CHAPTER 22

Configuring SPAN

This chapter describes how to configure Switch Port Analyzer (SPAN) on your switch.

Note For complete syntax and usage information for the commands used in this chapter, refer to the *Catalyst 3550 Multilayer Switch Command Reference* for this release.

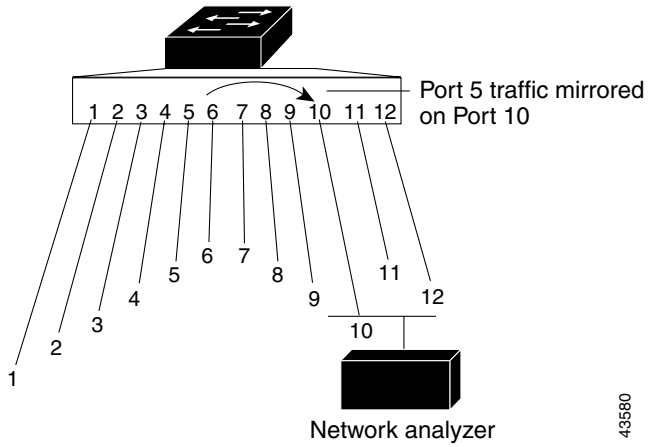
This chapter consists of these sections:

Understanding SPAN

You can analyze network traffic passing through ports or VLANs by using SPAN to send a copy of the traffic to another port on the switch that has been connected to a SwitchProbe device or other Remote Monitoring (RMON) probe. SPAN mirrors received or sent (or both) traffic on a source port, or received traffic on one or more source ports or source VLANs, to a destination port for analysis.

For example, in Figure 22-1, all traffic on Gigabit Ethernet port 5 (the source port) is mirrored to Gigabit Ethernet port 10 (the destination port). A network analyzer on port 10 receives all network traffic from port 5 without being physically attached to port 5.

Figure 22-1 Example SPAN Configuration



Only traffic that enters or leaves source ports or traffic that enters source VLANs can be monitored by using SPAN; traffic that gets routed to ingress source ports or source VLANs cannot be monitored. For example, if incoming traffic is being monitored, traffic that gets routed from another VLAN to the source VLAN is not monitored; however, traffic that is received on the source VLAN and routed to another VLAN is monitored.

This release supports only local SPAN, which means the source and destination interfaces must be on the same switch.

SPAN does not affect the switching of network traffic on source ports or source VLANs; a copy of the packets received or sent by the source interfaces are sent to the destination interface. However, an oversubscribed SPAN destination, for example, a 10-Mbps port monitoring a 100-Mbps port, can cause congestion on the switch. Destination ports do not receive or forward traffic, except that required for the SPAN session.

SPAN Concepts and Terminology

This section describes concepts and terminology associated with SPAN configuration.

SPAN Session

A SPAN session is an association of a destination port with source ports or source VLANs. You configure SPAN sessions by using parameters that specify the type of network traffic to monitor. Traffic monitoring in a SPAN session has these restrictions:

- You can monitor incoming traffic on a series or range of ports or VLANs.
- You can monitor outgoing traffic on a single port; you cannot monitor outgoing traffic on multiple ports.
- You cannot monitor outgoing traffic on VLANs.

You can configure two separate SPAN sessions with separate or overlapping sets of SPAN source VLANs. Both switched and routed ports can be configured as SPAN sources and destinations. SPAN sessions do not interfere with the normal operation of the switch.

You can configure SPAN sessions on disabled ports; however, a SPAN session does not become active unless you enable the destination port and at least one source port or VLAN for that session. The **show monitor session** *session_number* privileged EXEC command displays the operational status of a SPAN session.

A SPAN session remains inactive after system power-on until the destination port is operational.

Traffic Types

SPAN sessions include these traffic types:

- Receive (Rx) SPAN—The goal of receive (or ingress) SPAN is to monitor as much as possible all the packets received by the source interface or VLAN before any modification or processing is performed by the switch. A copy of each packet received by the source is sent to the destination port for that SPAN session. You can monitor a series or range of ingress ports or VLANs in a SPAN session.

  On tagged packets (ISL or 802.1Q), the tagging is removed at the ingress port. At the destination port, if tagging is enabled, the packets are seen with the ISL or 802.1Q headers, as specified. If no tagging is specified, packets are seen in the native format.

  Packets that are modified because of routing are copied without modification for Rx SPAN; that is, the original packet is copied. Packets that are modified because of quality of service (QoS)—for example, modified Differentiated Services Code Point (DSCP)—are copied with modification for Rx SPAN.

  Some features that can cause a packet to be dropped during receive processing have no effect on SPAN; the destination port receives a copy of the packet even if the actual incoming packet is dropped. These features include IP standard and extended input access control lists (ACLs), IP standard and extended output ACLs for unicast, VLAN maps, ingress QoS policing, and policy-based routing. Switch congestion that causes packets to be dropped also has no effect on SPAN.

- Transmit (Tx) SPAN—The goal of transmit (or egress) SPAN is to monitor as much as possible all the packets sent by the source interface after all modification and processing is performed by the switch. A copy of each packet sent by the source is sent to the destination port for that SPAN session. The copy is provided after the packet is modified.

  Only one egress source port is allowed in one SPAN session. VLAN monitoring is not supported in the egress direction.

  Packets that are modified because of routing—for example, with a time-to-live (TTL) or MAC-address modification—are duplicated at the destination port. On packets that are modified because of QoS, the modified packet might not have the same DSCP (IP packet) or CoS (non-IP packet) as the SPAN source.

  Some features that can cause a packet to be dropped during transmit processing might also affect the duplicated copy for SPAN. These features include VLAN maps, IP standard and extended output ACLs on multicast packets, and egress QoS policing. In the case of output ACLs, if the SPAN source drops the packet, the SPAN destination would also drop the packet. In the case of egress QoS policing, if the SPAN source drops the packet, the SPAN destination might not drop it. If the source port is oversubscribed, the destination ports will have different dropping behavior.

- Both—In a SPAN session, a single port can be monitored for both received and sent packets.

Source Port

A source port (also called a *monitored port*) is a switched or routed port that you monitor for network traffic analysis. In a single SPAN session, you can monitor source port traffic such as received (Rx), transmitted (Tx), or bidirectional (both); however, on a VLAN, you can monitor only received traffic. The switch supports any number of source ports (up to the maximum number of available ports on the switch) and any number of source ingress VLANs (up to the maximum number of VLANs supported).

A source port has these characteristics:

- It can be any port type (for example, EtherChannel, Fast Ethernet, Gigabit Ethernet, and so forth).
- It can be monitored in multiple SPAN sessions.
- It cannot be a destination port.
- Each source port can be configured with a direction (ingress, egress, or both) to monitor. For EtherChannel sources, the monitored direction would apply to all the physical ports in the group.
- Source ports can be in the same or different VLANs.

For VLAN SPAN (VSPAN), all active ports in the source VLAN are included as source ports.

You can configure a trunk port as a source port. By default, all VLANs active on the trunk are monitored on a trunk source port. You can limit SPAN traffic monitoring on trunk source ports to specific VLANs by using trunk VLAN filtering, which is the analysis of network traffic on a selected set of VLANs on source trunk ports. Only switched traffic in the selected VLANs is sent to the destination port. This feature affects only traffic forwarded to the destination SPAN port and does not affect the switching of normal traffic. This feature is not applicable for VLAN SPAN sessions.

Destination Port

Each SPAN session must have a destination port (also called a *monitoring port*) that receives a copy of traffic from the source port.

The destination port has these characteristics:

- It must reside on the same switch as the source port.
- It can be any Ethernet physical port.
- It can participate in only one SPAN session at a time (a destination port in one SPAN session cannot be a destination port for a second SPAN session).
- It cannot be a source port.
- It cannot be an EtherChannel port or a VLAN.
- When it is active, incoming traffic is disabled; it does not forward any traffic except that required for the SPAN session.
- It does not participate in spanning tree while the SPAN session is active.
- When it is an active destination port, it does not participate in any of the Layer 2 protocols (STP, VTP, CDP, DTP, PagP).
- A destination port that belongs to a source VLAN of any SPAN session is excluded from the source list and is not monitored.
- No address learning occurs on the destination port.

VLAN-Based SPAN

VLAN-based SPAN (VSPAN) is the analysis of the network traffic in one or more VLANs. You can configure VSPAN to monitor only received (Rx) traffic, which applies to all the ports for that VLAN.

Use these guidelines for VSPAN sessions:

- Trunk ports are included as source ports for VSPAN sessions.
- Only traffic with the monitored VLAN number is sent to the destination port.
- If a destination port belongs to a source VLAN, it is excluded from the source list and is not monitored.
- If ports are added to or removed from the source VLANs, they are added to or removed from the source ports being monitored.
- VLAN pruning and the VLAN allowed list have no effect on SPAN monitoring.
- VSPAN only monitors traffic that enters the switch, not traffic that is routed between VLANs. For example, if a VLAN is being Rx-monitored and the multilayer switch routes traffic from another VLAN to the monitored VLAN, that traffic is not monitored and is not received on the SPAN destination port.

SPAN Traffic

You can use SPAN to monitor all network traffic, including multicast and bridge protocol data unit (BPDU) packets, and CDP, VTP, DTP, STP, and PagP packets. Multicast packet monitoring is enabled by default.

In some SPAN configurations, multiple copies of the same source packet are sent to the SPAN destination port. For example, a bidirectional (both Rx and Tx) SPAN session is configured for sources a1 and a2 to a destination port d1. If a packet enters the switch through a1 and is switched to a2, both incoming and outgoing packets are sent to destination port d1. Both packets are the same (unless a Layer-3 rewrite occurs, in which case the packets are different because of the added Layer 3 information).

SPAN Interaction with Other Features

SPAN interacts with these features:

- Routing—Ingress SPAN does not monitor routed traffic. VSPAN only monitors traffic that enters the switch, not traffic that is routed between VLANs. For example, if a VLAN is being Rx-monitored and the multilayer switch routes traffic from another VLAN to the monitored VLAN, that traffic is not monitored and not received on the SPAN destination port.
- Spanning Tree Protocol (STP)—A destination port does not participate in STP while its SPAN session is active. The destination port can participate in STP after the SPAN session is disabled. On a source port, SPAN does not affect the STP status.

Caution Make sure there are no potential loops in the network topology when you enable incoming traffic for a destination port.

- Cisco Discovery Protocol (CDP)—A SPAN destination port does not participate in CDP while the SPAN session is active. After the SPAN session is disabled, the port again participates in CDP

- VLAN and trunking—You can modify VLAN membership or trunk settings for source and destination ports at any time. However, changes in VLAN membership or trunk settings for a destination port do not take effect until you disable the SPAN session. Changes in VLAN membership or trunk settings for a source port immediately take effect, and the respective SPAN sessions automatically adjust accordingly.
- EtherChannel—You can configure an EtherChannel group as a source port but not as a SPAN destination port. SPAN configuration fails if the destination port is part of an EtherChannel group. When a channel group is configured as a SPAN source, the entire group is monitored.

  If a port is added to a monitored EtherChannel group, the new port is added to the SPAN source port list. If a port is removed from a monitored EtherChannel group, it is automatically removed from the source port list. If the port is the only port in the EtherChannel group, the EtherChannel group is removed from SPAN.

  If a physical port that belongs to an EtherChannel group is configured as a SPAN source or destination port, it is removed from the EtherChannel group. After the port is removed from the SPAN session, it rejoins the EtherChannel group.
- QoS—For ingress monitoring, the packets sent to the SPAN destination port might be different from the packets actually received at the SPAN source port because the packets are forwarded after ingress QoS classification and policing. The packet DSCP might not be the same as the received packet.

  For egress monitoring, the packets sent out the SPAN destination port might not be the same as the packets sent out of SPAN source ports because the egress QoS policing at the SPAN source port might change the packet classification. QoS policing is not applied at SPAN destination ports.
- Multicast traffic can be monitored. For egress and ingress port monitoring, only a single unedited packet is sent to the SPAN destination port. It does not reflect the number of times the multicast packet is sent.
- A secure port cannot be a SPAN destination port.
- You can enable 802.1X on a port that is a SPAN destination port; however, 802.1X is disabled until the port is removed as a SPAN destination. You can enable 802.1X on a SPAN source port.

Configuring SPAN

This section describes how to configure SPAN on your switch. It contains this configuration information:

Default SPAN Configuration

Table 22-1 shows the default SPAN configuration.

This release supports only local SPAN; remote SPAN (RSPAN) is not supported.

Table 22-1 Default SPAN Configuration

Feature	Default Setting
SPAN state	Disabled
Source port traffic to monitor	Both received and sent traffic (both) **Note** Only received traffic can be monitored on source VLANs or multiple source ports
Encapsulation type (destination port)	Native form (no encapsulation type header)

SPAN Configuration Guidelines

Follow these guidelines when configuring SPAN:

- Use a network analyzer to monitor ports.
- Only two SPAN sessions can be active on a switch at the same time.
- The destination port cannot be a source port; a source port cannot be a destination port.
- You can have only one destination port per SPAN session. You cannot have two SPAN sessions using the same destination port.
- An EtherChannel port can be a SPAN source port; it cannot be a SPAN destination port.
- An 802.1X port can be a SPAN source port.You can enable 802.1X on a port that is a SPAN destination port; however, 802.1X is disabled until the port is removed as a SPAN destination.
- For a SPAN source port, you can monitor transmitted traffic for a single port or received traffic for a series or range of ports or VLANs.
- When you configure a switch port as a SPAN destination port, it is no longer a normal switch port; only monitored traffic passes through the SPAN destination port.
- A trunk port can be a source port or a destination port. When a destination port is a trunk port, outgoing packets through the SPAN port carry the encapsulation headers configured by the user—either Inter-Switch Link (ISL) or IEEE 802.1Q. If no encapsulation type is defined, the packets are sent in native form.
- When you specify a single source port and do not specify a traffic type (Tx, Rx, or both), both is used as the default.
- You can configure a disabled port to be a source or destination port, but the SPAN function does not start until the destination port and at least one source port or source VLAN are enabled.
- For received traffic, you can mix multiple source port and source VLANs within a single SPAN session. You cannot mix source VLANs and filter VLANs within a SPAN session; you can have source VLANs or filter VLANs, but not both at the same time.
- You can limit SPAN traffic to specific VLANs by using the **filter vlan** keyword. If a trunk port is being monitored, only traffic on the VLANs specified with this keyword is monitored. By default, all VLANs are monitored on a trunk port.

- The **no monitor session** *session_number* global configuration command removes a source or destination port from the SPAN session or removes a source VLAN from the SPAN session. If you do not specify any options following the **no monitor session** *session_number* command, the entire SPAN session is removed. The **no monitor** global configuration command also clears all SPAN sessions.
- A SPAN destination port never participates in any VLAN spanning tree. SPAN does include BPDUs in the monitored traffic, so any spanning-tree BPDUs received on the SPAN destination port for a SPAN session were copied from the SPAN source ports.
- When SPAN is enabled, configuration changes have these results:
  - If you change the VLAN configuration of a destination port, the change is not effective until SPAN is disabled.
  - If you disable all source ports or the destination port, the SPAN function stops until both a source and destination port are enabled.
  - If the source is a VLAN, the number of ports being monitored changes when you move a switched port in or out of the monitored VLAN.

Creating a SPAN Session and Specifying Ports to Monitor

Beginning in privileged EXEC mode, follow these steps to create a SPAN session and specify the source (monitored) and destination (monitoring) ports:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no monitor session** *session_number*	Clear any existing SPAN configuration for the session.
Step 3	**monitor session** *session_number* **source interface** *interface-id* [**,** | **-**] [**both** | **rx** | **tx**]	Specify the SPAN session and the source port (monitored port). For *session_number*, specify 1 or 2. For *interface-id*, specify the source port to monitor. Valid interfaces include physical interfaces and port-channel logical interfaces (**port-channel** *port-channel-number*). (Optional) [**,** | **-**] —Specify a series or range of interfaces. This option is valid when monitoring only received traffic. Enter a space after the comma; enter a space before and after the hyphen. (Optional) Specify the direction of traffic to monitor. If you do not specify a traffic direction, the source interface sends both transmitted and received traffic. • **both**—Monitor both received and transmitted traffic. • **rx**—Monitor received traffic. • **tx**—Monitor transmitted traffic.

	Command	Purpose
Step 4	**monitor session** *session_number* **destination interface** *interface-id* [**encapsulation** {**dot1q** | **isl**}]	Specify the SPAN session and the destination port (monitoring port). For *session_number*, specify 1 or 2. For *interface-id*, specify the destination port. Valid interfaces include physical interfaces. (Optional) Specify the encapsulation header for outgoing packets. If not specified, packets are sent in native form. • **isl**—Use ISL encapsulation. • **dot1q**—Use 802.1Q encapsulation.
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**show monitor** [**session** *session_number*]	Verify your entries.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove the entire SPAN session, use the **no monitor session** *session_number* global configuration command. To remove a source or destination port from the SPAN session, use the **no monitor session** *session_number* **source interface** *interface-id* global configuration command or the **no monitor session** *session_number* **destination interface** *interface-id* global configuration command.

This example shows how to set up a SPAN session, session 1, for monitoring source port traffic to a destination port. First, any existing SPAN configuration for session 1 is cleared, and then bidirectional traffic is mirrored from source port 1 to destination port 10. The **show monitor session** privileged EXEC command is used to verify the configuration.

```
Switch(config)# no monitor session 1
Switch(config)# monitor session 1 source interface gigabitethernet0/1
Switch(config)# monitor session 1 destination interface gigabitethernet0/10 encapsulation
dot1q
Switch(config)# end
Switch# show monitor session 1
Session 1
---------
Source Ports:
    RX Only:       None
    TX Only:       None
    Both:          Gi0/1
Source VLANs:
    RX Only:       None
    TX Only:       None
    Both:          None
Destination Ports: Gi0/10
    Encapsulation: DOT1Q
Filter VLANs:      None
```

Removing Ports from a SPAN Session

Beginning in privileged EXEC mode, follow these steps to remove a port as a SPAN source for a session:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no monitor session** *session_number* **source interface** *interface-id* [**,** | **-**] [**both** | **rx** | **tx**]	Specify the characteristics of the source port (monitored port) and SPAN session to remove. For *session*, specify 1 or 2. For *interface-id*, specify the source port to no longer monitor. Valid interfaces include physical interfaces and port-channel logical interfaces (**port-channel** *port-channel-number*). (Optional) Use [**,** | **-**] to specify a series or range of interfaces if they were configured. This option is valid when monitoring only received traffic. Enter a space after the comma; enter a space before and after the hyphen. (Optional) Specify the direction of traffic (**both**, **rx**, or **tx**) to no longer monitor. If you do not specify a traffic direction, both transmit and receive are disabled.
Step 3	**end**	Return to privileged EXEC mode.
Step 4	**show monitor** [**session** *session_number*]	Verify your entries.
Step 5	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove a destination port from the SPAN session, use the **no monitor session** *session_number* **destination interface** *interface-id* global configuration command. To change the encapsulation type back to the default (native), use the **monitor session** *session_number* **destination interface** *interface-id* without the **encapsulation** keyword.

This example shows how to remove port 1 as a SPAN source for SPAN session 1 and verify the configuration:

```
Switch(config)# no monitor session 1 source interface gigabitethernet0/1
Switch(config)# end
Switch# show monitor session 1
Session 1
---------
Source Ports:
    RX Only:       None
    TX Only:       None
    Both:          None
Source VLANs:
    RX Only:       None
    TX Only:       None
    Both:          None
Destination Ports:Gi0/6
    Encapsulation:DOT1Q
Filter VLANs:     None
```

This example shows how to disable received traffic monitoring on port 1, which was configured for bidirectional monitoring:

```
Switch(config)# no monitor session 1 source interface gigabitethernet0/1 rx
```

The monitoring of traffic received on port 1 is disabled, but traffic sent from this port continues to be monitored.

Specifying VLANs to Monitor

VLAN monitoring is similar to port monitoring. Beginning in privileged EXEC mode, follow these steps to specify VLANs to monitor:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no monitor session** *session_number*	Clear any existing SPAN configuration for the session. For *session_number*, specify 1 or 2.
Step 3	**monitor session** *session_number* **source vlan** *vlan-id* [**,** | **-**] **rx**	Specify the SPAN session and the source VLANs (monitored VLANs). You can monitor only received (**rx**) traffic on VLANs. For *session_number*, specify 1 or 2. For *vlan-id*, the range is 1 to 4094; do not enter leading zeros. (Optional) Use a comma (**,**) to specify a series of VLANs, or use a hyphen (**-**) to specify a range of VLANs. Enter a space after the comma; enter a space before and after the hyphen.
Step 4	**monitor session** *session_number* **destination interface** *interface-id* [**encapsulation** {**dot1q** | **isl**}]	Specify the SPAN session and the destination port (monitoring port). For *session_number*, specify 1 or 2. For *interface-id*, specify the destination port. Valid interfaces include physical interfaces. (Optional) Specify the encapsulation header for outgoing packets. If not specified, packets are sent in native form. • **isl**—Use ISL encapsulation. • **dot1q**—Use 802.1Q encapsulation.
Step 5	**end**	Return to privileged EXEC mode.
Step 6	**show monitor** [**session** *session_number*]	Verify your entries.
Step 7	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To remove one or more source VLANs or destination ports from the SPAN session, use the **no monitor session** *session_number* **source vlan** *vlan-id* global configuration command or the **no monitor session** *session_number* **destination interface** *interface-id* global configuration command.

This example shows how to clear any existing configuration on SPAN session 2, configure SPAN session 2 to monitor received traffic on all ports belonging to VLANs 1 through 3, and send it to destination port 7. The configuration is then modified to also monitor received traffic on all ports belonging to VLAN 10.

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source vlan 1 - 3 rx
Switch(config)# monitor session 2 destination interface gigabitethernet0/7
Switch(config)# monitor session 2 source vlan 10 rx
Switch(config)# end
Switch# show monitor session 2
Session 2
---------
Source Ports:
    RX Only:       None
    TX Only:       None
    Both:          None
Source VLANs:
    RX Only:       1-3,10
    TX Only:       None
    Both:          None
Destination Ports:Gi0/7
    Encapsulation: Native
Filter VLANs:      None
```

Specifying VLANs to Filter

Beginning in privileged EXEC mode, follow these steps to limit SPAN source traffic to specific VLANs:

	Command	Purpose
Step 1	**configure terminal**	Enter global configuration mode.
Step 2	**no monitor session** *session_number*	Clear any existing SPAN configuration for the session.
Step 3	**monitor session** *session_number* **interface** *interface-id* **rx**	Specify the characteristics of the source port (monitored port) and SPAN session. For *session_number*, specify 1 or 2. For *interface-id*, specify the source port to monitor. The interface specified must already be configured as a trunk port.
Step 4	**monitor session** *session_number* **filter vlan** *vlan-id* [**,** | **-**]	Limit the SPAN source traffic to specific VLANs. For *session_number*, specify 1 or 2. For *vlan-id*, the range is 1 to 4094; do not enter leading zeros. (Optional) Use a comma (**,**) to specify a series of VLANs or use a hyphen (**-**) to specify a range of VLANs. Enter a space after the comma; enter a space before and after the hyphen.
Step 5	**monitor session** *session_number* **destination interface** *interface-id*	Specify the characteristics of the destination port (monitoring port) and SPAN session. For *session_number*, specify 1 or 2. For *interface-id*, specify the destination port. Valid interfaces include physical interfaces.
Step 6	**end**	Return to privileged EXEC mode.

	Command	Purpose
Step 7	**show monitor** [**session** *session_number*]	Verify your entries.
Step 8	**copy running-config startup-config**	(Optional) Save your entries in the configuration file.

To monitor all VLANs on the trunk port, use the **no monitor session** *session_number* **filter** global configuration command.

This example shows how to clear any existing configuration on SPAN session 2, configure SPAN session 2 to monitor traffic received on trunk port 4, and send traffic for only VLANs 1 through 5 and 9 to destination port 8.

```
Switch(config)# no monitor session 2
Switch(config)# monitor session 2 source interface gigabitethernet0/4 rx
Switch(config)# monitor session 2 filter vlan 1 - 5 , 9
Switch(config)# monitor session 2 destination interface gigabitethernet0/8
Switch(config)# end
Switch# show monitor session 2
Session 2
---------
Source Ports:
    RX Only:       Gi0/4
    TX Only:       None
    Both:          None
Source VLANs:
    RX Only:       None
    TX Only:       None
    Both:          None
Destination Ports:Gi0/8
    Encapsulation: Native
Filter VLANs:      1-5,9
```

Displaying SPAN Status

To display the status of the current SPAN configuration, use the **show monitor** privileged EXEC command.

This is an example of output for the **show monitor** privileged EXEC command for **session 2**:

```
Switch# show monitor session 2
Session 2
---------
Source Ports:
    RX Only:       Gi0/4
    TX Only:       None
    Both:          None
Source VLANs:
    RX Only:       None
    TX Only:       None
    Both:          None
Destination Ports:Gi0/7
    Encapsulation: Native
Filter VLANs:      1-5,9
```