Configuring the Catalyst Switched Port Analyzer (SPAN) Feature

Document ID: 10570

Contents

Introduction

The Switched Port Analyzer (SPAN) feature, sometimes called port mirroring or port monitoring, selects network traffic for analysis by a network analyzer such as a SwitchProbe device or other Remote Monitoring (RMON) probe. Previously, SPAN was a relatively basic feature on the Catalyst family of switches, but the latest releases of the Catalyst OS (CatOS) introduced great enhancements and many new possibilities that are now available to the user. This document is not intended to be an alternate configuration guide for the SPAN feature, but rather an introduction to the recent features of SPAN that have been implemented. This document answers the most common questions about SPAN, such as:

- What is SPAN and how do I configure it?
- What are the different features available (especially multiple SPAN sessions at the same time), and what software level is needed to run them?
- Does SPAN impact the performances of a switch?

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document uses CatOS 5.5 as a reference for the Catalyst 4500/4000, 5500/5000, and 6500/6000 series switches. On the Catalyst 2900XL/3500XL series, Cisco IOS® Software Release 12.0(5)XU is used. Though this document is updated to reflect changes to SPAN, refer to your switch platform documentation release notes for the latest developments on the SPAN feature.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

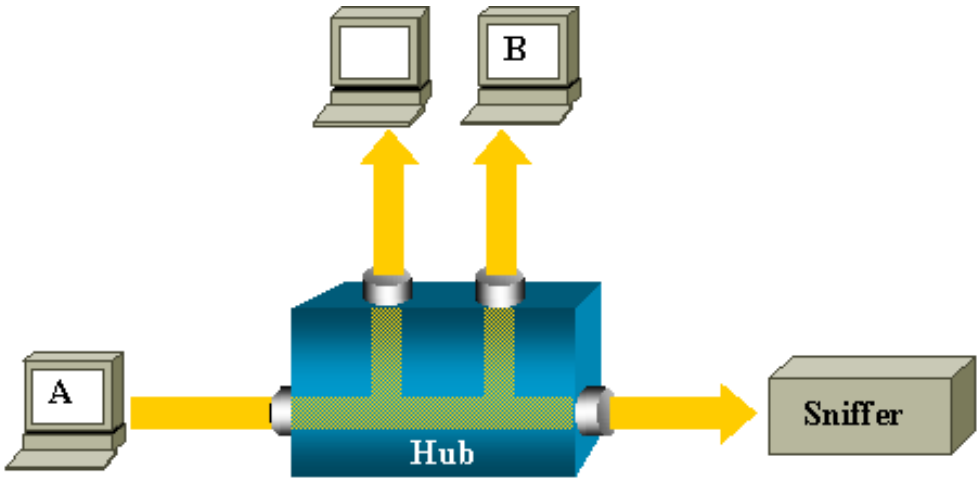
Conventions

For more information on document conventions, refer to the Cisco Technical Tips Conventions.

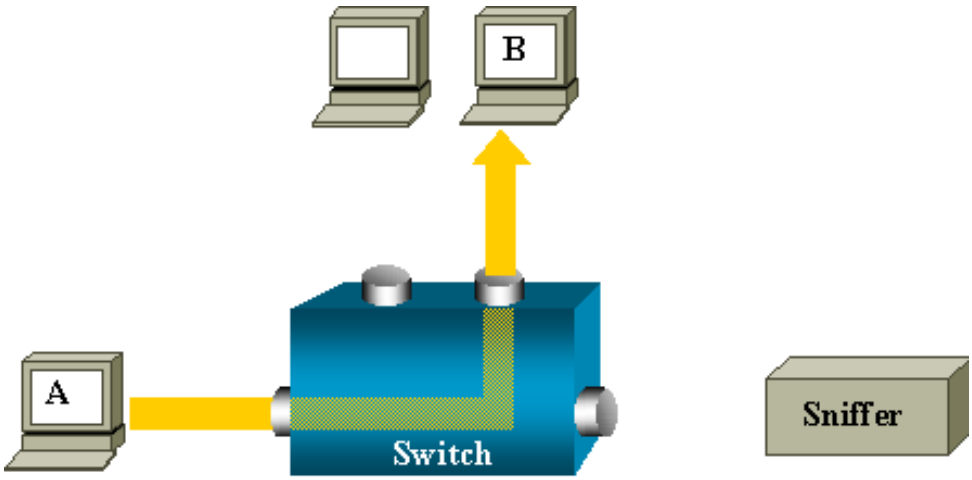
Brief Description of SPAN

What is SPAN and why is it needed? The SPAN feature was introduced on switches because of a fundamental difference they have with hubs. When a hub receives a packet on one port, it sends out a copy of that packet on all ports except on the one where it was received. After a switch boots, it starts to build up a Layer 2 forwarding table based on the source MAC address of the different packets received. Once this forwarding table has been built, the switch forwards traffic destined for a MAC address directly to the corresponding port.

For example, if you want to capture Ethernet traffic sent by host A to host B and both are connected to a hub, just attach a sniffer to this hub because all other ports see the traffic between hosts A and B:

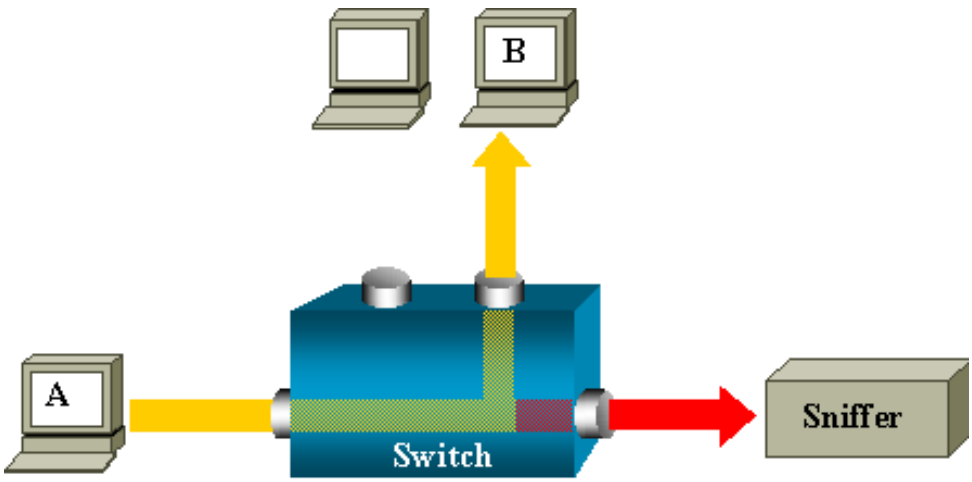


On a switch, after the host B MAC address is learned, unicast traffic from A to B is only forwarded to the B port, and therefore, is not seen by the sniffer:



In this configuration, the sniffer only captures traffic flooded to all ports, such as broadcast traffic, multicast traffic with CGMP or Internet Group Management Protocol (IGMP) snooping disabled, and unknown unicast traffic. Unicast flooding happens when the switch does not have the destination MAC in its content-addressable memory (CAM) table. It does not know where to send the traffic, and it floods the packets to all the ports in the destination VLAN.

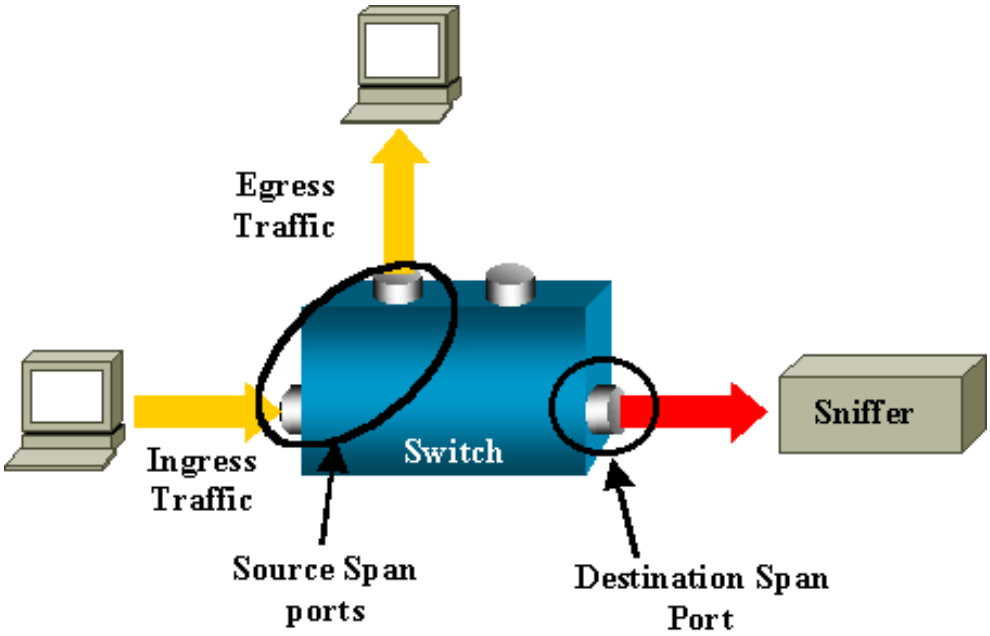
An extra feature is needed that artificially copies unicast packets sent by host A to the sniffer port:



In the above diagram, the sniffer is attached to a port that is configured to receive a copy of every packet that is sent by host A. This port is called a SPAN port. The sections below describe how this feature can be tuned very precisely to do more than just monitor a port.

SPAN Terminology

- **Ingress Traffic:** traffic entering the switch.
- **Egress Traffic:** traffic leaving the switch.
- **Source (SPAN) Port:** a port that is monitored using the SPAN feature.
- **Destination (SPAN) Port:** a port that is monitoring source ports, usually where a network analyzer is connected.
- **Monitor Port:** a monitor port is also a destination SPAN port in Catalyst 2900XL/3500XL/2950 terminology.



- **Local SPAN:** the SPAN feature is local when the monitored ports are all located on the same switch as the destination port. This is in contrast to Remote SPAN, below.
- **Remote SPAN (RSPAN):** some source ports are not located on the same switch as the destination port. This is an advanced feature that requires a special VLAN to carry the traffic being monitored by SPAN between switches. RSPAN is not supported on all switches, so check the respective release notes or configuration guide to see if it can be used on the switch you are deploying.
- **Port-Based SPAN (PSPAN):** the user specifies one or several source ports on the switch and one destination port.
- **VLAN-Based SPAN (VSPAN):** on a given switch, the user can choose to monitor all the ports belonging to a particular VLAN in a single command.
- **ESPAN:** means enhanced SPAN version. This term has been used several times during the evolution of the SPAN to name additional features and, therefore, is not very clear. Its use is avoided in this document.
- **Administrative Source:** list of source ports or VLANs that have been configured to be monitored.
- **Operational Source:** list of ports that are effectively monitored. This can be different from the administrative source. For example, a port that is in shutdown mode can appear in the administrative source, but is not effectively monitored.

SPAN on the Catalyst 2900XL/3500XL Switches

Features Available and Restrictions

The port monitoring feature is not very extensive on the Catalyst 2900XL/3500XL and is therefore relatively easy to understand.

You can create as many local PSPAN sessions as necessary. For example, you can create PSPAN sessions on the configuration port that you have chosen to be a destination SPAN port; just list the source ports you want to monitor using the **port monitor**

interface command. A monitor port is actually a destination SPAN port in Catalyst 2900XL/3500XL terminology.

- The main restriction is that all the ports related to a given session (whether source or destination) must belong to the same VLAN.
- If you do not specify any interface in the **port monitor** command, all other ports belonging to the same VLAN as the interface are monitored.

Below are some restrictions that are taken from the Cisco IOS Command Reference, Catalyst 2900XL/3500XL:

ATM ports are the only ports that cannot be monitor ports. However, you can monitor ATM ports. The following restrictions apply for ports that have port-monitoring capability:

- A monitor port cannot be in a Fast EtherChannel or Gigabit EtherChannel port group.
- A monitor port cannot be enabled for port security.
- A monitor port cannot be a multi-VLAN port.
- A monitor port must be a member of the same VLAN as the port monitored. VLAN membership changes are disallowed on monitor ports and ports being monitored.
- A monitor port cannot be a dynamic-access port or a trunk port. However, a static-access port can monitor a VLAN on a trunk, a multi-VLAN, or a dynamic-access port. The VLAN monitored is the one associated with the static-access port.
- Port monitoring does not work if both the monitor and monitored ports are protected ports.

Refer to this document for additional information on feature conflicts:

- *Managing Configuration Conflicts* section of Managing Switches - Catalyst 2900XL/3500XL Series Switches

Be careful that a port in the monitor state is not running the Spanning Tree Protocol (STP) while still belonging to the VLAN of the ports it is mirroring. If the port monitor is part of a loop (if, for instance, you connect it to a hub or a bridge, looping to another part of the network), you may end up in a catastrophic bridging loop condition because you are no longer protected by the STP. See the section entitled Why Is the SPAN Session Creating a Bridging Loop? for an example of how this can happen.

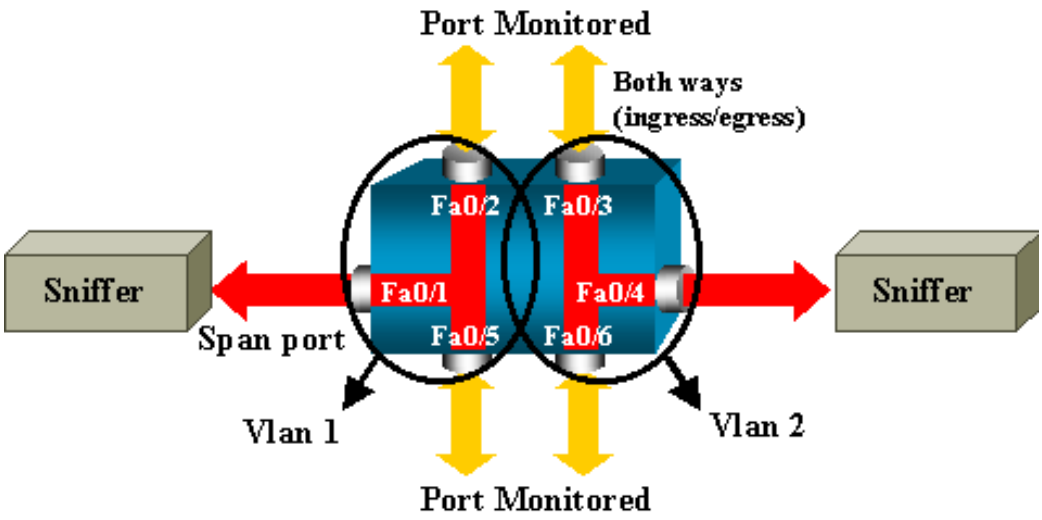
Configuration Example

In this example, two concurrent SPAN sessions are created.

- Port Fa0/1 monitors traffic sent and received by port Fa0/2 and Fa0/5. It also monitors traffic to and from the management interface VLAN 1.
- Port Fa0/4 monitors ports Fa0/3 and Fa0/6.

Ports Fa0/3, Fa0/4, and Fa0/6 are all configured in VLAN 2; other ports and the management interface are configured in the default VLAN 1.

Network Diagram



Sample Configuration on the Catalyst 2900XL/3500XL

2900XL/3500XL SPAN Sample Configuration

```
!--- Output suppressed.

!
interface FastEthernet0/1
port monitor FastEthernet0/2
 port monitor FastEthernet0/5
 port monitor VLAN1
!
interface FastEthernet0/2
!
interface FastEthernet0/3
switchport access vlan 2
!
interface FastEthernet0/4
 port monitor FastEthernet0/3
 port monitor FastEthernet0/6
 switchport access vlan 2
!
interface FastEthernet0/5
!
interface FastEthernet0/6
 switchport access vlan 2
!

!--- Output suppressed.

!
interface VLAN1
 ip address 10.200.8.136 255.255.252.0
 no ip directed-broadcast
 no ip route-cache
!

!--- Output suppressed.
```

Configuration Steps Explained

To configure port Fa0/1 as a destination port, and the source ports Fa0/2, Fa0/5, and the management interface (VLAN 1), select the interface Fa0/1 in the configuration mode:

```
Switch(config)# interface fa0/1
```

Enter the list of ports to be monitored:

```
Switch(config-if)# port monitor fastethernet 0/2
Switch(config-if)# port monitor fastethernet 0/5
```

With this, every packet received or transmitted by these two ports is also copied to port Fa0/1. Configure the monitoring for the administrative interface, using a variation on the **port monitor** command:

```
Switch(config-if)# port monitor vlan 1
```

Note: The command above does not mean that port Fa0/1 monitors the entire VLAN 1. The **vlan 1** keyword simply refers to the administrative interface of the switch.

This command has been issued to illustrate the impossibility of monitoring a port in a different VLAN:

```
Switch(config-if)# port monitor fastethernet 0/3
FastEthernet0/1 and FastEthernet0/3 are in different vlan
```

To finish the configuration, configure another session, this time using Fa0/4 as a destination SPAN port:

```
Switch(config-if)# interface fa0/4
Switch(config-if)# port monitor fastethernet 0/3
Switch(config-if)# port monitor fastethernet 0/6
Switch(config-if)# ^Z
```

The best way to check the configuration is to issue a simple **show running** command, or to use the **show port monitor** command:

```
Switch# show port monitor
Monitor Port Port Being Monitored
---------------------- ---------------------
FastEthernet0/1 VLAN1
FastEthernet0/1 FastEthernet0/2
FastEthernet0/1 FastEthernet0/5
FastEthernet0/4 FastEthernet0/3
FastEthernet0/4 FastEthernet0/6
```

Note: The Catalyst 2900XL and 3500XL do not support SPAN in the receive direction only (Rx SPAN or ingress SPAN), or in transmit direction only (Tx SPAN or egress SPAN). All SPAN ports are designed to capture both receive (Rx) and transmit (Tx) traffic.

SPAN on the Catalyst 2948G-L3 and 4908G-L3

The Catalyst 2948G-L3 and 4908G-L3 are fixed configuration switch routers or Layer 3 switches. The SPAN feature on a Layer 3 switch is called port snooping. However, port snooping is not supported on these switches. Refer to the *Features Not Supported* section of the document Release Notes for Catalyst 2948G-L3 and Catalyst 4908G-L3 for Cisco IOS Software Release 12.0(10)W5(18g).

SPAN on the Catalyst 8500

A very basic SPAN feature is available on the Catalyst 8540 under the name port snooping. Check the current Catalyst 8540 documentation for additional information:

- Command Reference, Catalyst 8500

- *About Port Snooping* section of Layer 3 Switching Interface Configurations

Here is an excerpt from the command reference:

Port snooping lets you transparently mirror traffic from one or more source ports to a destination port.

To set up port-based traffic mirroring, or snooping, use the **snoop** command. To disable snooping, use the **no** form of this command.

```
snoop interface source_port direction snoop_direction


no snoop interface source_port
```

The variable *source_port* refers to the port being monitored, and *snoop_direction* is the direction of traffic on the source port or ports that is monitored: receive, transmit, or both.

```
8500CSR# configure terminal
8500CSR(config)# interface fastethernet 12/0/15
8500CSR(config-if)# shutdown
8500CSR(config-if)# snoop interface fastethernet 0/0/1 direction both
8500CSR(config-if)# no shutdown
```

This example shows output from the **show snoop** command:

```
8500CSR# show snoop
Snoop Test Port Name: FastEthernet1/0/4 (interface status=SNOOPING)
Snoop option:         (configured=enabled)(actual=enabled)
Snoop direction:      (configured=receive)(actual=receive)
Monitored Port Name:
(configured=FastEthernet1/0/3)(actual=FastEthernet1/0/3)
```

Note: This command is not supported on Ethernet ports in a Catalyst 8540 if you are running a multiservice ATM switch router (MSR) image, such as 8540m-in-mz. Instead, you must use a campus switch router (CSR) image, such as 8540c-in-mz. When running an MSR image, snooping is supported only on ATM interfaces by issuing the following commands:

- **atm snoop**
- **atm snoop-vp**
- **atm snoop-vc**

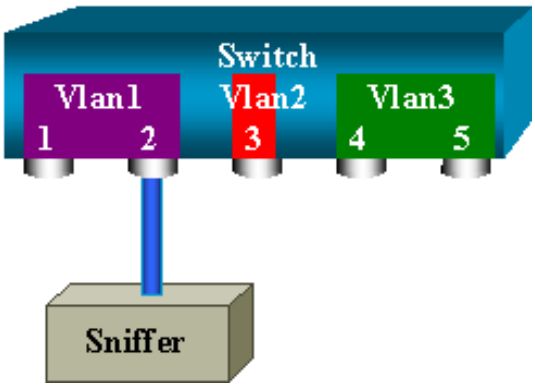
SPAN on the Catalyst 4500/4000, 5500/5000, and 6500/6000 Series Switches Running CatOS

Local SPAN

SPAN features have been added one by one to the CatOS, and a SPAN configuration consists of a single **set span** command. There is now a wide range of options available for the command:

```
switch (enable) set span
Usage: set span disable [dest_mod/dest_port|all]
       set span <src_mod/src_ports...|src_vlans...|sc0>
              <dest_mod/dest_port> [rx|tx|both]
              [inpkts <enable|disable>]
              [learning <enable|disable>]
              [multicast <enable|disable>]
              [filter <vlans...>]
              [create]
```

The different SPAN possibilities using variations are introduced in this network diagram:

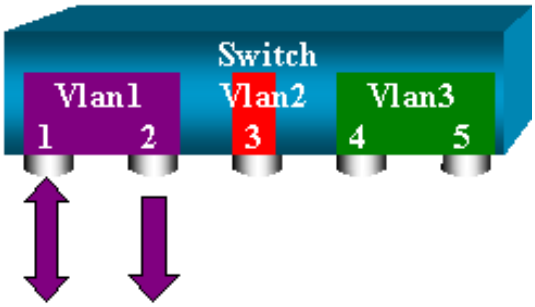


This diagram represents part of a single line card located in slot 6 of a Catalyst 6500/6000 switch. Ports 6/1 and 6/2 belong to VLAN 1, port 6/3 belongs to VLAN 2, and ports 6/4 and 6/5 belong to VLAN 3. Connect a sniffer to port 6/2 and use it as a monitor port in several different cases.

PSPAN, VSPAN: Monitor Some Ports or an Entire VLAN

The simplest form of the **set span** command is used to monitor a single port. The syntax is: **set span** ***source_port destination_port*** .

Monitor a Single Port with SPAN



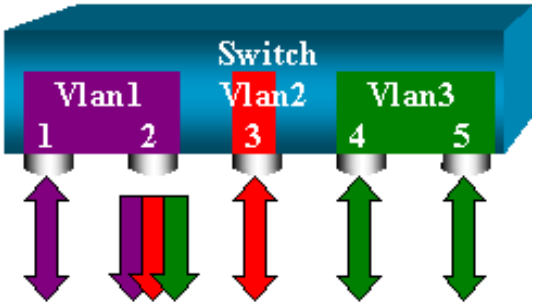

```
switch (enable) set span 6/1 6/2

Destination : Port 6/2
Admin Source : Port 6/1
Oper Source : Port 6/1
Direction : transmit/receive
Incoming Packets: disabled
Learning : enabled
Multicast : enabled
Filter : -
Status : active
switch (enable) 2000 Sep 05 07:04:14 %SYS-5-SPAN_CFGSTATECHG:local span
session active for destination port 6/2
```

With this configuration, every packet received or sent by port 6/1 is copied on port 6/2. This is clearly described when the configuration is entered. To get a summary of the current SPAN configuration, just use the **show span** command:

```
switch (enable) show span
Destination : Port 6/2
Admin Source : Port 6/1
Oper Source : Port 6/1
Direction : transmit/receive
Incoming Packets: disabled
Learning : enabled
```

```
Multicast : enabled
Filter : -
Status : active

Total local span sessions: 1
```

Monitor Several Ports with SPAN



The **set span** ***source_ports destination_port*** command allows the user to specify more than one source port. Simply list all the ports on which you want to implement the SPAN, separated by commas. The command line interpreter also allows you to specify a range of ports by using the hyphen. The example below illustrates this ability; SPAN on port 6/1 and a range of three ports starting from 6/3 are used. There can only be one destination port, and it is always specified after the SPAN source.

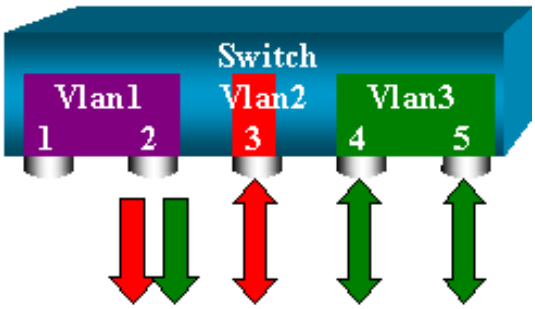
```
switch (enable) set span 6/1,6/3-5 6/2

2000 Sep 05 07:17:36 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
      for destination port 6/2
      Destination : Port 6/2
      Admin Source : Port 6/1,6/3-5
      Oper Source : Port 6/1,6/3-5
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active
      switch (enable) 2000 Sep 05 07:17:36 %SYS-5-SPAN_CFGSTATECHG:local span
      session active for destination port 6/2
```

Note: Unlike the Catalyst 2900XL/3500XL switches, the Catalyst 4500/4000, 5500/5000, and 6500/6000 can monitor ports belonging to several different VLANs earlier than CatOS 5.1. Here, the mirrored ports are assigned to VLAN 1, 2, and 3.

Monitor VLANs with SPAN

Eventually, the **set span** command allows you to simply configure a port to monitor local traffic for an entire VLAN: **set span** ***source_vlan(s) destination_port*** .

Instead of a list of ports, simply use a list of one or more VLANs as a source:




```
switch (enable) set span 2,3 6/2
```

```
2000 Sep 05 07:40:10 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
for destination port 6/2
Destination : Port 6/2
Admin Source : VLAN 2-3
Oper Source : Port 6/3-5,15/1
Direction : transmit/receive
Incoming Packets: disabled
Learning : enabled
Multicast : enabled
Filter : -
Status : active
switch (enable) 2000 Sep 05 07:40:10 %SYS-5-SPAN_CFGSTATECHG:local span
session active for destination port 6/2
```

With the above configuration, every packet entering or leaving VLAN 2 or 3 is duplicated to port 6/2.

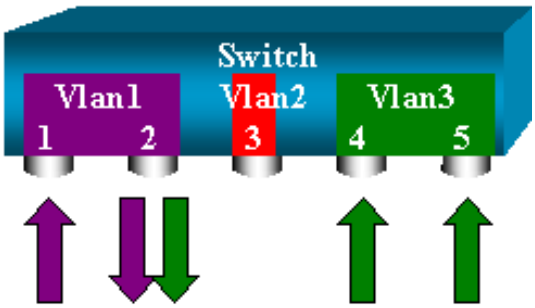
Note: The result is exactly the same as if you implemented SPAN individually on all the ports that belong to the VLANs specified in the command. You can see this by comparing the `Oper Source` and the `Admin Source` fields. The `Admin Source` basically lists all that you have configured for the SPAN session, whereas the `Oper Source` field lists the ports that are using SPAN.

Ingress/Egress SPAN

In the previous example, traffic entering and leaving the specified ports was monitored. You can see this in the field `Direction: transmit/receive`. The Catalyst 4500/4000, 5500/5000, and 6500/6000 series switches allow you to collect only egress (outbound) or ingress (inbound) traffic on a given port. You only need to add the keyword **rx** (receive) or **tx** (transmit) to the end of the command. The default value is **both** (transmit and receive).

set span *source_port destination_port* [rx | tx | both]

In this example, the session captures all incoming traffic for VLAN 1 and 3 and mirrors it to port 6/2:




```
switch (enable) set span 1,3 6/2 rx
          2000 Sep 05 08:09:06 %SYS-5-SPAN_CFGSTATECHG:local span session
          inactive for destination port 6/2
          Destination : Port 6/2
          Admin Source : VLAN 1,3
          Oper Source : Port 1/1,6/1,6/4-5,15/1
          Direction : receive
          Incoming Packets: disabled
          Learning : enabled
          Multicast : enabled
          Filter : -
          Status : active
          switch (enable) 2000 Sep 05 08:09:06 %SYS-5-SPAN_CFGSTATECHG:local span
          session active for destination port 6/2
```

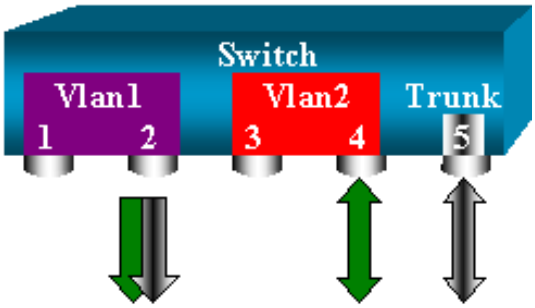
Implement SPAN on a Trunk

Trunks are a special case in a switch because they are ports carrying several VLANs. If a trunk is selected as a source port, the traffic for all the VLANs on this trunk is monitored.

Monitor a Subset of VLANs That Belong to a Trunk

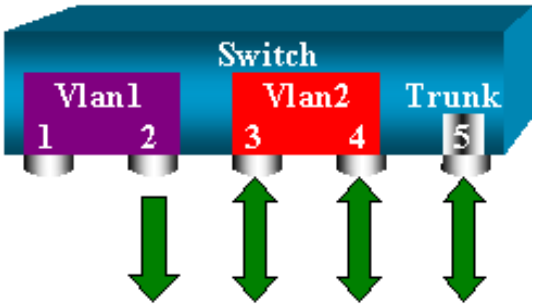
In the diagram below, port 6/5 is now a trunk carrying all VLANs. Imagine you want to use SPAN on the traffic in VLAN 2 for ports 6/4 and 6/5. Simply use the command:

```
switch (enable) set span 6/4-5 6/2
```



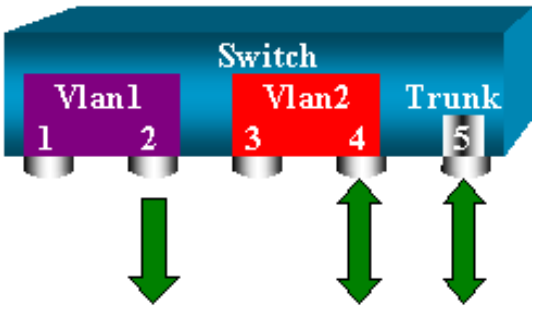
In this case, the traffic received on the SPAN port is a mix of the traffic you want and all the VLANs carried by trunk 6/5. For instance, there is no way to distinguish on the destination port whether a packet is coming from port 6/4 in VLAN 2 or port 6/5 in VLAN 1. Another possibility is to use SPAN on the entire VLAN 2:

```
switch (enable) set span 2 6/2
```



With this configuration, at least, you only monitor traffic belonging to VLAN 2 from the trunk. The problem is that now you also receive traffic that you did not want from port 6/3. The CatOS includes another keyword that allows you to select some VLAN to monitor from a trunk:

```
switch (enable) set span 6/4-5 6/2 filter 2
      2000 Sep 06 02:31:51 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
      for destination port 6/2
      Destination : Port 6/2
      Admin Source : Port 6/4-5
      Oper Source : Port 6/4-5
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : 2
      Status : active
```



This command achieves the goal by only selecting VLAN 2 on all the trunks monitored. (Of course, you can specify several VLANs with this filter option).

Note: This filter option is only supported on Catalyst 4500/4000 and Catalyst 6500/6000 switches. Catalyst 5500/5000 does not support the filter option available with the **set span** command.

Trunking on the Destination Port

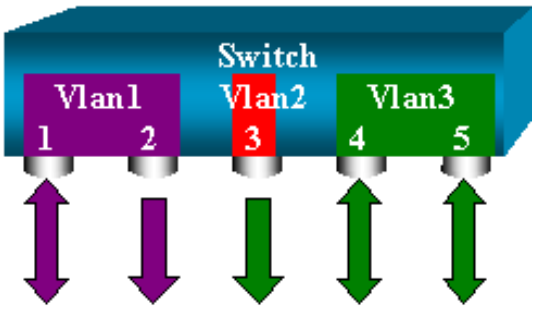
If you have source ports that belong to several different VLANs, or if you are using SPAN on several VLANs on a trunk port, you may want to identify to which VLAN a packet you are receiving on the destination SPAN port belongs. This is possible if you enable trunking on the destination port before you configure it for SPAN. This way, all packets forwarded to the sniffer are also tagged with their respective VLAN IDs.

Note: Your sniffer needs to recognize the corresponding encapsulation.

```
switch (enable) set span disable 6/2
      This command will disable your span session.
      Do you want to continue (y/n) [n]?y
      Disabled Port 6/2 to monitor transmit/receive traffic of Port 6/4-5
      2000 Sep 06 02:52:22 %SYS-5-SPAN_CFGSTATECHG:local span session
      inactive for destination port 6/2
      switch (enable) set trunk 6/2 nonegotiate isl

      Port(s) 6/2 trunk mode set to nonegotiate.
      Port(s) 6/2 trunk type set to isl.
      switch (enable) 2000 Sep 06 02:52:33 %DTP-5-TRUNKPORTON:Port 6/2 has become
       isl trunk
      switch (enable) set span 6/4-5 6/2
      Destination : Port 6/2
      Admin Source : Port 6/4-5
      Oper Source : Port 6/4-5
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active
      2000 Sep 06 02:53:23 %SYS-5-SPAN_CFGSTATECHG:local span session active for
      destination port 6/2
```

Create Several Simultaneous Sessions

So far, only a single SPAN session has been created. Each time you issue a new **set span** command, the previous configuration is invalidated. The CatOS now has the ability to run several sessions concurrently; that is, it can have different destination ports at the same time. Use the **set span *source destination* create** command to add an additional SPAN session. In this session, port 6/1 to 6/2 is monitored, and at the same time, VLAN 3 to port 6/3 is monitored:




```
switch (enable) set span 6/1 6/2
      2000 Sep 05 08:49:04 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
      for destination port 6/2
      Destination : Port 6/2
      Admin Source : Port 6/1
      Oper Source : Port 6/1
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active
      switch (enable) 2000 Sep 05 08:49:05 %SYS-5-SPAN_CFGSTATECHG:local span
      session active for destination port 6/2
      switch (enable) set span 3 6/3 create
      Destination : Port 6/3
      Admin Source : VLAN 3
      Oper Source : Port 6/4-5,15/1
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active
      switch (enable) 2000 Sep 05 08:55:38 %SYS-5-SPAN_CFGSTATECHG:local span
      session active for destination port 6/3
```

Now, check to determine if you have two sessions at the same time by issuing the **show span** command:

```
switch (enable) show span
      Destination : Port 6/2
      Admin Source : Port 6/1
      Oper Source : Port 6/1
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active
      --------------------------------------------------------------------------
      Destination : Port 6/3
      Admin Source : VLAN 3
      Oper Source : Port 6/4-5,15/1
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
```

```
        Status : active
        Total local span sessions: 2
```

Now additional sessions have been created. You need a way to delete some sessions. The command is:

set span disable {all | *destination_port*}

A session is identified by its destination port (because there can only be one destination port per session). Delete the first session created, the one that uses port 6/2 as destination:

```
switch (enable) set span disable 6/2
      This command will disable your span session.
      Do you want to continue (y/n) [n]?y
      Disabled Port 6/2 to monitor transmit/receive traffic of Port 6/1
      2000 Sep 05 09:04:33 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
      for destination port 6/2
```

You can now check that you have only one session remaining:

```
switch (enable) show span
      Destination : Port 6/3
      Admin Source : VLAN 3
      Oper Source : Port 6/4-5,15/1
      Direction : transmit/receive
      Incoming Packets: disabled
      Learning : enabled
      Multicast : enabled
      Filter : -
      Status : active

    Total local span sessions: 1
```

To disable all the current sessions in a single step, use this command:

```
switch (enable) set span disable all
      This command will disable all span session(s).
      Do you want to continue (y/n) [n]?y
      Disabled all local span sessions
      2000 Sep 05 09:07:07 %SYS-5-SPAN_CFGSTATECHG:local span session inactive
      for destination port 6/3

    switch (enable) show span
      No span session configured
```

Other SPAN Options

The syntax for the **set span** command is:

```
switch (enable) set span
Usage: set span disable [dest_mod/dest_port|all]
      set span <src_mod/src_ports...|src_vlans...|sc0>
               <dest_mod/dest_port> [rx|tx|both]
               [inpkts <enable|disable>]
               [learning <enable|disable>]
               [multicast <enable|disable>]
               [filter <vlans...>]
               [create]
```

This section introduces briefly the options that have not yet been discussed in this document:

- **sc0:** The **sc0** keyword is specified in a SPAN configuration when you need to monitor the traffic to the management interface sc0. This feature is available on the Catalyst 5500/5000 and 6500/6000 code version CatOS 5.1 or later.

- **inpkts *enable/disable*:** This option is extremely important. As stated earlier, a port you configure as the SPAN destination still belongs to its original VLAN. Packets received on a destination port then enter the VLAN, as if this port were a normal access port. This behavior may be desired. If you are using a PC as a sniffer, you may want this PC to be fully connected to the VLAN. Nevertheless, it may be dangerous if you connect the destination port to other networking equipment that creates a loop in the network. The destination SPAN port does not run the STP, and you can end up in a dangerous bridging-loop situation. See theWhy Is the SPAN Session Creating a Bridging Loop? section of this document to understand how this can happen. The default setting for this option is disable, which means that the destination SPAN port discards packets it receives, thus protecting from bridging loops. This option appeared in CatOS 4.2.
- **learning *enable/disable*:** This option allows you to disable learning on the destination port. By default, learning is enabled and the destination port learns MAC addresses from incoming packets it receives. This feature appeared in CatOS 5.2 on the Catalyst 4500/4000 and 5500/5000, and in CatOS 5.3 on the Catalyst 6500/6000.
- **multicast *enable/disable*:** As its name suggests, this option allows you to enable or disable the monitoring of multicast packets. (The default is enable.) This feature is available on the Catalyst 5500/5000 and 6500/6000, CatOS 5.1 and later.
- **spanning port 15/1:** On the Catalyst 6500/6000, it is also possible to use port 15/1 (or 16/1) as a SPAN source. This allows it to monitor the traffic forwarded to the Multilayer Switch Feature Card (MSFC). (It captures traffic that is software-routed or directed to the MSFC.)

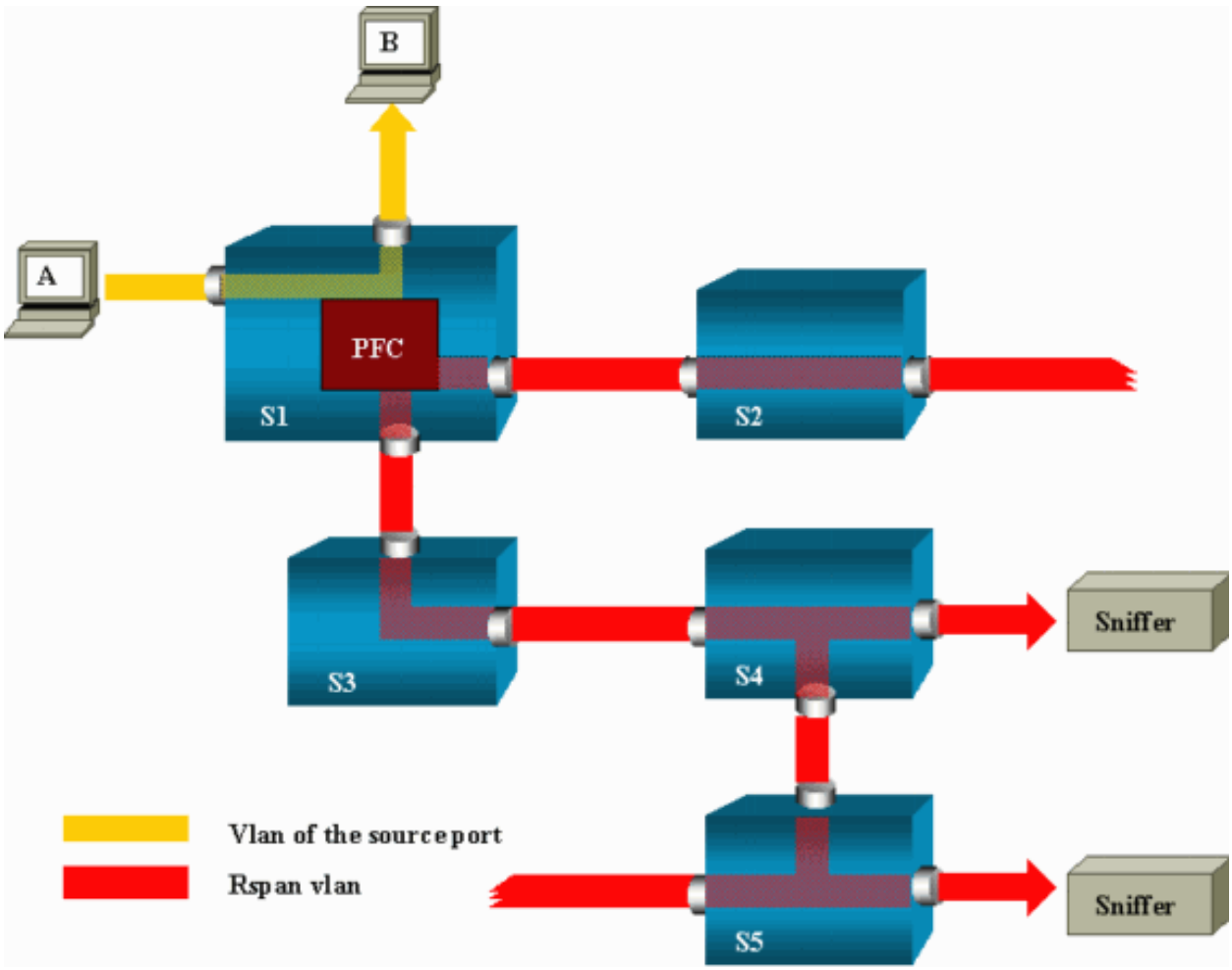
Remote SPAN

RSPAN Overview

RSPAN allows you to monitor source ports spread all over a switched network, not only locally on a switch with SPAN. This feature appeared in CatOS 5.3 in the Catalyst 6500/6000 series switches and has been added in the Catalyst 4500/4000 series switches in CatOS 6.3 and later.

The functionality works exactly as a regular SPAN session. The traffic monitored by SPAN, instead of being directly copied to the destination port, is flooded into a special RSPAN VLAN. The destination port can then be located anywhere in this RSPAN VLAN. (There can even be several destination ports.)

This diagram illustrates the structure of an RSPAN session:



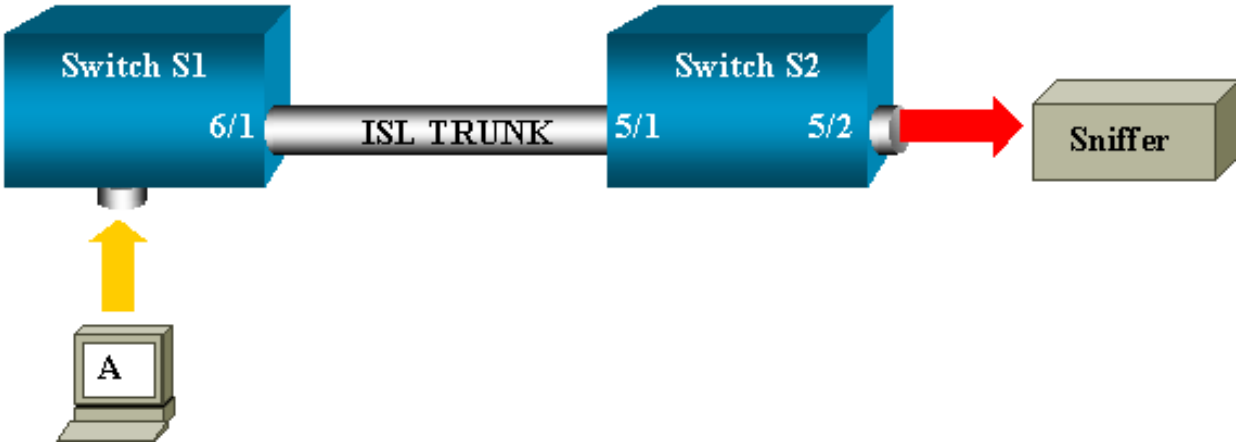
In this example, you configure RSPAN to monitor traffic sent by host A. When A generates a frame destined for B, the packet is copied by an application-specific integrated circuit (ASIC) of the Catalyst 6500/6000 Policy Feature Card (PFC) into a predefined RSPAN VLAN. From there, the packet is flooded to all other ports belonging to the RSPAN VLAN. All the interswitch links drawn here are trunks; this is a requirement for RSPAN. The only access ports are destination ports, where the sniffers are connected (here, on S4 and S5).

A few remarks on this design:

- S1 is called a source switch. Packets only enter the RSPAN VLAN in switches configured as RSPAN source. Currently, a switch can only be source for one RSPAN session (which means that a source switch can only feed one RSPAN VLAN at a time).
- S2 and S3 are intermediate switches. They are not RSPAN sources and do not have destination ports. A switch can be intermediate for any number of RSPAN sessions.
- S4 and S5 are destination switches. Some of their ports are configured to be destination for an RSPAN session. Currently, a Catalyst 6500/6000 can have up to 24 RSPAN destination ports, for one or several different sessions. You can also notice that S4 is both a destination and an intermediate switch.
- You can see that RSPAN packets are flooded into the RSPAN VLAN; even switches like S2, which are not on the path to a destination port, are receiving the traffic for the RSPAN VLAN. It clearly shows that it may be useful to prune this VLAN on such S1-S2 links.
- The flooding is achieved by disabling learning on the RSPAN VLAN.
- To prevent loops, the STP has been maintained on the RSPAN VLAN. Because of this, RSPAN cannot monitor Bridge Protocol Data Units (BPDUs).

RSPAN Configuration Example

The information below illustrates the setup of these different elements with a very simple RSPAN design. S1 and S2 are two Catalyst 6500/6000 switches. To monitor some S1 ports or VLANs from S2, most of the work consists of setting up a dedicated RSPAN VLAN. The rest of the commands are syntactically very similar to the ones used in a typical SPAN session.



Setup of the ISL Trunk Between the Two Switches S1 and S2

To start from the beginning, you need to put the same VLAN Trunk Protocol (VTP) domain on each switch and configure one side as trunking desirable. VTP negotiation does the rest. Issue this command on S1:

```
S1> (enable) set vtp domain cisco
      VTP domain cisco modified
```

Issue the following on S2:

```
S2> (enable) set vtp domain cisco
      VTP domain cisco modified
      S2> (enable) set trunk 5/1 desirable
      Port(s) 5/1 trunk mode set to desirable.
      S2> (enable) 2000 Sep 12 04:32:44 %PAGP-5-PORTFROMSTP:Port 5/1 left bridge
      port 5/1
      2000 Sep 12 04:32:47 %DTP-5-TRUNKPORTON:Port 5/1 has become isl trunk
```

Creation of the RSPAN VLAN

An RSPAN session needs a specific RSPAN VLAN. This VLAN must be created. (You cannot convert an existing VLAN into an RSPAN VLAN). In this example, the VLAN 100 is used:

```
S2> (enable) set vlan 100 rspan
      Vlan 100 configuration successful
```

Issue this command on one switch (which is configured as VTP server). The knowledge of RSPAN VLAN 100 is propagated automatically in the whole VTP domain.

Configuration of Port 5/2 of S2 as an RSPAN Destination Port

```
S2> (enable) set rspan destination 5/2 100
      Rspan Type : Destination
      Destination : Port 5/2
      Rspan Vlan : 100
      Admin Source : -
      Oper Source : -
      Direction : -
      Incoming Packets: disabled
      Learning : enabled
      Multicast : -
      Filter : -
      Status : active
```

```
        2000 Sep 12 04:34:47 %SYS-5-SPAN_CFGSTATECHG:remote span destination session
        active for destination port 5/2
```

Configuration of an RSPAN Source Port on S1

In this example, incoming traffic entering S1 via port 6/2 is monitored. Issue this command:

```
    S1> (enable) set rspan source 6/2 100 rx
          Rspan Type : Source
          Destination : -
          Rspan Vlan : 100
          Admin Source : Port 6/2
          Oper Source : Port 6/2
          Direction : receive
          Incoming Packets: -
          Learning : -
          Multicast : enabled
          Filter : -
          Status : active
          S1> (enable) 2000 Sep 12 05:40:37 %SYS-5-SPAN_CFGSTATECHG:remote span
          source session active for remote span vlan 100
```

All incoming packets on port 6/2 are now flooded on the RSPAN VLAN 100 and reach the destination port configured on S1 via the trunk.

Verify the Configuration

The **show rspan** command gives a summary of the current RSPAN configuration on the switch. Again, there can only be one source RSPAN session at a given time.

```
    S1> (enable) show rspan
        Rspan Type : Source
        Destination : -
        Rspan Vlan : 100
        Admin Source : Port 6/2
        Oper Source : Port 6/2
        Direction : receive
        Incoming Packets: -
        Learning : -
        Multicast : enabled
        Filter : -
        Status : active
        Total remote span sessions: 1
```

Other Configurations Possible with the set rspan Command

Refer to the command reference for a complete list of the **set rspan** command options. You configure the source and the destination using several command lines with RSPAN. Apart from this, SPAN and RSPAN really behave in the same way. You can even use RSPAN locally, on a single switch, if you want to have several destination SPAN ports.

Refer to the RSPAN Configuration Guidelines for a list of restrictions that apply to RSPAN configuration.

Feature Summary and Limitations

This table summarizes the different features introduced and provides the minimum CatOS release needed to run the feature on the specified platform:

Feature	Catalyst 4500/4000	Catalyst 5500/5000	Catalyst 6500/6000

inpkts ***enable/disable*** option	4.4	4.2	5.1
Multiple sessions, ports in different VLANs	5.1	5.1	5.1
sc0 option		5.1	5.1
multicast ***enable/disable*** option		5.1	5.1
learning ***enable/disable*** option	5.2	5.2	5.3
RSPAN	6.3		5.3

This is a short summary of the current restrictions on the number of possible SPAN sessions:

Feature	Catalyst 4500/4000 Range of Switches	Catalyst 5500/5000 Range of Switches	Catalyst 6500/6000 Range of Switches
Rx or both SPAN sessions	5	1	2
Tx SPAN sessions	5	4	4
Rx, Tx, or both RSPAN source sessions	5	Not Supported	1
RSPAN destination	5	Not Supported	24
Total sessions	5	5	30

Refer to the Cisco documents Configuring SPAN and RSPAN, Catalyst 4500/4000, Configuring SPAN, Catalyst 5500/5000 and Configuring SPAN and RSPAN, Catalyst 6500/6000 for additional restrictions and configuration guidelines.

SPAN on the Catalyst 2940, 2950, 2955, 2970, 3550, 3560 and 3750 Series Switches

The following are guidelines to configure the SPAN feature on the Catalyst 2940, 2950, 2955, 2970, 3550, 3560 and 3750 series switches.

- The Catalyst 2950 switches can have only one SPAN session active at a time and can monitor only source ports; they cannot monitor VLANs.
- The Catalyst 2950 and 3550 switches can forward traffic on a destination SPAN port in Cisco IOS Software Release 12.1(13)EA1 and later.
- The Catalyst 3550, 3560, and 3750 switches can support up to two SPAN sessions at a time and can monitor source ports as well as VLANs.

- The Catalyst 2970, 3560, and 3750 switches do not require configuration of a reflector port when configuring an RSPAN session.
- The Catalyst 3750 switches support session configuration using source and destination ports that reside on any of the switch stack members.

The SPAN feature configuration commands are similar on the Catalyst 2950 and Catalyst 3550, except that Catalyst 2950 can not monitor the VLANs. The SPAN can be configured as shown in this example:

```
C2950# configure terminal
C2950(config)#
C2950(config)# monitor session 1 source interface fastethernet 0/2

!--- Interface fa0/2 is configured as source port.

C2950(config)# monitor session 1 destination interface fastethernet 0/3

!--- Interface fa0/3 is configured as destination port.

C2950(config)#

C2950# show monitor session 1
Session 1
---------
Source Ports:
    RX Only:       None
        TX Only:       None
        Both:          Fa0/2
Destination Ports: Fa0/3
C2950#
```

Note: Unlike the 2900XL and 3500XL series switches, the Catalyst 2940, 2950, 2955, 2970, 3550, 3560 and 3750 series switches support SPAN on source port traffic in the receive direction only (Rx SPAN or ingress SPAN), in the transmit direction only (Tx SPAN or egress SPAN), or both.

Note: The above commands are not supported on Catalyst 2950 with Cisco IOS Software Release 12.0(5.2)WC(1) and with any software earlier than Cisco IOS Software Release 12.1(6)EA2. To configure SPAN on a Catalyst 2950 with software earlier than Cisco IOS Software Release 12.1(6)EA2, refer to the *Enabling Switch Port Analyzer* section of this document:

- Managing Switches

Note: Catalyst 2950 switches using Cisco IOS Software Release 12.1.(9)EA1d and earlier releases in the Cisco IOS Software Release 12.1 train support SPAN, with the warning that all packets seen on the SPAN destination port (connected to the sniffing device or PC) have an IEEE 802.1Q tag on them, even though the SPAN source port (monitored port) may not be an 802.1Q trunk port. If the sniffing device or PC network interface card (NIC) does not understand 802.1Q-tagged packets, it may drop the packets or have difficulty decoding them. Ability to see the 802.1Q-tagged frames is important only when the SPAN source port is a trunk port. With Cisco IOS Software Release 12.1(11)EA1 and later, you can enable and disable tagging of the packets at the SPAN destination port. Issue the **monitor session *session_number* destination interface *interface_id* encapsulation dot1q** command to enable encapsulation of the packets at the destination port. If the **encapsulation** keyword is not specified, the packets are sent untagged, which is the default in Cisco IOS Software Release 12.1(11)EA1 and later.

Feature	Catalyst 2950/3550
Ingress (inpkts) *enable/disable* option	Cisco IOS Software Release 12.1(12c)EA1
RSPAN	Cisco IOS Software Release 12.1(12c)EA1

Feature	Catalyst 2940*, 2950, 2955, 2970, 3550, 3560, 3750
Rx or both SPAN sessions	2
Tx SPAN sessions	2
Rx, Tx, or both RSPAN source sessions	2
RSPAN destination	2
Total sessions	2

Note: * The Catalyst 2940 switches only support local SPAN. RSPAN is not supported in this platform.

For more information on configuring SPAN and RSPAN, refer to these configuration guides:

- Configuring SPAN, Catalyst 2940
- Configuring SPAN and RSPAN, Catalyst 2950 and 2955
- Configuring SPAN and RSPAN, Catalyst 2970
- Configuring SPAN and RSPAN, Catalyst 3550
- Configuring SPAN and RSPAN, Catalyst 3560
- Configuring SPAN and RSPAN, Catalyst 3750

SPAN on the Catalyst 4500/4000 and Catalyst 6500/6000 Series Switches Running Cisco IOS System Software

The SPAN feature is supported on the Catalyst 4500/4000 and Catalyst 6500/6000 series switches running Cisco IOS System Software. Both of these switch platforms use the identical command-line interface (CLI) of, and a configuration similar to, the configuration covered in the SPAN on the Catalyst 2940, 2950, 2955, 2970, 3550, 3560 and 3750 Series Switches section. The related configuration can be found in these documents:

- Configuring Local SPAN and RSPAN, Catalyst 6500/6000
- Configuring SPAN and RSPAN, Catalyst 4500/4000

Configuration Example

The SPAN can be configured as shown in this example:

```
4507R# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.

4507R(config)# monitor session 1 source interface fastethernet 4/2

!--- Interface fa4/2 is configured as source port.

4507R(config)# monitor session 1 destination interface fastethernet 4/3

!--- Interface fa0/3 is configured as destination port.



4507R# show monitor session 1
```

```
Session 1
---------
Type : Local Session
Source Ports :
Both : Fa4/2
Destination Ports : Fa4/3


4507R#
```

Feature Summary and Limitations

This table summarizes the different features introduced and provides the minimum Cisco IOS Software release needed to run the feature on the specified platform:

Feature	Catalyst 4500/4000 (Cisco IOS Software)	Catalyst 6500/6000 (Cisco IOS Software)
Ingress (inpkts) *enable/disable* option	Cisco IOS Software Release 12.1(19)EW	Not Currently Supported(1)
RSPAN	Cisco IOS Software Release 12.1(20)EW	Cisco IOS Software Release 12.1(13)E

(1)Feature currently not available, and the availability of these features is typically not published until release.

This is a short summary of the current restrictions on the number of possible SPAN and RSPAN sessions:

Feature	Catalyst 4500/4000 (Cisco IOS Software)	Catalyst 6500/6000 (Cisco IOS Software)
Rx or both SPAN sessions	2	2
Tx SPAN sessions	4	2
Rx, Tx, or both RSPAN source sessions	2 (Rx, Tx or both), and up to 4 for Tx only	1 (+ 1 ingress SPAN only)(1)
RSPAN destination	2	64
Total sessions	6	66

(1)If you have two Rx, Tx or both SPAN sessions already configured, then you cannot have RSPAN source sessions.

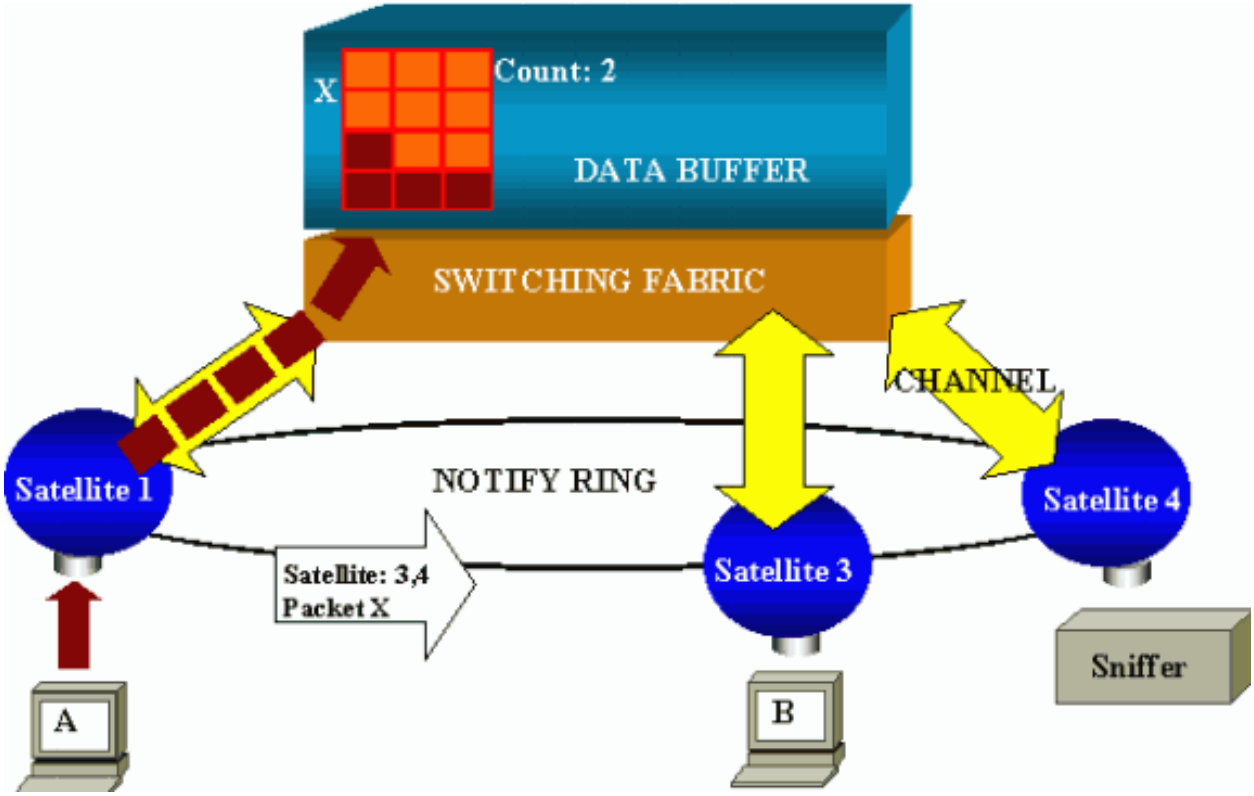
Refer to the Cisco documents Configuring SPAN and RSPAN, Catalyst 4500/4000 and Configuring Local SPAN and RSPAN, Catalyst 6500/6000 for additional restrictions and configuration guidelines.

Performance Impact of SPAN on the Different Catalyst Platforms

Catalyst 2900XL/3500XL Series

Architecture Overview

This is a very simplistic view of the 2900XL/3500XL switches internal architecture:



The ports of the switch are attached to satellites that communicate to a switching fabric via radial channels. On the top of that, all the satellites are interconnected via a high-speed notify ring, dedicated to signaling traffic.

When a packet is received by a satellite from a port, it is split into cells and sent to the switching fabric via one or more channels. The packet is then stored in the shared memory. Each satellite has knowledge of the destination ports. In the above diagram, satellite 1 knows that the packet X is to be received by satellite 3 and 4. It sends a message to these satellites via the notify ring so that they can start retrieving the cells from the shared memory via their radial channels, and eventually forward the packet. As the source satellite knows the destination, it also transmits an index that specifies the number of times this packet will be downloaded by the other satellites. Each time a satellite retrieves the packet from the shared memory, this index is decremented. Once the index reaches zero, the shared memory can be released.

Performance Impact

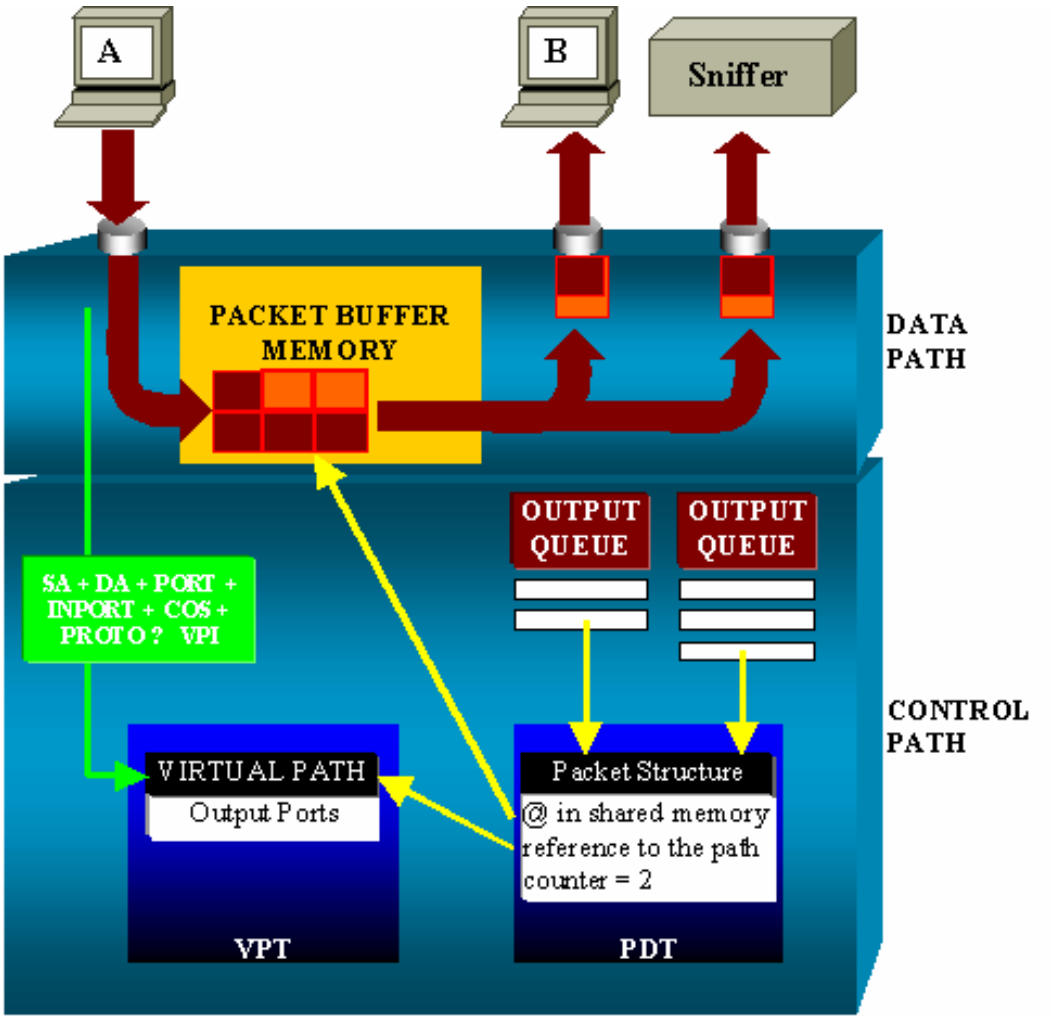
To monitor some ports with SPAN, a packet must be copied from the data buffer to a satellite an additional time. The impact on the high-speed switching fabric is negligible.

The monitoring port receives copies of transmitted and received traffic for all monitored ports. In this architecture, a packet destined for multiple destinations is stored in memory until all copies have been forwarded. If the monitoring port is 50 percent oversubscribed for a sustained period of time, it likely becomes congested and holds part of the shared memory. One or more of the ports being monitored may then also experience a slowdown.

Catalyst 4500/4000 Series

Architecture Overview

The Catalyst 4500/4000 is based on a shared-memory switching fabric. Below is a high-level overview of the path of a packet through the switch. The actual implementation is, in fact, much more complex.



On a Catalyst 4500/4000, you can distinguish the data path, which corresponds to the real transfer of data within the switch, from the control path, where all the decisions are taken.

When a packet enters the switch, a buffer is allocated in the Packet Buffer Memory (a shared memory), and a packet structure pointing to this buffer is initialized in the Packet Descriptor Table (PDT). While the data is copied into shared memory, the control path determines where to switch it; a hash value is computed from the packet source address, destination address, VLAN, protocol type, input port, and class of service (CoS) (either IEEE 802.1p tag or port default). This value is used to find the Virtual Path Index (VPI) of a path structure in the Virtual Path Table (VPT). This virtual path entry in the VPT holds several fields related to this particular flow, including the destination ports. The packet structure in the PDT is now updated with a reference to the virtual path and counter. In the above example, the packet is to be transmitted to two different ports, so the counter is initialized to two. Finally, the packet structure is added to the output queue of the two destination ports. From there, the data is copied from the shared memory into the output buffer of the port, and the packet structure counter is decremented. When it reaches zero, the shared memory buffer is released.

Performance Impact

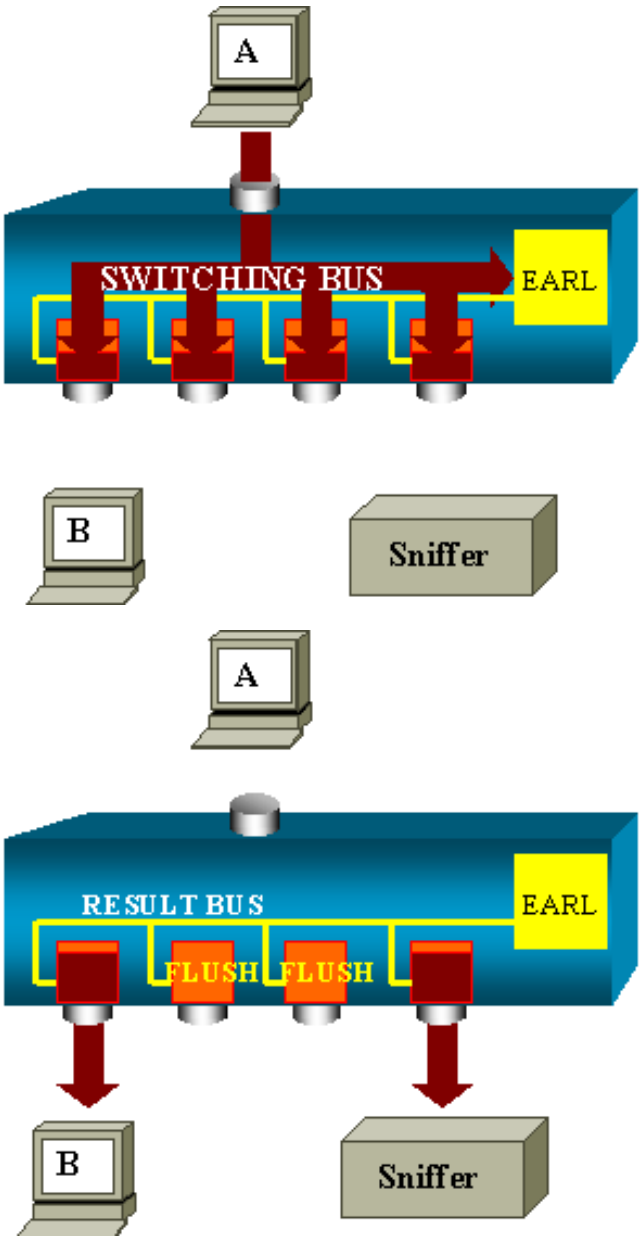
When using the SPAN feature, a packet must be sent to two different ports, as in the above example. This is not an issue because the switching fabric is non-blocking. If the destination SPAN port is congested, packets are dropped in the output queue and are correctly released from the shared memory. Therefore, there is no impact on the switch operation.

Catalyst 5500/5000 and 6500/6000 Series

Architecture Overview

On the Catalyst 5500/5000 and 6500/6000 series switches, a packet received on a port is transmitted on the internal switching bus. Every line card in the switch starts storing this packet in its internal buffers. At the same time, the Encoded Address Recognition Logic (EARL) receives the header of the packet and computes a result index that it sends to all the line cards via the result bus.

The knowledge of this index allows the line card to decide individually whether it should flush or transmit the packet it is still receiving in its buffers.



Performance Impact

Whether one or several ports eventually transmit the packet has absolutely no influence on the switch operation. Therefore, considering this architecture, the SPAN feature has no impact on the performance.

Frequently Asked Questions and Common Problems

Connectivity Issues Because of SPAN Misconfiguration

This occurred frequently in CatOS versions earlier than 5.1. At that time, there was only one SPAN session possible, and it stayed in the configuration, even when SPAN was disabled. Simply by issuing **set span enable**, the user reactivates the stored SPAN session. (This is frequently due to a typographical error, for example, if the user wants to enable STP.) This can cause severe connectivity issues if the destination port is used to forward user traffic.

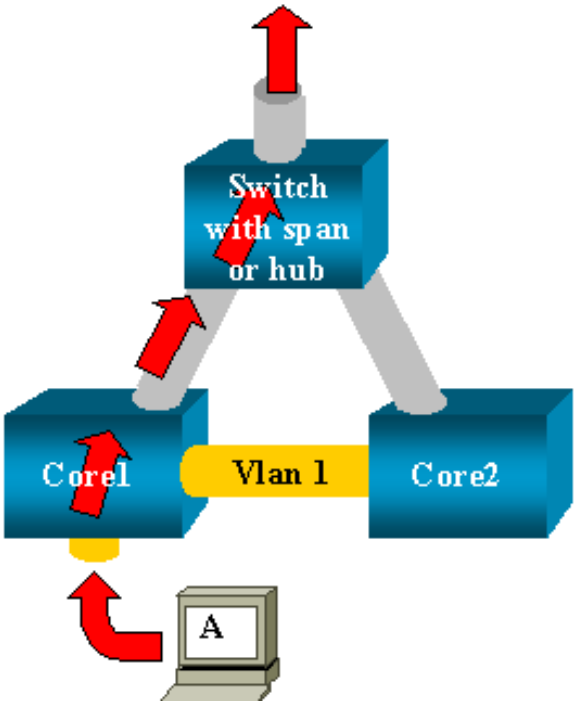
Warning: This is still in the current implementation of the CatOS, so be very careful of the port you choose as a SPAN

destination.

Why Is the SPAN Session Creating a Bridging Loop?

This typically occurs when the administrator is trying to fake the RSPAN feature, or simply because of a configuration error.

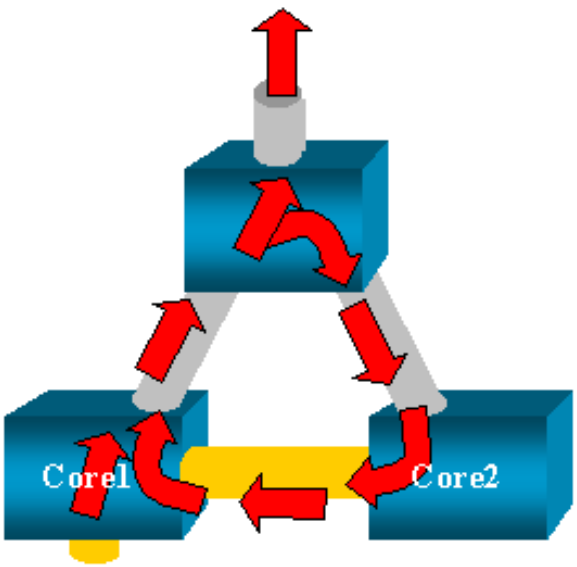
This is an example of the scenario:



Each of two core switches, linked by a trunk, for instance, has several servers, clients or other bridges connected to them. The administrator wants to monitor VLAN 1, which is appearing on several bridges with SPAN. To achieve that, he creates a SPAN session monitoring the whole VLAN 1 on each core switch, and, to merge these two sessions, connects the destination port to the same hub (or the same switch, using another SPAN session).

The goal is achieved; each single packet received on VLAN 1 by a core switch is duplicated on its SPAN port and forwarded upward to the hub. The traffic is eventually captured by a sniffer.

The only problem is that the traffic is also reinjected into Core 2 via the destination SPAN port, thereby creating a bridging loop in VLAN 1. Remember that a destination SPAN port is not running the STP and is not able to prevent such a loop.



Note: Since the introduction of the inpkts (input packets) option on the CatOS, a SPAN destination port drops any incoming

packets by default, thus preventing this failure scenario. However, the potential issue is still present on the Catalyst 2900XL/3500XL series switches.

Note: Even with the inpkts option preventing the loop, the above configuration may cause some problem in the network (because of MAC address learning issues associated with learning enabled on the destination port).

Does SPAN Impact Performances?

The links below describe the performance impact for the specified Catalyst platforms:

- Catalyst 2900XL/3500XL Series
- Catalyst 4500/4000 Series
- Catalyst 5500/5000 and 6500/6000 Series

Can You Configure SPAN on an EtherChannel Port?

An EtherChannel does not form if one of the ports in the bundle is a SPAN destination port. If you try to configure this, the switch tells you:

```
Channel port cannot be a Monitor Destination Port
Failed to configure span feature
```

A port in an EtherChannel bundle can be used as a SPAN source port.

Can You Have Several SPAN Sessions Running at the Same Time?

On the Catalyst 2900XL/3500XL series switches, the number of destination ports available on the switch is the only limit to the number of SPAN sessions.

On the Catalyst 2950 series switches, you can have only one assigned monitor port at any given time. If you select another port as the monitor port, the previous monitor port is disabled, and the newly selected port becomes the monitor port.

On the Catalyst 4500/4000, 5500/5000, and 6500/6000, with CatOS 5.1 and later, you can have several concurrent SPAN sessions. See the section Create Several Simultaneous Sessions, and also see the section Feature Summary and Limitations in this document.

Why Are You Not Able to Capture Corrupted Packets with SPAN?

This is, again, due to the way switches operate in general. When a packet goes through a switch, these events occur:

- The packet reaches the ingress port.
- It is then stored in at least one buffer.
- It is eventually retransmitted on the egress port.

If the switch receives a corrupted packet, the ingress port usually drops it, so you do not see it on the egress port. It is true, then, that a switch is not completely transparent when it is a matter of capturing traffic. Similarly, when you see a corrupted packet on your sniffer in the above scenario, the errors were generated at step 3, on the egress segment.

If you think that a device is sending corrupted packets, you may want to put the sending host and the sniffer device on a hub. The hub does not perform any error checking so, unlike the switch, the hub does not drop the packets; this way, the packets can be viewed.

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