Cisco – How To Configure InterVLAN Routing on Layer 3 Switc

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How To Configure InterVLAN Routing on Layer 3 Switches

Introduction

Layer 3 Catalyst switches incorporate routing functionality which allows the switch to perform interVLAN routing. 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 running Cisco IOS® (for example, Catalyst 4000 Series with Sup II+ or higher, or Catalyst 6000 Series running Cisco IOS on the Supervisor and MSFC).

Before You Begin

Conventions

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

Prerequisites

Before attempting this configuration, please ensure that you meet the following prerequisites:

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

Image Type and Version	InterVLAN Routing Capability
Enhanced Multilayer Image (EMI) − All Versions	Yes
Standard Multilayer Image (SMI) − prior to 12.1(11)EA1	No
Standard Multilayer Image (SMI) − 12.1(11)EA1 and later	Yes

For more information on the differences between SMI and EMI, refer to the document Upgrading Software Images on Catalyst 3550 Series Switches Using the Command Line Interface. The 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 can communicate with one another. If you need information on configuring VLANs, access ports and trunking on the 3550, please refer to Creating Ethernet VLANs on Catalyst Switches or the Catalyst 3550 Software Configuration Guide for the specific IOS version you are running on the switch.

Components Used

The information in this document is based on the software and hardware versions below.

- Catalyst 3550−48 running 12.1(12c)EA1 EMI Software release

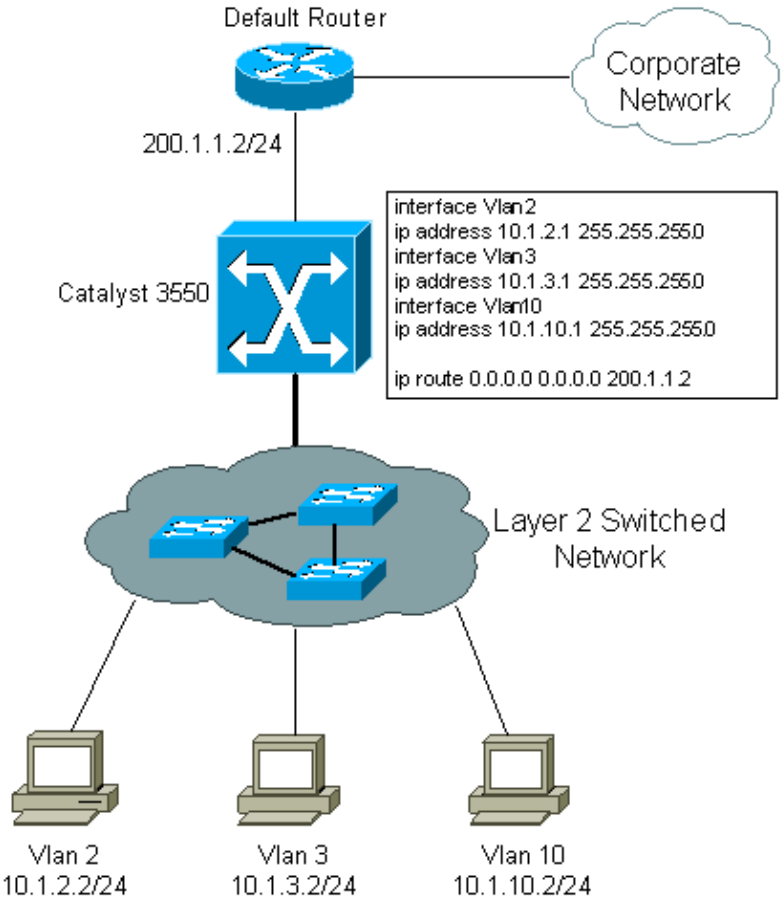
The information presented in this document was created from devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If you are working in a live network, ensure that you understand the potential impact of any command before using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

Configuring InterVLAN Routing

Task

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

The following 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 using a Catalyst 3550, please refer to the document Configuring InterVLAN Routing with Catalyst 3550 Series Switches.



Step−by−Step Instructions

Do the following to configure a switch to perform interVLAN routing.

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

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

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

   Tip: Check the **show running−configuration** and verify whether **ip routing** is enabled. The command, if enabled, will appear 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 our example, we 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, you must add them on the switch.

```
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 VTP to propagate these VLANs to other switches. Refer to the document 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 and in turn it is sent to the port where the end device is attached.
5. Configure the VLAN interfaces with the IP address identified in Step 4.

```
Switch#conf t
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 we 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. Also notice that the IP address is in the same subnet as the default router.

   Note: This step can be omitted if the switch can reach 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) hence 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 designating the default gateway.

Verify

This section provides information you can use to confirm your configuration is working properly.

Certain **show** commands are supported by the Output Interpreter Tool (registered customers only) , which 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. Hence, devices in VLAN 3 can communicate with devices in VLAN 10, VLAN 2 and vice versa. Also, 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 can be used to verify that the VLAN interfaces and ports on the switch are up/up.

Troubleshoot

This section provides information you can use to troubleshoot your configuration.

Troubleshooting Procedure

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

1. Verify you have Layer 2 connectivity by issuing 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 the document 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 a ICMP ping from an end device connected to the Catalyst 3550 to its corresponding VLAN interface. In this example, you could 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. You should also 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 can route between VLANs. In this example we would 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 was successful in step 3, but fails to reach the end device on other 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 is pointing to the correct IP address on the default router. Also verify that the IP address and subnet mask on the switch are configured correctly.

Related Information

- **Configuring InterVLAN Routing with Catalyst 3550 Series Switches**
- **Configuring Layer 3 Interfaces for the Catalyst 4000**
- **Technical Support − Cisco Systems**