Configuring Port Security

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Prerequisites for Port Security

Note If you try to set the maximum value to a number less than the number of secure addresses already configured on an interface, the command is rejected.

Restrictions for Port Security

The maximum number of secure MAC addresses that you can configure on a switch or switch stack is set by the maximum number of available MAC addresses allowed in the system. This number is determined by the active Switch Database Management (SDM) template. This number is the total of available MAC addresses, including those used for other Layer 2 functions and any other secure MAC addresses configured on interfaces.

Information About Port Security

Port Security

You can use the port security feature to restrict input to an interface by limiting and identifying MAC addresses of the stations allowed to access the port. When you assign secure MAC addresses to a secure port, the port does not forward packets with source addresses outside the group of defined addresses. If you limit the number of secure MAC addresses to one and assign a single secure MAC address, the workstation attached to that port is assured the full bandwidth of the port.

If a port is configured as a secure port and the maximum number of secure MAC addresses is reached, when the MAC address of a station attempting to access the port is different from any of the identified secure MAC addresses, a security violation occurs. Also, if a station with a secure MAC address configured or learned on one secure port attempts to access another secure port, a violation is flagged.

Related Topics

Enabling and Configuring Port Security, on page 6
Configuration Examples for Port Security, on page 13
Enabling and Configuring Port Security, on page 6
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Types of Secure MAC Addresses

The switch supports these types of secure MAC addresses:

- Static secure MAC addresses—These are manually configured by using the **switchport port-security mac-address** *mac-address* interface configuration command, stored in the address table, and added to the switch running configuration.
- Dynamic secure MAC addresses—These are dynamically configured, stored only in the address table, and removed when the switch restarts.
- Sticky secure MAC addresses—These can be dynamically learned or manually configured, stored in the address table, and added to the running configuration. If these addresses are saved in the configuration file, when the switch restarts, the interface does not need to dynamically reconfigure them.

Sticky Secure MAC Addresses

You can configure an interface to convert the dynamic MAC addresses to sticky secure MAC addresses and to add them to the running configuration by enabling sticky learning. The interface converts all the dynamic secure MAC addresses, including those that were dynamically learned before sticky learning was enabled, to sticky secure MAC addresses. All sticky secure MAC addresses are added to the running configuration.

The sticky secure MAC addresses do not automatically become part of the configuration file, which is the startup configuration used each time the switch restarts. If you save the sticky secure MAC addresses in the configuration file, when the switch restarts, the interface does not need to relearn these addresses. If you do not save the sticky secure addresses, they are lost.

If sticky learning is disabled, the sticky secure MAC addresses are converted to dynamic secure addresses and are removed from the running configuration.

Security Violations

It is a security violation when one of these situations occurs:

- The maximum number of secure MAC addresses have been added to the address table, and a station whose MAC address is not in the address table attempts to access the interface.
- An address learned or configured on one secure interface is seen on another secure interface in the same VLAN.

You can configure the interface for one of three violation modes, based on the action to be taken if a violation occurs:

- protect—when the number of secure MAC addresses reaches the maximum limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses to drop below the maximum value or increase the number of maximum allowable addresses. You are not notified that a security violation has occurred.

Note We do not recommend configuring the protect violation mode on a trunk port. The protect mode disables learning when any VLAN reaches its maximum limit, even if the port has not reached its maximum limit.

- restrict—when the number of secure MAC addresses reaches the maximum limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses to drop below the maximum value or increase the number of maximum allowable addresses. In this mode, you are notified that a security violation has occurred. An SNMP trap is sent, a syslog message is logged, and the violation counter increments.
- shutdown—a port security violation causes the interface to become error-disabled and to shut down immediately, and the port LED turns off. When a secure port is in the error-disabled state, you can bring it out of this state by entering the **errdisable recovery cause** *psecure-violation* global configuration command, or you can manually re-enable it by entering the **shutdown** and **no shut down** interface configuration commands. This is the default mode.
- shutdown vlan—Use to set the security violation mode per-VLAN. In this mode, the VLAN is error disabled instead of the entire port when a violation occurs

This table shows the violation mode and the actions taken when you configure an interface for port security.

Table 1: Security Violation Mode Actions

Violation Mode	Traffic is forwarded [1]	Sends SNMP trap	Sends syslog message	Displays error message [2]	Violation counter increments	Shuts down port
protect	No	No	No	No	No	No

Violation Mode	Traffic is forwarded [1]	Sends SNMP trap	Sends syslog message	Displays error message [2]	Violation counter increments	Shuts down port
restrict	No	Yes	Yes	No	Yes	No
shutdown	No	No	No	No	Yes	Yes
shutdown vlan	No	No	Yes	No	Yes	No [3]

1 Packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses.
2 The switch returns an error message if you manually configure an address that would cause a security violation.
3 Shuts down only the VLAN on which the violation occurred.

Port Security Aging

You can use port security aging to set the aging time for all secure addresses on a port. Two types of aging are supported per port:

- Absolute—The secure addresses on the port are deleted after the specified aging time.
- Inactivity—The secure addresses on the port are deleted only if the secure addresses are inactive for the specified aging time.

Related Topics

Enabling and Configuring Port Security Aging, on page 10
Enabling and Configuring Port Security Aging, on page 10

Port Security and Switch Stacks

When a switch joins a stack, the new switch will get the configured secure addresses. All dynamic secure addresses are downloaded by the new stack member from the other stack members.

When a switch (either the active switch or a stack member) leaves the stack, the remaining stack members are notified, and the secure MAC addresses configured or learned by that switch are deleted from the secure MAC address table.

Default Port Security Configuration

Table 2: Default Port Security Configuration

Feature	Default Setting
Port security	Disabled on a port.

Feature	Default Setting
Sticky address learning	Disabled.
Maximum number of secure MAC addresses per port	1.
Violation mode	Shutdown. The port shuts down when the maximum number of secure MAC addresses is exceeded.
Port security aging	Disabled. Aging time is 0. Static aging is disabled. Type is absolute.

Port Security Configuration Guidelines

- Port security can only be configured on static access ports or trunk ports.
- A secure port cannot be a destination port for Switched Port Analyzer (SPAN).
- A secure port cannot belong to a Gigabit EtherChannel port group.

Note Voice VLAN is only supported on access ports and not on trunk ports, even though the configuration is allowed.

- When you enable port security on an interface that is also configured with a voice VLAN, set the maximum allowed secure addresses on the port to two. When the port is connected to a Cisco IP phone, the IP phone requires one MAC address. The Cisco IP phone address is learned on the voice VLAN, but is not learned on the access VLAN. If you connect a single PC to the Cisco IP phone, no additional MAC addresses are required. If you connect more than one PC to the Cisco IP phone, you must configure enough secure addresses to allow one for each PC and one for the phone.
- When a trunk port configured with port security and assigned to an access VLAN for data traffic and to a voice VLAN for voice traffic, entering the **switchport voice** and **switchport priority extend** interface configuration commands has no effect.

  When a connected device uses the same MAC address to request an IP address for the access VLAN and then an IP address for the voice VLAN, only the access VLAN is assigned an IP address.
- When you enter a maximum secure address value for an interface, and the new value is greater than the previous value, the new value overwrites the previously configured value. If the new value is less than the previous value and the number of configured secure addresses on the interface exceeds the new value, the command is rejected.
- The switch does not support port security aging of sticky secure MAC addresses.

This table summarizes port security compatibility with other port-based features.

Table 3: Port Security Compatibility with Other Switch Features

Type of Port or Feature on Port	Compatible with Port Security
DTP [4] port [5]	No
Trunk port	Yes
Routed port	No
SPAN source port	Yes
SPAN destination port	No
EtherChannel	No
Tunneling port	Yes
Protected port	Yes
IEEE 802.1x port	Yes
Voice VLAN port [6]	Yes
IP source guard	Yes
Dynamic Address Resolution Protocol (ARP) inspection	Yes
Flex Links	Yes

4 DTP=Dynamic Trunking Protocol

5 A port configured with the **switchport mode dynamic** interface configuration command.

6 You must set the maximum allowed secure addresses on the port to two plus the maximum number of secure addresses allowed on the access VLAN.

How to Configure Port Security

Enabling and Configuring Port Security

Before You Begin

This task restricts input to an interface by limiting and identifying MAC addresses of the stations allowed to access the port:

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport mode** {**access** | **trunk**}
4. **switchport voice vlan** *vlan-id*
5. **switchport port-security**
6. **switchport port-security [maximum** *value* [**vlan** {*vlan-list* | {**access** | **voice**}}]]
7. **switchport port-security violation** {**protect** | **restrict** | **shutdown** | **shutdown vlan**}
8. **switchport port-security [mac-address** *mac-address* [**vlan** {*vlan-id* | {**access** | **voice**}}]
9. **switchport port-security mac-address sticky**
10. **switchport port-security mac-address sticky** [*mac-address* | **vlan** {*vlan-id* | {**access** | **voice**}}]
11. **end**
12. **show port-security**
13. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**interface** *interface-id* **Example:** `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface to be configured, and enter interface configuration mode.
Step 3	**switchport mode** {**access**	**trunk**} **Example:** `Switch(config-if)# switchport mode access`	Sets the interface switchport mode as access or trunk; an interface in the default mode (dynamic auto) cannot be configured as a secure port.
Step 4	**switchport voice vlan** *vlan-id* **Example:** `Switch(config-if)# switchport voice vlan 22`	Enables voice VLAN on a port. vlan-id—Specifies the VLAN to be used for voice traffic.

	Command or Action	Purpose
Step 5	**switchport port-security** **Example:** `Switch(config-if)# switchport port-security`	Enable port security on the interface.
Step 6	**switchport port-security [maximum** *value* [**vlan** {*vlan-list* | {**access** | **voice**}}]] **Example:** `Switch(config-if)# switchport port-security maximum 20`	(Optional) Sets the maximum number of secure MAC addresses for the interface. The maximum number of secure MAC addresses that you can configure on a switch or switch stack is set by the maximum number of available MAC addresses allowed in the system. This number is set by the active Switch Database Management (SDM) template. This number is the total of available MAC addresses, including those used for other Layer 2 functions and any other secure MAC addresses configured on interfaces. (Optional) **vlan—**sets a per-VLAN maximum value Enter one of these options after you enter the **vlan** keyword: • *vlan-list***—**On a trunk port, you can set a per-VLAN maximum value on a range of VLANs separated by a hyphen or a series of VLANs separated by commas. For nonspecified VLANs, the per-VLAN maximum value is used. • **access—**On an access port, specifies the VLAN as an access VLAN. • **voice—**On an access port, specifies the VLAN as a voice VLAN. **Note** The **voice** keyword is available only if a voice VLAN is configured on a port and if that port is not the access VLAN. If an interface is configured for voice VLAN, configure a maximum of two secure MAC addresses.
Step 7	**switchport port-security violation** {**protect** | **restrict** | **shutdown** | **shutdown vlan**} **Example:** `Switch(config-if)# switchport port-security violation restrict`	(Optional) Sets the violation mode, the action to be taken when a security violation is detected, as one of these: • **protect—**When the number of port secure MAC addresses reaches the maximum limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses to drop below the maximum value or increase the number of maximum allowable addresses. You are not notified that a security violation has occurred. **Note** We do not recommend configuring the protect mode on a trunk port. The protect mode disables learning when any VLAN reaches its maximum limit, even if the port has not reached its maximum limit. • **restrict—**When the number of secure MAC addresses reaches the limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses or increase the number of maximum allowable addresses. An SNMP trap is sent, a syslog message is logged, and the violation counter increments.

	Command or Action	Purpose
		• **shutdown—**The interface is error-disabled when a violation occurs, and the port LED turns off. An SNMP trap is sent, a syslog message is logged, and the violation counter increments. • **shutdown vlan—**Use to set the security violation mode per VLAN. In this mode, the VLAN is error disabled instead of the entire port when a violation occurs. **Note** When a secure port is in the error-disabled state, you can bring it out of this state by entering the **errdisable recovery cause psecure-violation** global configuration command. You can manually re-enable it by entering the **shutdown** and **no shutdown** interface configuration commands or by using the **clear errdisable interface vlan** privileged EXEC command.
Step 8	**switchport port-security [mac-address** *mac-address* [**vlan** {*vlan-id* | {**access** | **voice**}}]	(Optional) Enters a secure MAC address for the interface. You can use this command to enter the maximum number of secure MAC addresses. If you configure fewer secure MAC addresses than the maximum, the remaining MAC addresses are dynamically learned. **Note** If you enable sticky learning after you enter this command, the secure addresses that were dynamically learned are converted to sticky secure MAC addresses and are added to the running configuration. (Optional) **vlan—**sets a per-VLAN maximum value. Enter one of these options after you enter the **vlan** keyword: • *vlan-id***—**On a trunk port, you can specify the VLAN ID and the MAC address. If you do not specify a VLAN ID, the native VLAN is used. • **access—**On an access port, specifies the VLAN as an access VLAN. • **voice—**On an access port, specifies the VLAN as a voice VLAN. **Note** The **voice** keyword is available only if a voice VLAN is configured on a port and if that port is not the access VLAN. If an interface is configured for voice VLAN, configure a maximum of two secure MAC addresses.
	Example: `Switch(config-if)# switchport port-security mac-address 00:A0:C7:12:C9:25 vlan 3 voice`	
Step 9	**switchport port-security mac-address sticky**	(Optional) Enables sticky learning on the interface.
	Example: `Switch(config-if)# switchport port-security mac-address sticky`	
Step 10	**switchport port-security mac-address sticky** [*mac-address* | **vlan** {*vlan-id* | {**access** | **voice**}}]	(Optional) Enters a sticky secure MAC address, repeating the command as many times as necessary. If you configure fewer secure MAC addresses than the maximum, the remaining MAC addresses are dynamically learned, are converted to sticky secure MAC addresses, and are added to the running configuration. **Note** If you do not enable sticky learning before this command is entered, an error message appears, and you cannot enter a sticky secure MAC address. (Optional) **vlan—**sets a per-VLAN maximum value.
	Example: `Switch(config-if)# switchport port-security mac-address sticky`	

	Command or Action	Purpose
	`00:A0:C7:12:C9:25 vlan voice`	Enter one of these options after you enter the **vlan** keyword: • *vlan-id*—On a trunk port, you can specify the VLAN ID and the MAC address. If you do not specify a VLAN ID, the native VLAN is used. • **access**—On an access port, specifies the VLAN as an access VLAN. • **voice**—On an access port, specifies the VLAN as a voice VLAN. **Note** The **voice** keyword is available only if a voice VLAN is configured on a port and if that port is not the access VLAN.
Step 11	**end** **Example:** `Switch(config-if)# end`	Returns to privileged EXEC mode.
Step 12	**show port-security** **Example:** `Switch# show port-security`	Verifies your entries.
Step 13	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Port Security, on page 2
Configuration Examples for Port Security, on page 13
Port Security, on page 2
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Enabling and Configuring Port Security Aging

Use this feature to remove and add devices on a secure port without manually deleting the existing secure MAC addresses and to still limit the number of secure addresses on a port. You can enable or disable the aging of secure addresses on a per-port basis.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-id*
3. **switchport port-security aging** {**static** | **time** *time* | **type** {**absolute** | **inactivity**}}
4. **end**
5. **show port-security** [**interface** *interface-id*] [**address**]
6. **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**configure terminal** **Example:** `Switch# configure terminal`	Enters global configuration mode.
Step 2	**interface** *interface-id* **Example:** `Switch(config)# interface gigabitethernet1/0/1`	Specifies the interface to be configured, and enter interface configuration mode.
Step 3	**switchport port-security aging** {**static** | **time** *time* | **type** {**absolute** | **inactivity**}} **Example:** `Switch(config-if)# switchport port-security aging time 120`	Enables or disable static aging for the secure port, or set the aging time or type. **Note** The switch does not support port security aging of sticky secure addresses. Enter **static** to enable aging for statically configured secure addresses on this port. For *time*, specifies the aging time for this port. The valid range is from 0 to 1440 minutes. For **type**, select one of these keywords: • **absolute—**Sets the aging type as absolute aging. All the secure addresses on this port age out exactly after the time (minutes) specified lapses and are removed from the secure address list. • **inactivity—**Sets the aging type as inactivity aging. The secure addresses on this port age out only if there is no data traffic from the secure source addresses for the specified time period.
Step 4	**end** **Example:** `Switch(config)# end`	Returns to privileged EXEC mode.

	Command or Action	Purpose
Step 5	**show port-security** [**interface** *interface-id*] [**address**] **Example:** `Switch# show port-security interface gigabitethernet1/0/1`	Verifies your entries.
Step 6	**copy running-config startup-config** **Example:** `Switch# copy running-config startup-config`	(Optional) Saves your entries in the configuration file.

Related Topics

Port Security Aging, on page 4

Port Security Aging, on page 4

Monitoring Port Security

This table displays port security information.

Table 4: Commands for Displaying Port Security Status and Configuration

Command	Purpose
show port-security [**interface** *interface-id*]	Displays port security settings for the switch or for the specified interface, including the maximum allowed number of secure MAC addresses for each interface, the number of secure MAC addresses on the interface, the number of security violations that have occurred, and the violation mode.
show port-security [**interface** *interface-id*] **address**	Displays all secure MAC addresses configured on all switch interfaces or on a specified interface with aging information for each address.
show port-security interface *interface-id* **vlan**	Displays the number of secure MAC addresses configured per VLAN on the specified interface.

Configuration Examples for Port Security

This example shows how to enable port security on a port and to set the maximum number of secure addresses to 50. The violation mode is the default, no static secure MAC addresses are configured, and sticky learning is enabled.

```
Switch(config)# interface gigabitethernet1/0/1
Switch(config-if)# switchport mode access
Switch(config-if)# switchport port-security
Switch(config-if)# switchport port-security maximum 50
Switch(config-if)# switchport port-security mac-address sticky
```

This example shows how to configure a static secure MAC address on VLAN 3 on a port:

```
Switch(config)# interface gigabitethernet1/0/2
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport port-security
Switch(config-if)# switchport port-security mac-address 0000.02000.0004 vlan 3
```

This example shows how to enable sticky port security on a port, to manually configure MAC addresses for data VLAN and voice VLAN, and to set the total maximum number of secure addresses to 20 (10 for data VLAN and 10 for voice VLAN).

```
Switch(config)# interface tengigabitethernet1/0/1
Switch(config-if)# switchport access vlan 21
Switch(config-if)# switchport mode access
Switch(config-if)# switchport voice vlan 22
Switch(config-if)# switchport port-security
Switch(config-if)# switchport port-security maximum 20
Switch(config-if)# switchport port-security violation restrict
Switch(config-if)# switchport port-security mac-address sticky
Switch(config-if)# switchport port-security mac-address sticky 0000.0000.0002
Switch(config-if)# switchport port-security mac-address 0000.0000.0003
Switch(config-if)# switchport port-security mac-address sticky 0000.0000.0001 vlan voice
Switch(config-if)# switchport port-security mac-address 0000.0000.0004 vlan voice
Switch(config-if)# switchport port-security maximum 10 vlan access
Switch(config-if)# switchport port-security maximum 10 vlan voice
```

Related Topics

Port Security, on page 2
Enabling and Configuring Port Security, on page 6
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