



Configuring 802.1X

This chapter describes how to configure IEEE 802.1X port-based authentication on Cisco NX-OS devices and includes the following sections:

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About 802.1X

802.1X defines a client-server based access control and authentication protocol that restricts unauthorized clients from connecting to a LAN through publicly accessible ports. The authentication server authenticates each client connected to a Cisco NX-OS device port.

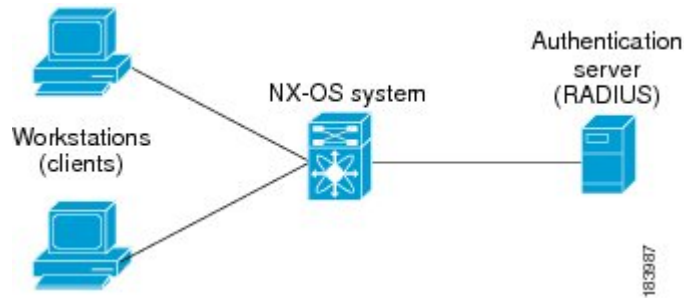
Until the client is authenticated, 802.1X access control allows only Extensible Authentication Protocol over LAN (EAPOL) traffic through the port to which the client is connected. After authentication is successful, normal traffic can pass through the port.

Device Roles

With 802.1X port-based authentication, the devices in the network have specific roles.

Figure 1: 802.1X Device Roles

This figure shows the device roles in 802.1X.



The specific roles are as follows:

Supplicant

The client device that requests access to the LAN and Cisco NX-OS device services and responds to requests from the Cisco NX-OS device. The workstation must be running 802.1X-compliant client software such as that offered in the Microsoft Windows XP operating device.



Note To resolve Windows XP network connectivity and Cisco 802.1X port-based authentication issues, read the Microsoft Knowledge Base article at this URL:
<http://support.microsoft.com/support/kb/articles/Q303/5/97.ASP>

Authentication server

The authentication server performs the actual authentication of the supplicant. The authentication server validates the identity of the supplicant and notifies the Cisco NX-OS device regarding whether the supplicant is authorized to access the LAN and Cisco NX-OS device services. Because the Cisco NX-OS device acts as the proxy, the authentication service is transparent to the supplicant. The Remote Authentication Dial-In User Service (RADIUS) security device with Extensible Authentication Protocol (EAP) extensions is the only supported authentication server; it is available in Cisco Secure Access Control Server, version 3.0. RADIUS uses a supplicant-server model in which secure authentication information is exchanged between the RADIUS server and one or more RADIUS clients.

Authenticator

The authenticator controls the physical access to the network based on the authentication status of the supplicant. The authenticator acts as an intermediary (proxy) between the supplicant and the authentication server, requesting identity information from the supplicant, verifying the requested identity information with the authentication server, and relaying a response to the supplicant. The authenticator includes the RADIUS client, which is responsible for encapsulating and decapsulating the EAP frames and interacting with the authentication server.

When the authenticator receives EAPOL frames and relays them to the authentication server, the authenticator strips off the Ethernet header and encapsulates the remaining EAP frame in the RADIUS format. This encapsulation process does not modify or examine the EAP frames, and the authentication server must support EAP within the native frame format. When the authenticator receives frames from the authentication server, the authenticator removes the server's frame header, leaving the EAP frame, which the authenticator then encapsulates for Ethernet and sends to the supplicant.



Note The Cisco NX-OS device can only be an 802.1X authenticator.

Authentication Initiation and Message Exchange

Either the authenticator (Cisco NX-OS device) or the supplicant (client) can initiate authentication. If you enable authentication on a port, the authenticator must initiate authentication when it determines that the port link state transitions from down to up. The authenticator then sends an EAP-request/identity frame to the supplicant to request its identity (typically, the authenticator sends an initial identity/request frame followed by one or more requests for authentication information). When the supplicant receives the frame, it responds with an EAP-response/identity frame.

If the supplicant does not receive an EAP-request/identity frame from the authenticator during bootup, the supplicant can initiate authentication by sending an EAPOL-start frame, which prompts the authenticator to request the supplicant's identity.



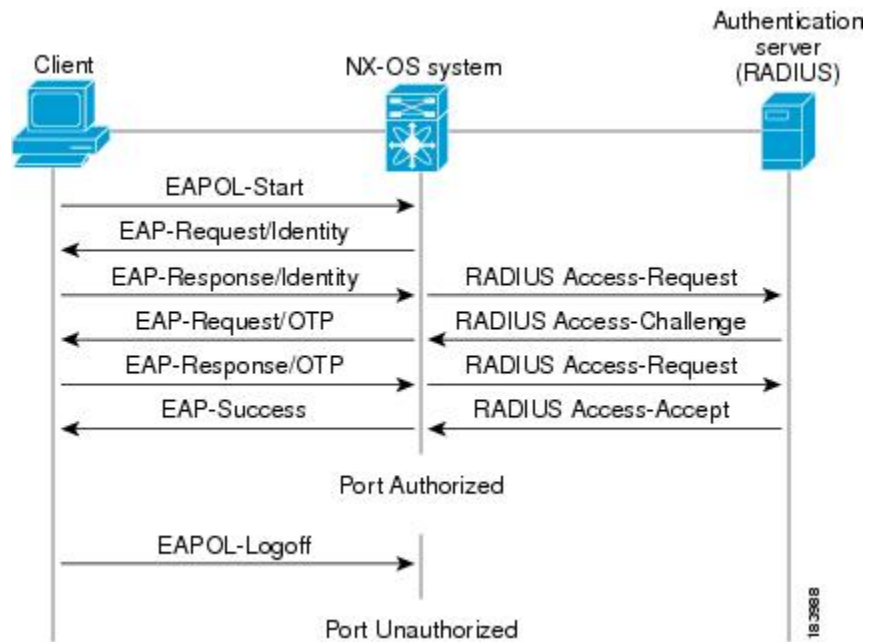
Note If 802.1X is not enabled or supported on the network access device, the Cisco NX-OS device drops any EAPOL frames from the supplicant. If the supplicant does not receive an EAP-request/identity frame after three attempts to start authentication, the supplicant transmits data as if the port is in the authorized state. A port in the authorized state means that the supplicant has been successfully authenticated.

When the supplicant supplies its identity, the authenticator begins its role as the intermediary, passing EAP frames between the supplicant and the authentication server until authentication succeeds or fails. If the authentication succeeds, the authenticator port becomes authorized.

The specific exchange of EAP frames depends on the authentication method being used.

Figure 2: Message Exchange

This figure shows a message exchange initiated by the supplicant using the One-Time-Password (OTP) authentication method with a RADIUS server. The OTP authentication device uses a secret pass-phrase to generate a sequence of one-time (single use) passwords.



The secret pass-phrase of the user never crosses the network at any time such as during authentication or during pass-phrase changes.

Authenticator PAE Status for Interfaces

When you enable 802.1X on an interface, the Cisco NX-OS software creates an authenticator port access entity (PAE) instance. An authenticator PAE is a protocol entity that supports authentication on the interface. When you disable 802.1X on the interface, the Cisco NX-OS software does not automatically clear the authenticator PAE instances. You can explicitly remove the authenticator PAE from the interface and then reapply it, as needed.

Ports in Authorized and Unauthorized States

The authenticator port state determines if the supplicant is granted access to the network. The port starts in the unauthorized state. In this state, the port disallows all ingress and egress traffic except for 802.1X protocol packets. When a supplicant is successfully authenticated, the port transitions to the authorized state, allowing all traffic for the supplicant to flow normally.

If a client that does not support 802.1X is connected to an unauthorized 802.1X port, the authenticator requests the client's identity. In this situation, the client does not respond to the request, the port remains in the unauthorized state, and the client is not granted access to the network.

In contrast, when an 802.1X-enabled client connects to a port that is not running the 802.1X protocol, the client initiates the authentication process by sending the EAPOL-start frame. When no response is received, the client sends the request for a fixed number of times. Because no response is received, the client begins sending frames as if the port is in the authorized state.

Ports can have the following authorization states:

Force authorized

Disables 802.1X port-based authentication and transitions to the authorized state without requiring any authentication exchange. The port transmits and receives normal traffic without 802.1X-based authentication of the client. This authorization state is the default.

Force unauthorized

Causes the port to remain in the unauthorized state, ignoring all attempts by the client to authenticate. The authenticator cannot provide authentication services to the client through the interface.

Auto

Enables 802.1X port-based authentication and causes the port to begin in the unauthorized state, allowing only EAPOL frames to be sent and received through the port. The authentication process begins when the link state of the port transitions from down to up or when an EAPOL-start frame is received from the supplicant. The authenticator requests the identity of the client and begins relaying authentication messages between the client and the authentication server. Each supplicant that attempts to access the network is uniquely identified by the authenticator by using the supplicant's MAC address.

If the supplicant is successfully authenticated (receives an Accept frame from the authentication server), the port state changes to authorized, and all frames from the authenticated supplicant are allowed through the port. If the authentication fails, the port remains in the unauthorized state, but authentication can be retried. If the authentication server cannot be reached, the authenticator can retransmit the request. If no response is received from the server after the specified number of attempts, authentication fails, and the supplicant is not granted network access.

When a supplicant logs off, it sends an EAPOL-logoff message, which causes the authenticator port to transition to the unauthorized state.

If the link state of a port transitions from up to down, or if an EAPOL-logoff frame is received, the port returns to the unauthorized state.

MAC Authentication Bypass

You can configure the Cisco NX-OS device to authorize a supplicant based on the supplicant MAC address by using the MAC authentication bypass feature. For example, you can enable this feature on interfaces configured for 802.1X that are connected to devices such as printers.

If 802.1X authentication times out while waiting for an EAPOL response from the supplicant, the Cisco NX-OS device tries to authorize the client by using MAC authentication bypass.

When you enable the MAC authentication bypass feature on an interface, the Cisco NX-OS device uses the MAC address as the supplicant identity. The authentication server has a database of supplicant MAC addresses that are allowed network access. After detecting a client on the interface, the Cisco NX-OS device waits for an Ethernet packet from the client. The Cisco NX-OS device sends the authentication server a RADIUS-access/request frame with a username and password based on the MAC address. If authorization succeeds, the Cisco NX-OS device grants the client access to the network.

If an EAPOL packet is detected on the interface during the lifetime of the link, the Cisco NX-OS device determines that the device connected to that interface is an 802.1X-capable supplicant and uses 802.1X authentication (not MAC authentication bypass) to authorize the interface. EAPOL history is cleared if the interface link status goes down.

If the Cisco NX-OS device already authorized an interface by using MAC authentication bypass and detects an 802.1X supplicant, the Cisco NX-OS device does not unauthorize the client connected to the interface. When reauthentication occurs, the Cisco NX-OS device uses 802.1X authentication as the preferred reauthentication process.

Clients that were authorized with MAC authentication bypass can be reauthenticated. The reauthentication process is the same as that for clients that were authenticated with 802.1X. During reauthentication, the port remains in the previously assigned VLAN. If reauthentication is successful, the switch keeps the port in the same VLAN.

If reauthentication is based on the Session-Timeout RADIUS attribute (Attribute[27]) and the Termination-Action RADIUS attribute (Attribute [29]) and if the Termination-Action RADIUS attribute (Attribute [29]) action is Initialize (the attribute value is DEFAULT), the MAC authentication bypass session ends, and connectivity is lost during reauthentication. If MAC authentication bypass is enabled and the 802.1X authentication times out, the switch uses the MAC authentication bypass feature to initiate reauthorization. For more information about these AV pairs, see RFC 3580, *IEEE 802.1X Remote Authentication Dial In User Service (RADIUS) Usage Guidelines*.

MAC authentication bypass interacts with the following features:

- 802.1X authentication—You can enable MAC authentication bypass only if 802.1X authentication is enabled on the port.
- Port security—You can configure 802.1X authentication and port security on the same Layer 2 ports.
- Network admission control (NAC) Layer 2 IP validation—This feature takes effect after an 802.1X port is authenticated with MAC authentication bypass, including hosts in the exception list.

Dynamic VLAN Assignment based on MAC-Based Authentication (MAB)

The Cisco Nexus 9000 Series switches supports dynamic VLAN assignment. After the 802.1x authentication or MAB is completed; before bringing up the port, you may want to (as part of authorization) allow the peer/host to be placed into a particular VLAN based as a result of the authentication. The RADIUS server typically indicates the desired VLAN by including tunnel attributes within the Access-Accept message. This procedure of getting the VLAN and binding it to the port constitutes to Dynamic VLAN assignment.

VLAN Assignment from RADIUS

After authentication is completed either through dot1x or MAB, the response from the RADIUS server can have dynamic VLAN information, which can be assigned to a port. This information is present in response from RADIUS server in Accept-Access message in the form of tunnel attributes. For use in VLAN assignment, the following tunnel attributes are sent:

- Tunnel-type=VLAN(13)
- Tunnel-Medium-Type=802
- Tunnel-Private-Group-ID=VLANID

All the three parameters must be received for configuring access VLAN.

Single Host and Multiple Hosts Support

The 802.1X feature can restrict traffic on a port to only one endpoint device (single-host mode) or allow traffic from multiple endpoint devices on a port (multi-host mode).

Single-host mode allows traffic from only one endpoint device on the 802.1X port. Once the endpoint device is authenticated, the Cisco NX-OS device puts the port in the authorized state. When the endpoint device leaves the port, the Cisco NX-OS device put the port back into the unauthorized state. A security violation in 802.1X is defined as a detection of frames sourced from any MAC address other than the single MAC address authorized as a result of successful authentication. In this case, the interface on which this security association violation is detected (EAPOL frame from the other MAC address) will be disabled. Single host mode is applicable only for host-to-switch topology and when a single host is connected to the Layer 2 (Ethernet access port) or Layer 3 port (routed port) of the Cisco NX-OS device.

Only the first host has to be authenticated on the 802.1X port configured with multiple host mode. The port is moved to the authorized state after the successful authorization of the first host. Subsequent hosts are not required to be authorized to gain network access once the port is in the authorized state. If the port becomes unauthorized when reauthentication fails or an EAPOL logoff message is received, all attached hosts are denied access to the network. The capability of the interface to shut down upon security association violation is disabled in multiple host mode. This mode is applicable for both switch-to-switch and host-to-switch topologies.

Supported Topologies

The 802.1X port-based authentication support point-to-point topology.

In this configuration, only one supplicant (client) can connect to the 802.1X-enabled authenticator (Cisco NX-OS device) port. The authenticator detects the supplicant when the port link state changes to the up state.

If a supplicant leaves or is replaced with another supplicant, the authenticator changes the port link state to down, and the port returns to the unauthorized state.

Licensing Requirements for 802.1X

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	802.1X requires no license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you.

Prerequisites for 802.1X

802.1X has the following prerequisites:

- One or more RADIUS servers are accessible in the network.

802.1X Guidelines and Limitations

802.1X port-based authentication has the following configuration guidelines and limitations:

- When you upgrade the Cisco Nexus Series switch to Cisco NX-OS Release 9.2(1) using the (disruptive/non-disruptive) In-Service Software Upgrades (ISSU), you must first disable 802.1x using the `no feature dot1x` command and then enable it using the `feature dot1x` command for multi-authentication to work.
- Beginning with Cisco NX-OS Release 9.2(1), multi-authentication mode is enabled on an 802.1X port. VLAN assignment occurs successfully for the first authenticated host. Subsequent authorized (based on user credentials) data hosts are considered successfully authenticated, provided either they have no VLAN assignment or have a VLAN assignment matching the first successfully authenticated host on the port. This ensures that all successfully authenticated hosts on a port are members of the same VLAN. Flexibility of VLAN assignment is only provided to the first authenticated host.
- The Cisco Nexus 3000 Series switches support 802.1X authentication only on physical ports.
- The Cisco Nexus 3000 Series switches support 802.1X authentication on member ports of a port channel but not on the port channel itself.
- The Cisco Nexus 3000 Series switches support 802.1X authentication only on Ethernet interfaces that are in a port channel, a trunk, or an access port.
- Cisco Nexus 3000 Series switches do not support 802.1X on the following:
 - FEX ports
 - VPC ports
 - PVLAN ports
 - L3 (routed) ports

- Port security
- Ports enabled with CTS and MACsec



Note You must disable 802.1X on FEX and VPC ports, and the unsupported features.

- The Cisco Nexus 3000 Series switches do not support 802.1X authentication on port channels or subinterfaces.
- The Cisco NX-OS software does not support the following 802.1X configurations on port channel members when the members are configured for 802.1X:
 - Host mode cannot be configured in single-host mode. Only multi-host mode is supported on the member ports.
 - Single-host mode cannot be configured on member ports of a port channel. Only multi-host mode is supported on member ports of a port channel.
 - MAC authentication bypass cannot be enabled on the member ports.
 - Port security cannot be configured on the port channel.
- Member ports with and without 802.1X configuration can coexist in a port channel. However, you must ensure the identical 802.1X configuration on all the member ports in order for channeling to operate with 802.1X.
- When you enable 802.1X authentication, supplicants are authenticated before any other Layer 2 or Layer 3 features are enabled on an Ethernet interface.
- On a 802.1X enabled port, the STP BPDUs are permitted only after a successful authentication. We recommend that you enable the 802.1X functionality only on the STP edge ports to avoid STP disputes.
- The Cisco Nexus 3000 Series switches do not support single host mode on trunk interfaces or member interfaces in a port channel.
- The Cisco Nexus 3000 series switches do not support MAC address authentication bypass on a port channel and trunk interfaces.
- The Cisco Nexus 3000 series switches do not support Dot1X on vPC ports and MCT.
- The Cisco Nexus 3000 Series switches do not support the following 802.1X hostmodes:
 - Multi authentication mode
 - Multi domain mode
- The Cisco Nexus 3000 Series switches do not support the following 802.1X protocol enhancements:
 - Critical VLAN
 - Auth failed VLAN
 - Dyanamic VLAN assignment
 - Private VLAN assignment

- Wake on LAN support
 - Voice VLAN support
 - Downloadable ACLs
 - One-to-many logical VLAN name to ID mapping
 - Web authorization
 - Dynamic domain bridge assignment
 - IP telephony
 - Guest VLANs
- A security violation occurs when the same mac is learnt on a different VLAN with dot1x enabled on the interface.
 - When you disable the dot1x feature on the Cisco Nexus 9000 Series switches, EAP packets flood in the BD.
 - Configuring mac learn disable with dot1x enabled on DME enabled platform does not display the error messages.
 - In Cisco Nexus Release 9.2(1), tagged EAPOL frames are processed even though the VLAN is not configured on the interface and the authentication is successful on the interface for the client.
 - Secure mac learnt on orphan port is not synced on the vPC peer.

Default Settings for 802.1X

This table lists the default settings for 802.1X parameters.

Table 1: Default 802.1X Parameters

Parameters	Default
802.1X feature	Disabled
AAA 802.1X authentication method	Not configured
Per-interface 802.1X protocol enable state	Disabled (force-authorized) Note The port transmits and receives normal traffic without 802.1X-based authentication of the supplicant.
Periodic reauthentication	Disabled
Number of seconds between reauthentication attempts	3600 seconds
Quiet timeout period	60 seconds (number of seconds that the Cisco NX-OS device remains in the quiet state following a failed authentication exchange with the supplicant)

Parameters	Default
Retransmission timeout period	30 seconds (number of seconds that the Cisco NX-OS device should wait for a response to an EAP request/identity frame from the supplicant before retransmitting the request)
Maximum retransmission number	2 times (number of times that the Cisco NX-OS device will send an EAP-request/identity frame before restarting the authentication process)
Host mode	Single host
Supplicant timeout period	30 seconds (when relaying a request from the authentication server to the supplicant, the amount of time that the Cisco NX-OS device waits for a response before retransmitting the request to the supplicant)
Authentication server timeout period	30 seconds (when relaying a response from the supplicant to the authentication server, the amount of time that the Cisco NX-OS device waits for a reply before retransmitting the response to the server)

Configuring 802.1X

This section describes how to configure the 802.1X feature.

Process for Configuring 802.1X

This section describes the process for configuring 802.1X.

Procedure

- Step 1** Enable the 802.1X feature.
 - Step 2** Configure the connection to the remote RADIUS server.
 - Step 3** Enable 802.1X feature on the Ethernet interfaces.
-

Enabling the 802.1X Feature

You must enable the 802.1X feature on the Cisco NX-OS device before authenticating any supplicant devices.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	feature dot1x Example: switch(config)# feature dot1x	Enables the 802.1X feature. The default is disabled.
Step 3	exit Example: switch(config)# exit switch#	Exits configuration mode.
Step 4	(Optional) show dot1x Example: switch# show dot1x	Displays the 802.1X feature status.
Step 5	(Optional) copy running-config startup-config Example: switch# copy running-config startup-config	Copies the running configuration to the startup configuration.

Configuring AAA Authentication Methods for 802.1X

You can use remote RADIUS servers for 802.1X authentication. You must configure RADIUS servers and RADIUS server groups and specify the default AAA authentication method before the Cisco NX-OS device can perform 802.1X authentication.

Before you begin

Obtain the names or addresses for the remote RADIUS server groups.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	aaa authentication dot1x default group <i>group-list</i> Example:	Specifies the RADIUS server groups to use for 802.1X authentication.

	Command or Action	Purpose
	<pre>switch(config)# aaa authentication dot1x default group rad2</pre>	<p>The <i>group-list</i> argument consists of a space-delimited list of group names. The group names are the following:</p> <ul style="list-style-type: none"> • radius—Uses the global pool of RADIUS servers for authentication. • <i>named-group</i> —Uses the global pool of RADIUS servers for authentication.
Step 3	<p>exit</p> <p>Example:</p> <pre>switch(config)# exit switch#</pre>	Exits configuration mode.
Step 4	<p>(Optional) show radius-server</p> <p>Example:</p> <pre>switch# show radius-server</pre>	Displays the RADIUS server configuration.
Step 5	<p>(Optional) show radius-server group [<i>group-name</i>]</p> <p>Example:</p> <pre>switch# show radius-server group rad2</pre>	Displays the RADIUS server group configuration.
Step 6	<p>(Optional) copy running-config startup-config</p> <p>Example:</p> <pre>switch# copy running-config startup-config</pre>	Copies the running configuration to the startup configuration.

Controlling 802.1X Authentication on an Interface

You can control the 802.1X authentication performed on an interface. An interface can have the following 802.1X authentication states:

Auto

Enables 802.1X authentication on the interface.

Force-authorized

Disables 802.1X authentication on the interface and allows all traffic on the interface without authentication. This state is the default.

Force-unauthorized

Disallows all traffic on the interface.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet slot / port Example: switch(config)# interface ethernet 2/1 switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x port-control {auto force-authorized forced-unauthorized} Example: switch(config-if)# dot1x port-control auto	Changes the 802.1X authentication state on the interface. The default is force-authorized.
Step 4	exit Example: switch(config)# exit switch#	Exits configuration mode.
Step 5	(Optional) show dot1x all Example: switch# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 6	(Optional) show dot1x interface ethernet slot / port Example: switch# show dot1x interface ethernet 2/1	Displays 802.1X feature status and configuration information for an interface.
Step 7	(Optional) copy running-config startup-config Example: switch# copy running-config startup-config	Copies the running configuration to the startup configuration.

Configuring 802.1X Authentication on Member Ports

You can configure 802.1X authentication on the members of a port channel.



Note You cannot configure 802.1X authentication on the port channel itself.

There are two ways to configure 802.1X authentication on member ports: 1) by configuring 802.1X on a member port and then adding the port to a port channel or 2) by creating a port channel, adding a port to the port channel, and then configuring 802.1X on the port. The following procedure provides instructions for the first method. To configure 802.1X using the second method, use these commands:

- **interface port-channel** *channel-number*
- **interface ethernet** *slot/port*
- **channel-group** *channel-number* [**force**] [**mode** {**on** | **active** | **passive**}]
- **dot1x port-control auto**



Note For more information on the above commands, see the *Cisco NX-OS Interfaces Command Reference* for your platform.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet <i>slot/port</i> Example: switch(config)# interface ethernet 7/1 switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x port-control auto Example: switch(config-if)# dot1x port-control auto	Changes the 802.1X authentication state on the interface.
Step 4	[no] switchport Example: switch(config-if)# switchport	Configures the interface as a Layer 2 port or, if you use the no keyword, as a Layer 3 port.
Step 5	dot1x host-mode multi-host Example: switch(config-if)# dot1x host-mode multi-host	Enables multiple hosts mode for the interface. This command is required in order to add a port to a port channel.

	Command or Action	Purpose
Step 6	<p>channel-group <i>channel-number</i> [force] [mode {on active passive}]</p> <p>Example:</p> <pre>switch(config-if)# channel-group 5 force</pre>	<p>Configures the port in a channel group and sets the mode. The channel number range is from 1 to 4096. The Cisco NX-OS software creates the port channel associated with this channel group if the port channel does not already exist.</p> <p>The optional force keyword allows you to force an interface with some incompatible configurations to join the channel. The forced interface must have the same speed, duplex, and flow control settings as the channel group.</p> <p>Note To remove an 802.1X-enabled port from a port channel, use the no channel-group <i>channel-number</i> command.</p>
Step 7	<p>exit</p> <p>Example:</p> <pre>switch(config-if)# exit switch(config)#</pre>	Exits interface configuration mode.
Step 8	<p>exit</p> <p>Example:</p> <pre>switch(config)# exit switch#</pre>	Exits global configuration mode.
Step 9	<p>(Optional) show dot1x all</p> <p>Example:</p> <pre>switch# show dot1x all</pre>	Displays all 802.1X feature status and configuration information.
Step 10	<p>(Optional) show dot1x interface ethernet slot/port</p> <p>Example:</p> <pre>switch# show dot1x interface ethernet 7/1</pre>	Displays 802.1X feature status and configuration information for an interface.
Step 11	<p>(Optional) copy running-config startup-config</p> <p>Example:</p> <pre>switch# copy running-config startup-config</pre>	Copies the running configuration to the startup configuration.

Creating or Removing an Authenticator PAE on an Interface

You can create or remove the 802.1X authenticator port access entity (PAE) instance on an interface.



Note By default, the Cisco NX-OS software creates the authenticator PAE instance on the interface when you enable 802.1X on an interface.

Before you begin

Enable the 802.1X feature.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	(Optional) show dot1x interface ethernet slot/port Example: <pre>switch# show dot1x interface ethernet 2/1</pre>	Displays the 802.1X configuration on the interface.
Step 3	interface ethernet slot/port Example: <pre>switch(config)# interface ethernet 2/1 switch(config-if)#</pre>	Selects the interface to configure and enters interface configuration mode.
Step 4	[no] dot1x pae authenticator Example: <pre>switch(config-if)# dot1x pae authenticator</pre>	Creates an authenticator PAE instance on the interface. Use the no form to remove the PAE instance from the interface. Note If an authenticator PAE already exists on the interface the dot1x pae authentication command does not change the configuration on the interface.
Step 5	(Optional) copy running-config startup-config Example: <pre>switch(config)# copy running-config startup-config</pre>	Copies the running configuration to the startup configuration.

Enabling Periodic Reauthentication for an Interface

You can enable periodic 802.1X reauthentication on an interface and specify how often it occurs. If you do not specify a time period before enabling reauthentication, the number of seconds between reauthentication defaults to the global value.



Note During the reauthentication process, the status of an already authenticated supplicant is not disrupted.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet slot/port Example: switch(config)# interface ethernet 2/1 switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x re-authentication Example: switch(config-if)# dot1x re-authentication	Enables periodic reauthentication of the supplicants connected to the interface. By default, periodic authentication is disabled.
Step 4	(Optional) dot1x timeout re-authperiod seconds Example: switch(config-if)# dot1x timeout re-authperiod 3300	Sets the number of seconds between reauthentication attempts. The default is 3600 seconds. The range is from 1 to 65535. Note This command affects the behavior of the Cisco NX-OS device only if you enable periodic reauthentication on the interface.
Step 5	exit Example: switch(config-if)# exit switch(config)#	Exits configuration mode.
Step 6	(Optional) show dot1x all Example: switch(config)# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 7	(Optional) copy running-config startup-config Example: switch(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Manually Reauthenticating Supplicants

You can manually reauthenticate the supplicants for the entire Cisco NX-OS device or for an interface.



Note During the reauthentication process, the status of an already authenticated supplicant is not disrupted.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	<p>dot1x re-authenticate [interface <i>slot/port</i>]</p> <p>Example:</p> <pre>switch# dot1x re-authenticate interface 2/1</pre>	Reauthenticates the supplicants on the Cisco NX-OS device or on an interface.

Changing 802.1X Authentication Timers for an Interface

You can change the following 802.1X authentication timers on the Cisco NX-OS device interfaces:

Quiet-period timer

When the Cisco NX-OS device cannot authenticate the supplicant, the switch remains idle for a set period of time and then tries again. The quiet-period timer value determines the idle period. An authentication failure might occur because the supplicant provided an invalid password. You can provide a faster response time to the user by entering a smaller number than the default. The default is the value of the global quiet period timer. The range is from 1 to 65535 seconds.

Rate-limit timer

The rate-limit period throttles EAPOL-Start packets from supplicants that are sending too many EAPOL-Start packets. The authenticator ignores EAPOL-Start packets from supplicants that have successfully authenticated for the rate-limit period duration. The default value is 0 seconds and the authenticator processes all EAPOL-Start packets. The range is from 1 to 65535 seconds.

Switch-to-authentication-server retransmission timer for Layer 4 packets

The authentication server notifies the switch each time that it receives a Layer 4 packet. If the switch does not receive a notification after sending a packet, the Cisco NX-OS device waits a set period of time and then retransmits the packet. The default is 30 seconds. The range is from 1 to 65535 seconds.

Switch-to-supplicant retransmission timer for EAP response frames

The supplicant responds to the EAP-request/identity frame from the Cisco NX-OS device with an EAP-response/identity frame. If the Cisco NX-OS device does not receive this response, it waits a set period of time (known as the retransmission time) and then retransmits the frame. The default is 30 seconds. The range is from 1 to 65535 seconds.

Switch-to-supplicant retransmission timer for EAP request frames

The supplicant notifies the Cisco NX-OS device it that received the EAP request frame. If the authenticator does not receive this notification, it waits a set period of time and then retransmits the frame. The default is the value of the global retransmission period timer. The range is from 1 to 65535 seconds.

Inactive period timeout

When the Cisco NX-OS device remains inactive for a set period of time. The timeout inactivity-period value determines the inactive period. The recommended minimum value is 1800 seconds. You must ensure that the value is less than the value of the re-authentication time.



Note You should change the default values only to adjust for unusual circumstances such as unreliable links or specific behavioral problems with certain supplicants and authentication servers.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet <i>slot/port</i> Example: switch(config)# interface ethernet 2/1 switch(config-if)	Selects the interface to configure and enters interface configuration mode.
Step 3	(Optional) dot1x timeout quiet-period <i>seconds</i> Example: switch(config-if)# dot1x timeout quiet-period 25	Sets the number of seconds that the authenticator waits for a response to an EAP-request/identity frame from the supplicant before retransmitting the request. The default is the global number of seconds set for all interfaces. The range is from 1 to 65535 seconds.
Step 4	(Optional) dot1x timeout ratelimit-period <i>seconds</i> Example: switch(config-if)# dot1x timeout ratelimit-period 10	Sets the number of seconds that the authenticator ignores EAPOL-Start packets from supplicants that have successfully authenticated. The default value is 0 seconds. The range is from 1 to 65535 seconds.
Step 5	(Optional) dot1x timeout server-timeout <i>seconds</i> Example: switch(config-if)# dot1x timeout server-timeout 60	Sets the number of seconds that the Cisco NX-OS device waits before retransmitting a packet to the authentication server. The default is 30 seconds. The range is from 1 to 65535 seconds.
Step 6	(Optional) dot1x timeout supp-timeout <i>seconds</i>	Sets the number of seconds that the Cisco NX-OS device waits for the supplicant to respond to an EAP request frame before the

	Command or Action	Purpose
	Example: switch(config-if)# dot1x timeout supp-timeout 20	Cisco NX-OS device retransmits the frame. The default is 30 seconds. The range is from 1 to 65535 seconds.
Step 7	(Optional) dot1x timeout tx-period <i>seconds</i> Example: switch(config-if)# dot1x timeout tx-period 40	Sets the number of seconds between the retransmission of EAP request frames when the supplicant does not send notification that it received the request. The default is the global number of seconds set for all interfaces. The range is from 1 to 65535 seconds.
Step 8	(Optional) dot1x timeout inactivity-period <i>seconds</i> Example: switch(config-if)# dot1x timeout inactivity-period 1800	Sets the number of seconds the switch can remain inactive. The recommended minimum value is 1800 seconds.
Step 9	exit Example: switch(config)# exit switch#	Exits configuration mode.
Step 10	(Optional) show dot1x all Example: switch# show dot1x all	Displays the 802.1X configuration.
Step 11	(Optional) copy running-config startup-config Example: switch# copy running-config startup-config	Copies the running configuration to the startup configuration.

Enabling MAC Authentication Bypass

You can enable MAC authentication bypass on an interface that has no supplicant connected.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.

	Command or Action	Purpose
Step 2	interface ethernet <i>slot/port</i> Example: switch(config)# interface ethernet 2/1 switch(config-if)	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x mac-auth-bypass [eap] Example: switch(config-if)# dot1x mac-auth-bypass	Enables MAC authentication bypass. The default is bypass disabled. Use the eap keyword to configure the Cisco NX-OS device to use EAP for authorization.
Step 4	exit Example: switch(config-if)# exit switch(config)#	Exits configuration mode.
Step 5	(Optional) show dot1x all Example: switch# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 6	(Optional) copy running-config startup-config Example: switch(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Enabling Single Host or Multiple Hosts Mode

You can enable single host or multiple hosts mode on an interface.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet <i>slot/port</i> Example: switch(config)# interface ethernet 2/1 switch(config-if)	Selects the interface to configure and enters interface configuration mode.

	Command or Action	Purpose
Step 3	dot1x host-mode {multi-host single-host} Example: <pre>switch(config-if) # dot1x host-mode multi-host</pre>	Configures the host mode. The default is single-host. Note Make sure that the dot1x port-control interface configuration command is set to auto for the specified interface.
Step 4	dot1x host-mode multi-auth Example: <pre>switch(config-if) # dot1x host-mode multi-auth</pre>	Configures the multiple authentication mode. The port is authorized only on a successful authentication of either EAP or MAB or a combination of both. Failure to authenticate will restrict network access. authentication either EAP or MAB
Step 5	exit Example: <pre>switch(config-if) # exit switch(config) #</pre>	Exits configuration mode.
Step 6	(Optional) show dot1x all Example: <pre>switch# show dot1x all</pre>	Displays all 802.1X feature status and configuration information.
Step 7	(Optional) copy running-config startup-config Example: <pre>switch(config) # copy running-config startup-config</pre>	Copies the running configuration to the startup configuration.

Disabling 802.1X Authentication on the Cisco NX-OS Device

You can disable 802.1X authentication on the Cisco NX-OS device. By default, the Cisco NX-OS software enables 802.1X authentication after you enable the 802.1X feature. However, when you disable the 802.1X feature, the configuration is removed from the Cisco NX-OS device. The Cisco NX-OS software allows you to disable 802.1X authentication without losing the 802.1X configuration.



Note When you disable 802.1X authentication, the port mode for all interfaces defaults to force-authorized regardless of the configured port mode. When you reenables 802.1X authentication, the Cisco NX-OS software restores the configured port mode on the interfaces.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	no dot1x system-auth-control Example: switch(config)# no dot1x system-auth-control	Disables 802.1X authentication on the Cisco NX-OS device. The default is enabled. Note Use the dot1x system-auth-control command to enable 802.1X authentication on the Cisco NX-OS device.
Step 3	exit Example: switch(config)# exit switch#	Exits configuration mode.
Step 4	(Optional) show dot1x Example: switch# show dot1x	Displays the 802.1X feature status.
Step 5	(Optional) copy running-config startup-config Example: switch# copy running-config startup-config	Copies the running configuration to the startup configuration.

Disabling the 802.1X Feature

You can disable the 802.1X feature on the Cisco NX-OS device.

When you disable 802.1X, all related configurations are automatically discarded. The Cisco NX-OS software creates an automatic checkpoint that you can use if you reenables 802.1X and want to recover the configuration. For more information, see the *Cisco NX-OS System Management Configuration Guide* for your platform.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example:	Enters global configuration mode.

	Command or Action	Purpose
	<code>switch# configure terminal</code> <code>switch(config)#</code>	
Step 2	no feature dot1x Example: <code>switch(config)# no feature dot1x</code>	Disables 802.1X. Caution Disabling the 802.1X feature removes all 802.1X configuration.
Step 3	exit Example: <code>switch(config)# exit</code> <code>switch#</code>	Exits configuration mode.
Step 4	(Optional) copy running-config startup-config Example: <code>switch# copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Resetting the 802.1X Interface Configuration to the Default Values

You can reset the 802.1X configuration for an interface to the default values.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters global configuration mode.
Step 2	interface ethernet <i>slot/port</i> Example: <code>switch(config)# interface ethernet 2/1</code> <code>switch(config-if)</code>	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x default Example: <code>switch(config-if)# dot1x default</code>	Reverts to the 802.1X configuration default values for the interface.
Step 4	exit Example: <code>switch(config-if)# exit</code> <code>switch(config)#</code>	Exits configuration mode.

	Command or Action	Purpose
Step 5	(Optional) show dot1x all Example: switch(config)# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 6	(Optional) copy running-config startup-config Example: switch(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Setting the Maximum Authenticator-to-Supplicant Frame for an Interface

You can set the maximum number of times that the Cisco NX-OS device retransmits authentication requests to the supplicant on an interface before the session times out. The default is 2 times and the range is from 1 to 10.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet slot/port Example: switch(config)# interface ethernet 2/1 switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x max-req count Example: switch(config-if)# dot1x max-req 3	Changes the maximum authorization request retry count. The default is 2 times and the range is from 1 to 10. Note Make sure that the dot1x port-control interface configuration command is set to auto for the specified interface.
Step 4	exit Example: switch(config)# exit switch#	Exits interface configuration mode.

	Command or Action	Purpose
Step 5	(Optional) show dot1x all Example: switch# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 6	(Optional) copy running-config startup-config Example: switch(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Enabling RADIUS Accounting for 802.1X Authentication

You can enable RADIUS accounting for the 802.1X authentication activity.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	dot1x radius-accounting Example: switch(config)# dot1x radius-accounting	Enables RADIUS accounting for 802.1X. The default is disabled.
Step 3	exit Example: switch(config)# exit switch#	Exits configuration mode.
Step 4	(Optional) show dot1x Example: switch# show dot1x	Displays the 802.1X 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 AAA Accounting Methods for 802.1X

You can enable AAA accounting methods for the 802.1X feature.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	<code>configure terminal</code>	Enters global configuration mode.
Step 2	<code>aaa accounting dot1x default group <i>group-list</i></code>	Configures AAA accounting for 802.1X. The default is disabled. The <i>group-list</i> argument consists of a space-delimited list of group names. The group names are the following: <ul style="list-style-type: none"> • radius—For all configured RADIUS servers. • named-group—Any configured RADIUS server group name.
Step 3	<code>exit</code>	Exits configuration mode.
Step 4	(Optional) <code>show aaa accounting</code>	Displays the AAA accounting configuration.
Step 5	(Optional) <code>copy running-config startup-config</code>	Copies the running configuration to the startup configuration.

Example

This example shows how to enable the 802.1x feature:

```
switch# configure terminal
switch(config)# aaa accounting dot1x default group radius
switch(config)# exit
switch# show aaa accounting
switch# copy running-config startup-config
```

Setting the Maximum Reauthentication Retry Count on an Interface

You can set the maximum number of times that the Cisco NX-OS device retransmits reauthentication requests to the supplicant on an interface before the session times out. The default is 2 times and the range is from 1 to 10.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal switch(config)#	Enters global configuration mode.
Step 2	interface ethernet <i>slot/port</i> Example: switch(config)# interface ethernet 2/1 switch(config-if)#	Selects the interface to configure and enters interface configuration mode.
Step 3	dot1x max-reauth-req <i>retry-count</i> Example: switch(config-if)# dot1x max-reauth-req 3	Changes the maximum reauthentication request retry count. The default is 2 times and the range is from 1 to 10.
Step 4	exit Example: switch(config)# exit switch#	Exits interface configuration mode.
Step 5	(Optional) show dot1x all Example: switch# show dot1x all	Displays all 802.1X feature status and configuration information.
Step 6	(Optional) copy running-config startup-config Example: switch(config)# copy running-config startup-config	Copies the running configuration to the startup configuration.

Verifying the 802.1X Configuration

To display 802.1X information, perform one of the following tasks:

Command	Purpose
show dot1x	Displays the status of the 802.1X.
show dot1x all [details statistics summary]	Displays the status and all related information of the 802.1X feature.
show dot1x interface ethernet <i>slot/port</i> [details statistics summary]	Displays the 802.1X feature status and configuration information for an Ethernet interface.
show running-config dot1x [all]	Displays the 802.1X feature configuration in the running configuration.

Command	Purpose
<code>show startup-config dot1x</code>	Displays the 802.1X feature configuration in the startup configuration.

For detailed information about the fields in the output from these commands, see the *Cisco Nexus 3000 Series NX-OS Security Command Reference*.

802.1X Support for VXLAN EVPN

This section describes how to configure 802.1X for VXLAN EVPN.

Guidelines and Limitations for 802.1X Support for VXLAN EVPN

The following are the guidelines and limitations for 802.1X support for VXLAN EVPN:

-
- Port channel interfaces or the member ports of the port channel are not supported.
- vPC ports are not supported.
- The current support of the feature uses regular and dynamic EVPN updates on the BGP-EVPN control plane for 802.1X secure MAC updates. As a result, we cannot prevent the move across EVPN even if the global policy is “dot1x mac-move deny”.
- Ensure that the “dot1x mac-move” policy is configured the same across the fabric. There is no configuration validation across the nodes, hence it could lead to unexpected behavior if the configuration policy is not in sync.
- The local to remote MAC moves behavior for the deny and permit modes is permitted. Therefore, the MAC move is permitted even if the deny mode is enabled.
- Ensure that the dot1x and the port-security ports use different VLANs. The same VLAN cannot be assigned to both ports.
- Dot1x is not VLAN aware and hence having the same MAC in two different VLANs is not possible. Depending on the mac-move mode that is selected, either the MAC is moved to a new VLAN or it is denied.
- You cannot configure static and secure MAC together.
- The Cisco Nexus 3164Q-40GE switch is not supported.
- RADIUS change of Authorization is supported for VXLAN EVPN.
- The recommended re-authentication time interval for a scale setup is the default value, which is 3600 seconds.

Configuring 802.1X Support for VXLAN EVPN

This procedure configures 802.1X for VXLAN EVPN.

Procedure

	Command or Action	Purpose
Step 1	configure terminal Example: switch# configure terminal	Enters global configuration mode.
Step 2	feature dot1x Example: switch(config)# feature dot1x	Enables the 802.1X feature. The default is disabled.
Step 3	dot1x mac-move {permit deny} Example: switch(config)# dot1x mac-move permit	The deny parameter denies MAC moves. The permit parameter permits MAC moves.
Step 4	(Optional) show running-config dot1x all Example: switch(config)# show running-config dot1x all !Command: show running-config dot1x all !No configuration change since last restart !Time: Thu Sep 20 10:22:58 2018 version 9.2(2) Bios:version 07.64 feature dot1x dot1x system-auth-control dot1x mac-move deny interface Ethernet1/1 dot1x host-mode multi-auth dot1x pae authenticator dot1x port-control auto no dot1x re-authentication dot1x max-req 1 dot1x max-reauth-req 2 dot1x timeout quiet-period 60 dot1x timeout re-authperiod 3600 dot1x timeout tx-period 1 dot1x timeout server-timeout 30 dot1x timeout ratelimit-period 0 dot1x timeout supp-timeout 30 dot1x timeout inactivity-period 0 dot1x mac-auth-bypass interface Ethernet1/33 dot1x host-mode multi-auth dot1x pae authenticator dot1x port-control auto no dot1x re-authentication dot1x max-req 1 dot1x max-reauth-req 2 dot1x timeout quiet-period 60 dot1x timeout re-authperiod 3600	Displays the 802.1X configuration.

	Command or Action	Purpose
	<pre>dot1x timeout tx-period 1 dot1x timeout server-timeout 30 dot1x timeout ratelimit-period 0 dot1x timeout supp-timeout 30 dot1x timeout inactivity-period 0 dot1x mac-auth-bypass</pre>	

Verifying the 802.1X Support for VXLAN EVPN

To display the 802.1X Support for VXLAN ENPN configuration information, enter one of the following commands:

Command	Purpose
show running-config dot1x all	Displays dot1x running configuration.
show dot1x all summary	Displays the interface status.
show dot1x	Displays the default settings.
show dot1x all	Displays additional interface detail.

Example of show running-config dot1x all command

```
switch# show running-config dot1x all
!Command: show running-config dot1x all
!No configuration change since last restart
!Time: Thu Sep 20 10:22:58 2018

version 9.2(2) Bios:version 07.64
feature dot1x

dot1x system-auth-control
dot1x mac-move deny

interface Ethernet1/1
  dot1x host-mode multi-auth
  dot1x pae authenticator
  dot1x port-control auto
  no dot1x re-authentication
  dot1x max-req 1
  dot1x max-reauth-req 2
  dot1x timeout quiet-period 60
  dot1x timeout re-authperiod 3600
  dot1x timeout tx-period 1
  dot1x timeout server-timeout 30
  dot1x timeout ratelimit-period 0
  dot1x timeout supp-timeout 30
  dot1x timeout inactivity-period 0
  dot1x mac-auth-bypass

interface Ethernet1/33
  dot1x host-mode multi-auth
  dot1x pae authenticator
  dot1x port-control auto
  no dot1x re-authentication
```

```

dot1x max-req 1
dot1x max-reauth-req 2
dot1x timeout quiet-period 60
dot1x timeout re-authperiod 3600
dot1x timeout tx-period 1
dot1x timeout server-timeout 30
dot1x timeout ratelimit-period 0
dot1x timeout supp-timeout 30
dot1x timeout inactivity-period 0
dot1x mac-auth-bypass

```

Example of the show dot1x all summary command

```
switch# show dot1x all summary
```

Interface	PAE	Client	Status
Ethernet1/1	AUTH	none	UNAUTHORIZED

Interface	PAE	Client	Status
Ethernet1/33	AUTH	00:16:5A:4C:00:07	AUTHORIZED
		00:16:5A:4C:00:06	AUTHORIZED
		00:16:5A:4C:00:05	AUTHORIZED
		00:16:5A:4C:00:04	AUTHORIZED

```
switch#
```

```
switch# show mac address-table vlan 10
```

```
Legend:
```

* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False, C - ControlPlane MAC, ~ - vsan

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
* 10	0016.5a4c.0004	secure	-	T	F	Eth1/33
* 10	0016.5a4c.0005	secure	-	T	F	Eth1/33
* 10	0016.5a4c.0006	secure	-	T	F	Eth1/33
* 10	0016.5a4c.0007	secure	-	T	F	Eth1/33

```
switch#
```

```
switch# show mac address-table vlan 10 (VPC-PEER)
```

```
Legend:
```

* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False, C - ControlPlane MAC, ~ - vsan

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
* 10	0016.5a4c.0004	secure	-	T	F	vPC Peer-Link
* 10	0016.5a4c.0005	secure	-	T	F	vPC Peer-Link
* 10	0016.5a4c.0006	secure	-	T	F	vPC Peer-Link
* 10	0016.5a4c.0007	secure	-	T	F	vPC Peer-Link

```
switch#
```

```
switch# show mac address-table vlan 10 (RVTEP)
```

```
Legend:
```

* - primary entry, G - Gateway MAC, (R) - Routed MAC, O - Overlay MAC
age - seconds since last seen,+ - primary entry using vPC Peer-Link,
(T) - True, (F) - False, C - ControlPlane MAC, ~ - vsan

VLAN	MAC Address	Type	age	Secure	NTFY	Ports
C 10	0016.5a4c.0004	dynamic	0	F	F	nvel(67.67.67.67)
C 10	0016.5a4c.0005	dynamic	0	F	F	nvel(67.67.67.67)
C 10	0016.5a4c.0006	dynamic	0	F	F	nvel(67.67.67.67)
C 10	0016.5a4c.0007	dynamic	0	F	F	nvel(67.67.67.67)

Example of the show dot1x command

```
switch# show dot1x
      Sysauthcontrol Enabled
Dot1x Protocol Version 2
      Mac-Move Deny
```

Example of the show dot1x all command

```
switch# show dot1x all
      Sysauthcontrol Enabled
Dot1x Protocol Version 2
      Mac-Move Deny

Dot1x Info for Ethernet1/1
-----
      PAE = AUTHENTICATOR
      PortControl = AUTO
      HostMode = MULTI AUTH
ReAuthentication = Disabled
      QuietPeriod = 60
      ServerTimeout = 30
      SuppTimeout = 30
      ReAuthPeriod = 3600 (Locally configured)
      ReAuthMax = 2
      MaxReq = 1
      TxPeriod = 1
      RateLimitPeriod = 0
      InactivityPeriod = 0
      Mac-Auth-Bypass = Enabled

Dot1x Info for Ethernet1/33
-----
      PAE = AUTHENTICATOR
      PortControl = AUTO
      HostMode = MULTI AUTH
ReAuthentication = Disabled
      QuietPeriod = 60
      ServerTimeout = 30
      SuppTimeout = 30
      ReAuthPeriod = 3600 (Locally configured)
      ReAuthMax = 2
      MaxReq = 1
      TxPeriod = 1
      RateLimitPeriod = 0
      InactivityPeriod = 0
      Mac-Auth-Bypass = Enabled
```

Monitoring 802.1X

You can display the statistics that the Cisco NX-OS device maintains for the 802.1X activity.

Before you begin

Enable the 802.1X feature on the Cisco NX-OS device.

Procedure

	Command or Action	Purpose
Step 1	show dot1x {all interface ethernet slot/port} statistics Example: switch# show dot1x all statistics	Displays the 802.1X statistics.

Configuration Example for 802.1X

The following example shows how to configure 802.1X for an access port:

```
feature dot1x
aaa authentication dot1x default group rad2
interface Ethernet2/1
dot1x pae-authenticator
dot1x port-control auto
```

The following example shows how to configure 802.1X for a trunk port:

```
feature dot1x
aaa authentication dot1x default group rad2
interface Ethernet2/1
dot1x pae-authenticator
dot1x port-control auto
dot1x host-mode multi-host
```



Note Repeat the **dot1x pae authenticator** and **dot1x port-control auto** commands for all interfaces that require 802.1X authentication.

Additional References for 802.1X

This section includes additional information related to implementing 802.1X.

Related Documents

Related Topic	Document Title
Cisco NX-OS Licensing	Cisco NX-OS Licensing Guide
Command reference	Cisco Nexus 9000 Series NX-OS Security Command Reference
VRF configuration	Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide

Standards

Standards	Title
IEEE Std 802.1X- 2004 (Revision of IEEE Std 802.1X-2001)	<i>802.1X IEEE Standard for Local and Metropolitan Area Networks Port-Based Network Access Control</i>
RFC 2284	<i>PPP Extensible Authentication Protocol (EAP)</i>
RFC 3580	<i>IEEE 802.1X Remote Authentication Dial In User Service (RADIUS) Usage Guidelines</i>

