 through 1440. **Note** If the dead-time interval for a RADIUS server group is greater than zero (0), that value takes precedence over the global dead-time value.
Step 5	(Optional) **server** {*ipv4-address* | *ipv6-address* | *host-name*} **Example:** `switch(config-radius)# server 10.10.1.1`	Configures the RADIUS server as a member of the RADIUS server group. **Tip** If the specified RADIUS server is not found, configure it using the **radius-server host** command and retry this command.
Step 6	(Optional) **use-vrf** *vrf-name* **Example:** `switch(config-radius)# use-vrf vrf1`	Specifies the VRF to use to contact the servers in the server group.

Step 7	**exit**
	Example:
	`switch(config-radius)# exit`
	`switch(config)#`
		Exits configuration mode.

Step 8	(Optional) **show radius-server groups** [*group-name*] **Example:** `switch(config)# show radius-server groups`	Displays the RADIUS server group configuration.
Step 9	(Optional) **copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring the RADIUS Dead-Time Interval, on page 22

Configuring the Global Source Interface for RADIUS Server Groups

You can configure a global source interface for RADIUS server groups to use when accessing RADIUS servers. You can also configure a different source interface for a specific RADIUS server group. By default, the Cisco NX-OS software uses any available interface.

SUMMARY STEPS

1. **configure terminal**
2. **ip radius source-interface** *interface*
3. **exit**
4. (Optional) **show radius-server**
5. (Optional) **copy running-config startup config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)`
		Enters global configuration mode.

Step 2	**ip radius source-interface** *interface* **Example:** `switch(config)# ip radius source-interface mgmt 0`	Configures the global source interface for all RADIUS server groups configured on the device.

Step 3	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 4	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration information.
Step 5	(Optional) **copy running-config startup config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring RADIUS Server Groups, on page 12

Allowing Users to Specify a RADIUS Server at Login

By default, the Cisco NX-OS device forwards an authentication request based on the default AAA authentication method. You can configure the Cisco NX-OS device to allow the user to specify a VRF and RADIUS server to send the authentication request by enabling the directed-request option. If you enable this option, the user

can log in as *username@vrfname*:*hostname*, where *vrfname* is the VRF to use and **hostname** is the name of a configured RADIUS server.

Note If you enable the directed-request option, the Cisco NX-OS device uses only the RADIUS method for authentication and not the default local method.

Note User-specified logins are supported only for Telnet sessions.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server directed-request**
3. (Optional) **show radius** {**pending** | **pending-diff**}
4. (Optional) **radius commit**
5. **exit**
6. (Optional) **show radius-server directed-request**
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server directed-request** **Example:** `switch(config)# radius-server directed-request`	Allows users to specify a RADIUS server to send the authentication request when logging in. The default is disabled.
Step 3	(Optional) **show radius** {**pending**	**pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 4	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 5	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

	Command or Action	Purpose
Step 6	(Optional) **show radius-server directed-request** **Example:** `switch# show radius-server directed-request`	Displays the directed request configuration.
Step 7	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

RADIUS Configuration Distribution, on page 3

Configuring the Global RADIUS Transmission Retry Count and Timeout Interval

You can configure a global retransmission retry count and timeout interval for all RADIUS servers. By default, a Cisco NX-OS device retries transmission to a RADIUS server only once before reverting to local authentication. You can increase this number up to a maximum of five retries per server. The timeout interval determines how long the Cisco NX-OS device waits for responses from RADIUS servers before declaring a timeout failure.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server retransmit** *count*
3. **radius-server timeout** *seconds*
4. (Optional) **show radius** {**pending** | **pending-diff**}
5. (Optional) **radius commit**
6. **exit**
7. (Optional) **show radius-server**
8. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server retransmit** *count* **Example:** `switch(config)# radius-server retransmit 3`	Specifies the retransmission count for all RADIUS servers. The default retransmission count is 1 and the range is from 0 to 5.
Step 3	**radius-server timeout** *seconds* **Example:** `switch(config)# radius-server timeout 10`	Specifies the transmission timeout interval for RADIUS servers. The default timeout interval is 5 seconds and the range is from 1 to 60 seconds.

	Command or Action	Purpose
Step 4	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 5	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 6	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 7	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration.
Step 8	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

RADIUS Configuration Distribution, on page 3

Configuring the RADIUS Transmission Retry Count and Timeout Interval for a Server

By default, a Cisco NX-OS device retries a transmission to a RADIUS server only once before reverting to local authentication. You can increase this number up to a maximum of five retries per server. You can also set a timeout interval that the Cisco NX-OS device waits for responses from RADIUS servers before declaring a timeout failure.

Before you begin

Configure one or more RADIUS server hosts.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **retransmit** *count*
3. **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **timeout** *seconds*
4. (Optional) **show radius** {**pending** | **pending-diff**}
5. (Optional) **radius commit**
6. **exit**

7. (Optional) **show radius-server**
8. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **retransmit** *count* **Example:** `switch(config)# radius-server host server1 retransmit 3`	Specifies the retransmission count for a specific server. The default is the global value. **Note** The retransmission count value specified for a RADIUS server overrides the count specified for all RADIUS servers.
Step 3	**radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **timeout** *seconds* **Example:** `switch(config)# radius-server host server1 timeout 10`	Specifies the transmission timeout interval for a specific server. The default is the global value. **Note** The timeout interval value specified for a RADIUS server overrides the interval value specified for all RADIUS servers.
Step 4	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 5	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 6	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 7	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration.
Step 8	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring RADIUS Server Hosts, on page 8
RADIUS Configuration Distribution, on page 3

Configuring Accounting and Authentication Attributes for RADIUS Servers

You can specify that a RADIUS server is to be used only for accounting purposes or only for authentication purposes. By default, RADIUS servers are used for both accounting and authentication. You can also specify the destination UDP port numbers where RADIUS accounting and authentication messages should be sent if there is a conflict with the default port.

Before you begin

Configure one or more RADIUS server hosts.

SUMMARY STEPS

1. **configure terminal**
2. (Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **acct-port** *udp-port*
3. (Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **accounting**
4. (Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **auth-port** *udp-port*
5. (Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **authentication**
6. (Optional) **show radius** {**pending** | **pending-diff**}
7. (Optional) **radius commit**
8. **exit**
9. (Optional) **show radius-server**
10. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	(Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **acct-port** *udp-port* **Example:** `switch(config)# radius-server host 10.10.1.1 acct-port 2004`	Specifies a UDP port to use for RADIUS accounting messages. The default UDP port is 1813. The range is from 0 to 65535.
Step 3	(Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **accounting** **Example:** `switch(config)# radius-server host 10.10.1.1 accounting`	Specifies to use the RADIUS server only for accounting purposes. The default is both accounting and authentication.

	Command or Action	Purpose
Step 4	(Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **auth-port** *udp-port* **Example:** `switch(config)# radius-server host 10.10.2.2 auth-port 2005`	Specifies a UDP port to use for RADIUS authentication messages. The default UDP port is 1812. The range is from 0 to 65535.
Step 5	(Optional) **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **authentication** **Example:** `switch(config)# radius-server host 10.10.2.2 authentication`	Specifies to use the RADIUS server only for authentication purposes. The default is both accounting and authentication.
Step 6	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 7	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 8	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 9	(Optional) **show radius-server** **Example:** `switch(config)# show radius-server`	Displays the RADIUS server configuration.
Step 10	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring RADIUS Server Hosts, on page 8
RADIUS Configuration Distribution, on page 3

Configuring Periodic RADIUS Server Monitoring on Individual Servers

You can monitor the availability of individual RADIUS servers. The configuration parameters include the username and password to use for the server and an idle timer. The idle timer specifies the interval during which a RADIUS server receives no requests before the Cisco NX-OS device sends out a test packet. You can configure this option to test servers periodically, or you can run a one-time only test.

Note For security reasons, we recommend that you do not configure a test username that is the same as an existing user in the RADIUS database.

Note The default idle timer value is 0 minutes. When the idle time interval is 0 minutes, the Cisco NX-OS device does not perform periodic RADIUS server monitoring.

Before you begin

Enable RADIUS.

Add one or more RADIUS server hosts.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **test** {**idle-time** *minutes* | **password** *password* [**idle-time** *minutes*] | **username** *name* [**password** *password* [**idle-time** *minutes*]]}
3. **radius-server deadtime** *minutes*
4. **exit**
5. (Optional) **show radius-server**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server host** {*ipv4-address* | *ipv6-address* | *host-name*} **test** {**idle-time** *minutes* | **password** *password* [**idle-time** *minutes*] | **username** *name* [**password** *password* [**idle-time** *minutes*]]} **Example:** `switch(config)# radius-server host 10.10.1.1 test username user1 password Ur2Gd2BH idle-time 3`	Specifies parameters for individual server monitoring. The default username is test, and the default password is test. The default value for the idle timer is 0 minutes, and the valid range is from 0 to 1440 minutes. **Note** For periodic RADIUS server monitoring, you must set the idle timer to a value greater than 0.
Step 3	**radius-server deadtime** *minutes* **Example:** `switch(config)# radius-server deadtime 5`	Specifies the number of minutes before the Cisco NX-OS device checks a RADIUS server that was previously unresponsive. The default value is 0 minutes, and the valid range is from 1 to 1440 minutes.
Step 4	**exit** **Example:**	Exits configuration mode.

	Command or Action	Purpose
	`switch(config)# exit` `switch#`	
Step 5	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring RADIUS Server Hosts, on page 8

Configuring the RADIUS Dead-Time Interval

You can configure the dead-time interval for all RADIUS servers. The dead-time interval specifies the time that the Cisco NX-OS device waits after declaring a RADIUS server is dead, before sending out a test packet to determine if the server is now alive. The default value is 0 minutes.

Note When the dead-time interval is 0 minutes, RADIUS servers are not marked as dead even if they are not responding. You can configure the dead-time interval for a RADIUS server group.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server deadtime** *minutes*
3. (Optional) **show radius** {**pending** | **pending-diff**}
4. (Optional) **radius commit**
5. **exit**
6. (Optional) **show radius-server**
7. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**radius-server deadtime** *minutes* **Example:** `switch(config)# radius-server deadtime 5`	Configures the dead-time interval. The default value is 0 minutes. The range is from 1 to 1440 minutes.

	Command or Action	Purpose
Step 3	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 4	(Optional) **radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 5	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 6	(Optional) **show radius-server** **Example:** `switch# show radius-server`	Displays the RADIUS server configuration.
Step 7	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Copies the running configuration to the startup configuration.

Related Topics

Configuring RADIUS Server Groups, on page 12
RADIUS Configuration Distribution, on page 3

Committing the RADIUS Distribution

You can apply the RADIUS global and server-specific configuration stored in the temporary buffer to the running configuration across all devices in the fabric (including the originating device).

SUMMARY STEPS

1. **configure terminal**
2. (Optional) **show radius** {**pending** | **pending-diff**}
3. **radius commit**
4. **exit**
5. (Optional) **show role session status**
6. (Optional) **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 3	**radius commit** **Example:** `switch(config)# radius commit`	Applies the RADIUS configuration changes in the temporary database to the running configuration and distributes the RADIUS configuration to other Cisco NX-OS devices if you have enabled CFS configuration distribution for the user role feature.

Step 4	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 5	(Optional) **show role session status** **Example:** `switch# show role session status`	Displays the user role CFS session status.
Step 6	(Optional) **copy running-config startup-config** **Example:** `switch# copy running-config startup-config`	Applies the running configuration to the startup configuration.

Discarding the RADIUS Distribution Session

You can discard the temporary database of RADIUS changes and end the CFS distribution session.

SUMMARY STEPS

1. **configure terminal**
2. (Optional) **show radius** {**pending** | **pending-diff**}
3. **radius abort**
4. **exit**
5. (Optional) **show radius session status**

DETAILED STEPS

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	(Optional) **show radius** {**pending** | **pending-diff**} **Example:** `switch(config)# show radius pending`	Displays the RADIUS configuration pending for distribution.
Step 3	**radius abort** **Example:** `switch(config)# radius abort`	Discards the RADIUS configuration in the temporary storage and ends the session.

Step 4	**exit**
	Example:
	`switch(config)# exit`
	`switch#`
		Exits configuration mode.

Step 5	(Optional) **show radius session status** **Example:** `switch# show radius session status`	Displays the RADIUS CFS session status.

Clearing the RADIUS Distribution Session

You can clear the ongoing Cisco Fabric Services distribution session (if any) and unlock the fabric for the RADIUS feature.

SUMMARY STEPS

1. **clear radius session**
2. (Optional) **show radius session status**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**clear radius session** **Example:** `switch# clear radius session`	Clears the session and unlocks the fabric.
Step 2	(Optional) **show radius session status** **Example:** `switch# show radius session status`	Displays the RADIUS CFS session status.

Manually Monitoring RADIUS Servers or Groups

You can manually issue a test message to a RADIUS server or to a server group.

SUMMARY STEPS

1. **test aaa server radius** {*ipv4-address* | *ipv6-address* | *host-name*} [**vrf** *vrf-name*] *username password*
2. **test aaa group** *group-name username password*

DETAILED STEPS

	Command or Action	Purpose
Step 1	**test aaa server radius** {*ipv4-address* | *ipv6-address* | *host-name*} [**vrf** *vrf-name*] *username password* **Example:** `switch# test aaa server radius 10.10.1.1 user1 Ur2Gd2BH`	Sends a test message to a RADIUS server to confirm availability.
Step 2	**test aaa group** *group-name username password* **Example:** `switch# test aaa group RadGroup user2 As3He3CI`	Sends a test message to a RADIUS server group to confirm availability.

Verifying the RADIUS Configuration

To display RADIUS configuration information, perform one of the following tasks:

Command	Purpose
show radius {**status** | **pending** | **pending-diff**}	Displays the RADIUS Cisco Fabric Services distribution status and other details.
show running-config radius [**all**]	Displays the RADIUS configuration in the running configuration.
show startup-config radius	Displays the RADIUS configuration in the startup configuration.
show radius-server [*host-name* | *ipv4-address* | *ipv6-address*] [**directed-request** | **groups** | **sorted** | **statistics**]	Displays all configured RADIUS server parameters.

For detailed information about the fields in the output from this command, see the *Cisco Nexus 7000 Series NX-OS Security Command Reference*.

Monitoring RADIUS Servers

You can monitor the statistics that the Cisco NX-OS device maintains for RADIUS server activity.

Before you begin

Configure one or more RADIUS server hosts.

SUMMARY STEPS

1. **show radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*}

DETAILED STEPS

	Command or Action	Purpose
Step 1	**show radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*} **Example:** `switch# show radius-server statistics 10.10.1.1`	Displays the RADIUS statistics.

Related Topics

Configuring RADIUS Server Hosts, on page 8
Clearing RADIUS Server Statistics, on page 27

Clearing RADIUS Server Statistics

You can display the statistics that the Cisco NX-OS device maintains for RADIUS server activity.

Before you begin

Configure RADIUS servers on the Cisco NX-OS device.

SUMMARY STEPS

1. (Optional) **show radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*}
2. **clear radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*}

DETAILED STEPS

	Command or Action	Purpose
Step 1	(Optional) **show radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*} **Example:** `switch# show radius-server statistics 10.10.1.1`	Displays the RADIUS server statistics on the Cisco NX-OS device.
Step 2	**clear radius-server statistics** {*hostname* | *ipv4-address* | *ipv6-address*} **Example:** `switch# clear radius-server statistics 10.10.1.1`	Clears the RADIUS server statistics.

Related Topics

Configuring RADIUS Server Hosts, on page 8

Configuration Example for RADIUS

The following example shows how to configure RADIUS:

```
radius-server key 7 "ToIkLhPpG"
radius-server host 10.10.1.1 key 7 "ShMoMhTl" authentication accounting
aaa group server radius RadServer
    server 10.10.1.1
```

Where to Go Next

You can now configure AAA authentication methods to include the server groups.

Additional References for RADIUS

This section describes additional information related to implementing RADIUS.

Related Documents

Related Topic	Document Title
Cisco NX-OS Licensing	*Cisco NX-OS Licensing Guide*
Command reference	*Cisco Nexus 7000 Series NX-OS Security Command Reference*
VRF configuration	*Cisco Nexus 7000 Series NX-OS Unicast Routing Configuration Guide*

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
• CISCO-AAA-SERVER-MIB • CISCO-AAA-SERVER-EXT-MIB	To locate and download MIBs, go to the following URL: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

Feature History for RADIUS

This table lists the release history for this feature.

Table 2: Feature History for RADIUS

Feature Name	Releases	Feature Information
RADIUS	6.0(1)	No change from Release 5.2.
RADIUS	5.2(1)	Added support for the Cisco Nexus 3000 Series Switches.
RADIUS	5.2(1)	Added type-6 encryption for RADIUS server keys.
RADIUS	5.1(1)	No change from Release 5.0.
RADIUS server groups	5.0(2)	Added support for configuring the global source interface for all RADIUS server groups.
RADIUS server groups	5.0(2)	Added support for configuring a source interface for a specific RADIUS server group.
Periodic server monitoring	5.0(2)	Added support for global periodic RADIUS server monitoring.
OTP	5.0(2)	Added support for one-time passwords.
RADIUS statistics	4.2(1)	Added support for clearing statistics for RADIUS server hosts.
RADIUS	4.2(1)	No change from Release 4.1.