

How To Configure InterVLAN Routing on Layer 3 Switches

Document ID: 41860

Introduction

Prerequisites

Requirements

Components Used

Conventions

Configure InterVLAN Routing

Task

Step-by-Step Instructions

Verify

Troubleshoot

Troubleshooting Procedure

Related Information

Introduction

VLANs divide broadcast domains in a LAN environment. Whenever hosts in one VLAN need to communicate with hosts in another VLAN, the traffic must be routed between them. This is known as inter-VLAN routing. On Catalyst switches it is accomplished by creating Layer 3 interfaces (Switch virtual interfaces (SVI)). This document provides the configuration and troubleshooting steps applicable to this capability.

Note: This document uses a Catalyst 3550 as an example. However, the concepts can also be applied to other Layer 3 switches that run Cisco IOS® (for example, Catalyst 3560, 3750, Catalyst 4500/4000 Series with Sup II+ or later, or Catalyst 6500/6000 Series that run Cisco IOS System software).

Prerequisites

Requirements

Catalyst switch models 3560, 3750, Catalyst 4500/4000 Series with Sup II+ or later, or Catalyst 6500/6000 Series that run Cisco IOS system software support basic InterVLAN routing features in all their supported software versions. Before you attempt this configuration on a 3550 series switch, ensure that you meet these prerequisites:

- InterVLAN routing on the Catalyst 3550 has certain software requirements to support interVLAN routing on the switch. See this table to determine whether your switch can support interVLAN routing.

Image Type and Version	InterVLAN Routing Capability
Enhanced Multilayer Image (EMI) – All Versions	Yes
	No

Standard Multilayer Image (SMI) – prior to Cisco IOS Software Release 12.1(11)EA1	
Standard Multilayer Image (SMI) – Cisco IOS Software Release 12.1(11)EA1 and later	Yes

For more information on the differences between SMI and EMI, refer to *Upgrading Software Images on Catalyst 3550 Series Switches Using the Command Line Interface*. This document also provides the procedure to upgrade the IOS code to a version that supports interVLAN routing.

- This document assumes that Layer 2 has been configured and that the devices within the same VLAN connected to the 3550 communicate with one another. If you need information on configuring VLANs, access ports and trunking on the 3550, refer to *Creating Ethernet VLANs on Catalyst Switches* or the *Catalyst 3550 Software Configuration Guide* for the specific IOS version you run on the switch.

Components Used

The information in this document is based on these software and hardware versions:

- Catalyst 3550–48 that runs Cisco IOS Software Release 12.1(12c)EA1 EMI

The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using it.

Conventions

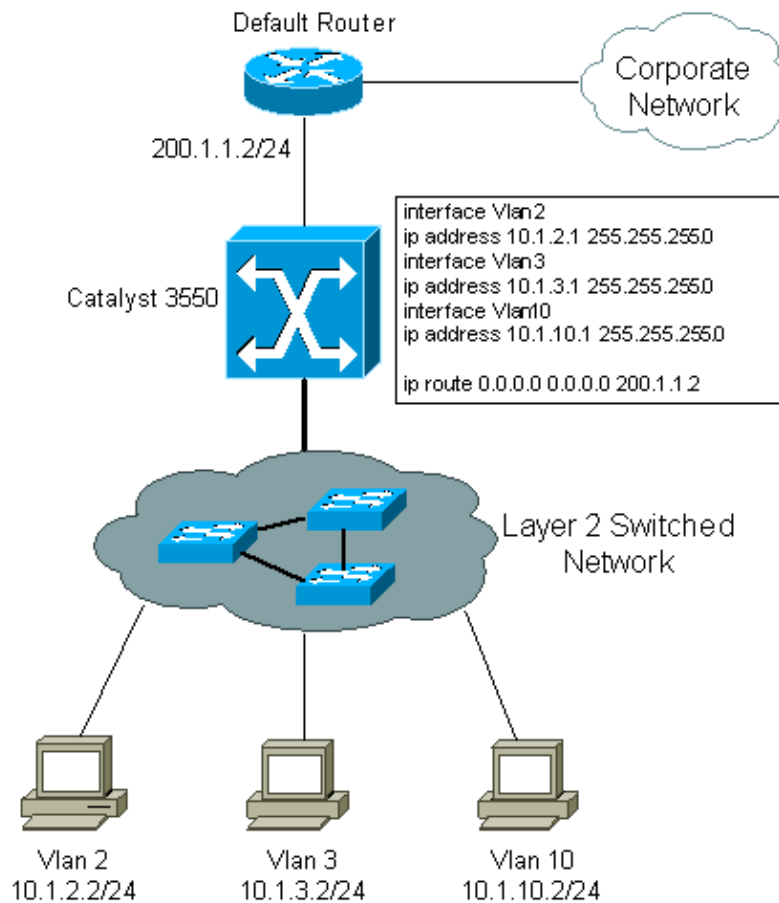
For more information on document conventions, refer to the *Cisco Technical Tips Conventions*.

Configure InterVLAN Routing

Task

In this section, you are presented with the information to configure the features described in this document.

This logical diagram explains a simple interVLAN routing scenario. The scenario can be expanded to include a multi-switch environment by first configuring and testing inter-switch connectivity across the network before configuring the routing capability. For such a scenario that uses a Catalyst 3550, refer to *Configuring InterVLAN Routing with Catalyst 3550 Series Switches*.



Step-by-Step Instructions

Complete these steps to configure a switch to perform interVLAN routing.

1. Enable routing on the switch by using the **ip routing** command. Even if IP routing was previously enabled, this step ensures that it is activated.

```
Switch(config)#ip routing
```

Note: If the switch does not accept the **ip routing** command, upgrade to either SMI image Cisco IOS Software Release 12.1(11)EA1 or later, or an EMI image, and repeat this step. See the Prerequisites section for more information.

Tip: Check the **show running-configuration**. Verify whether **ip routing** is enabled. The command, if enabled, appears towards the top of the output.

```
hostname Switch
!
!
ip subnet-zero
ip routing
!
vtp domain Cisco
vtp mode transparent
```

2. Make note of the VLANs that you want to route between. In this example, you want to route traffic between VLANs 2, 3 and 10.
3. Use the **show vlan** command to verify that the VLANs exist in the VLAN database. If they do not

exist, add them on the switch. This is an example of adding VLANs 2, 3, and 10 to the switch VLAN database

```
Switch#vlan database
Switch(vlan)#vlan 2
VLAN 2 added:
    Name: VLAN0002
Switch(vlan)#vlan 3
VLAN 3 added:
    Name: VLAN0003
Switch(vlan)#vlan 10
VLAN 10 added:
    Name: VLAN0010
Switch(vlan)#exit
APPLY completed.
Exiting....
```

Tip: You can use VLAN Trunking Protocol (VTP) to propagate these VLANs to other switches. Refer to Understanding and Configuring VLAN Trunk Protocol (VTP).

4. Determine the IP addresses you want to assign to the VLAN interface on the switch. For the switch to be able to route between the VLANs, the VLAN interfaces must be configured with an IP address. When the switch receives a packet destined for another subnet/VLAN, the switch looks at the routing table to determine where to forward the packet. The packet is then passed to the VLAN interface of the destination. It is in turn sent to the port where the end device is attached.
5. Configure the VLAN interfaces with the IP address identified in step 4.

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface Vlan2
Switch(config-if)#ip address 10.1.2.1 255.255.255.0
Switch(config-if)#no shutdown
```

Repeat this process for all VLANs identified in step 1.

6. Configure the interface to the default router. In this scenario you have a Layer 3 FastEthernet port.

```
Switch(config)#interface FastEthernet 0/1
Switch(config-if)#no switchport
Switch(config-if)#ip address 200.1.1.1 255.255.255.0
Switch(config-if)#no shutdown
```

The **no switchport** command makes the interface Layer 3 capable. The IP address is in the same subnet as the default router.

Note: This step can be omitted if the switch reaches the default router through a VLAN. In its place, configure an IP address for that VLAN interface.

7. Configure the default route for the switch.

```
Switch(config)#ip route 0.0.0.0 0.0.0.0 200.1.1.2
```

From the diagram in the Task section, note that the IP address of the default router is 200.1.1.2. If the switch receives a packet for a network not in the routing table, it forwards it to the default gateway for further processing. From the switch, verify that you can ping the default router.

Note: The **ip default-gateway** command is used to specify the default gateway when routing is not enabled. However, in this case, routing is enabled (from step 1). Therefore, the **ip default-gateway** command is unnecessary.

8. Configure your end devices to use the respective Catalyst 3550 VLAN interface as their default gateway. For example, devices in VLAN 2 should use the interface VLAN 2 IP address as its default

gateway. Refer to the appropriate client configuration guide for more information on how to designate the default gateway.

9. (Optional) When you implement Inter-VLAN routing, you can also isolate some VLANs from being routed. Refer to the Isolation Between Two Layer 3 VLANs section of Creating Ethernet VLANs on Catalyst Switches for more information.

Verify

This section provides the information to confirm that your configuration works properly.

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only). This allows you to view an analysis of **show** command output.

- **show ip route** – Provides a snapshot of the routing table entries.

```
Cat3550#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is 200.1.1.2 to network 0.0.0.0

    200.1.1.0/30 is subnetted, 1 subnets
C       200.1.1.0 is directly connected, FastEthernet0/48
    10.0.0.0/24 is subnetted, 3 subnets
C       10.1.10.0 is directly connected, Vlan10
C       10.1.3.0 is directly connected, Vlan3
C       10.1.2.0 is directly connected, Vlan2
S*    0.0.0.0/0 [1/0] via 200.1.1.2
```

Note that the routing table has an entry for each VLAN interface subnet. Therefore, devices in VLAN 3 can communicate with devices in VLAN 10, VLAN 2 and vice versa. The default route with the next hop 200.1.1.2 allows the switch to forward traffic to the gateway of last resort (for traffic the switch cannot route).

- **show ip interface brief** – Lists a brief summary of an interface's IP information and status. This command is used to verify that the VLAN interfaces and ports on the switch are up/up.

Troubleshoot

This section provides the information used to troubleshoot your configuration.

Troubleshooting Procedure

Here is troubleshooting information relevant to this configuration. Follow the instructions to troubleshoot your configuration.

1. Verify you have Layer 2 connectivity by issuing Internet Control Message Protocol (ICMP) pings.
 - ◆ If you are not able to ping between two devices on the same VLAN on the same switch, verify that your source and destination ports have devices connected to them and are assigned to the same VLAN. For more information, refer to Creating Ethernet VLANs on Catalyst Switches.

- ◆ If you are not able to ping between two devices on the same VLAN but not on the same switch, verify that trunking is configured properly and that the native VLAN matches on both sides of the trunk.
2. Initiate an ICMP ping from an end device connected to the Catalyst 3550 to its corresponding VLAN interface. In this example, you can use a host on VLAN 2 (10.1.2.2) and ping interface VLAN 2 (10.1.2.1). If you are not able to ping the interface, verify that the host's default gateway points to the corresponding VLAN interface IP address and that the subnet masks match. For example, the default gateway of the device on VLAN 2 should point to Interface VLAN 2 (10.1.2.1). Also verify the interface VLAN status by issuing the **show ip interface brief** command.
 - ◆ If the interface status is administratively down, issue the **no shutdown** command in the VLAN interface configuration mode.
 - ◆ If the interface status is down/down, verify the VTP configuration and that the VLANs have been added to the VLAN database. Check to see if a port is assigned to the VLAN and whether it is in the Spanning Tree forwarding state.
 3. Initiate a ping from an end device in one VLAN to the interface VLAN on another VLAN to verify that the switch routes between VLANs. In this example, ping from VLAN 2 (10.1.2.1) to Interface VLAN 3 (10.1.3.1) or Interface VLAN 10 (10.1.10.1). If the ping fails, verify that IP routing is enabled and that the VLAN interfaces status is up by issuing the **show ip interface brief** command.
 4. Initiate a ping from the end device in one VLAN to the end device in another VLAN. For example, a device on VLAN 2 should be able to ping a device on VLAN 3. If the ping test is successful in step 3, but fails to reach the end device on other the VLAN, verify that the default gateway on the connected device is configured correctly.
 5. If you are not able to reach the Internet or corporate network, verify that the default route on the 3550 points to the correct IP address on the default router. Also verify that the IP address and subnet mask on the switch are configured correctly.

There is no set recommended value of bandwidth on a VLAN interface (SVI). The default is BW 1000000 Kbit (1 Gigabit), because the route processor internal inband is only 1 Gigabit by design. The bandwidth parameter on the **show interface vlan** output is not fixed bandwidth used by SVI as traffic is routed on the switch backplane. The bandwidth number can be used in order to manipulate routing metrics, calculate interface load statistics, and so forth.

The Catalyst 6500 switch platform mostly forwards traffic in hardware with the exception of control/special traffic, for example, SNMP, Telnet, SSH, Routing protocols, and ARP, which has to be processed by the Supervisor, which is done in the software.

Related Information

- [Configuring InterVLAN Routing with Catalyst 3550 Series Switches](#)
- [Configuring Interface Characteristics on the 3560 Series Switches](#)
- [Configuring Interface Characteristics on the 3750 Series Switches](#)
- [Configuring Layer 3 Interfaces on Catalyst 6500 Switches Running Cisco IOS](#)
- [LAN Product Support](#)
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