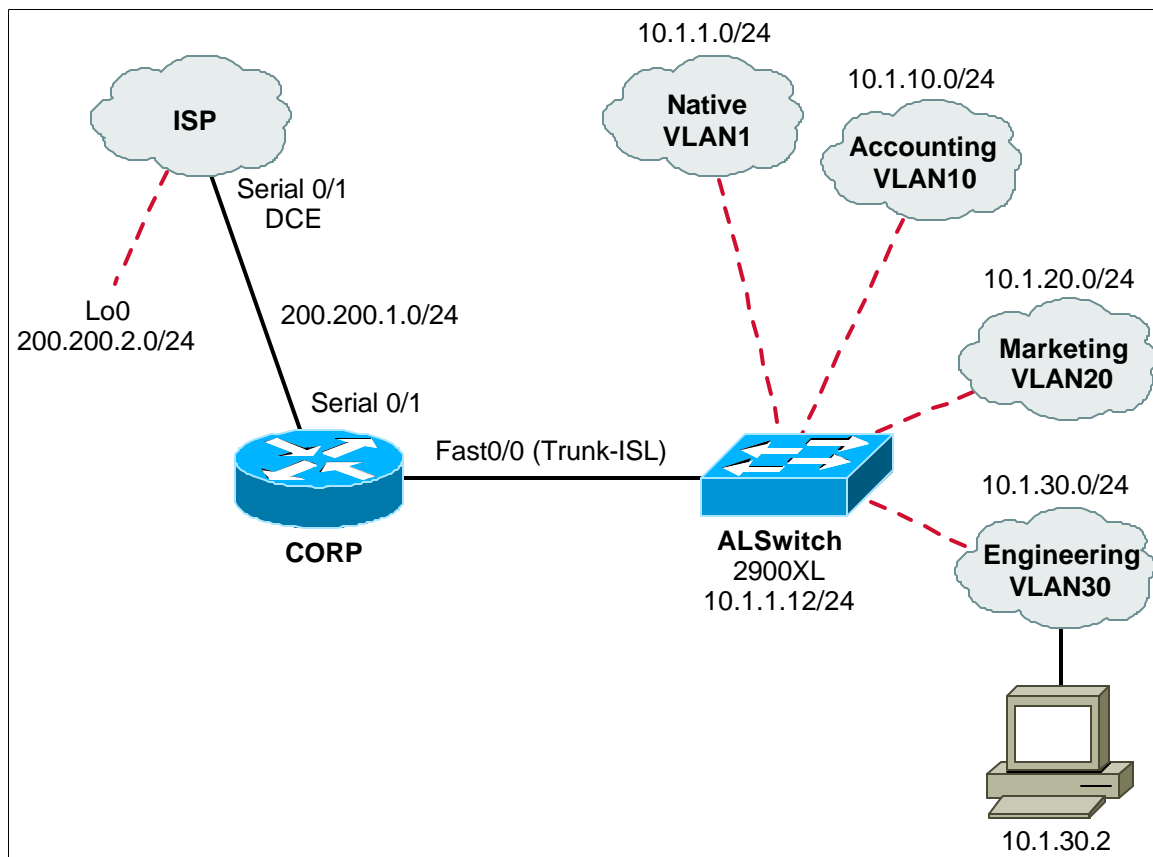


Lab 6.1.2: Configure an External Router to Route Inter-VLAN Traffic (Router-on-a-Stick)



Objective:

Configure an external router to route Inter-VLAN traffic (Router-on-a-Stick).

Scenario:

Network loads and management issues require you to segment your network from a single broadcast domain into four functional areas. You select to implement VLANs throughout your Cisco 2900-switched network and will refer to them as “Accounting”, “Marketing” and “Engineering” for the users, and “default” used for the native VLAN network management. After deciding on your subnet ranges and VTP information, illustrated below, your next step is to implement Inter-VLAN routing using your Cisco 2600 series router. Inter-VLAN routing will allow individuals and servers on your Virtual LANs to exchange information. Your 2600 Series WAN router already facilitates a 56k WAN connection to your ISP and a 100mb Ethernet private zone. Since you have only a single Ethernet connection available on your private zone, your router must be configured using the “Router-on-a-Stick” method to support the Inter-VLAN routing. Your VTP and subnetwork information are as follows:

Design:

2900 Switch VTP Configuration Information:

VTP Domain	VTP Mode
CORP	Server

VLAN Configuration Information:

VLAN ID	VLAN Name	VLAN Subnet	VLAN Gateway	Switch Ports
1	default	10.1.1.0/24	10.1.1.1	2
10	Accounting	10.1.10.0/24	10.1.10.1	3-4
20	Marketing	10.1.20.0/24	10.1.20.1	5-6
30	Engineering	10.1.30.0/24	10.1.30.1	7-8
Trunk				1, ISL Full-Duplex

Cisco 2600 Interface Configuration Information:

Interface	IP Address	VLAN
FastEthernet 0/0.1	10.1.1.1/24	1 "native"
FastEthernet 0/0.10	10.1.10.1/24	10
FastEthernet 0/0.20	10.1.20.1/24	20
FastEthernet 0/0.30	10.1.30.1/24	30
Serial0/0	200.200.1.2/24	

Notes:

Lab Tasks:

1. Cable the lab as shown in the diagram (the ISP cloud is represents a router here).
2. The first router to be configured will be the ISP router. Access the router through the console port and then enter privileged mode. Clear your NVRAM and reload. The ISP router is not a core part of the lab but a supplemental item for real-world illustration.
3. Configure the **ISP** router with the following information:

- a. Configure the hostname ISP on the 2600 router.

```
Router(config)#hostname ISP
```

- b. Configure a loopback 0 interface for simple testing.

```
ISP(config)#interface Loopback0
ISP(config-if)#ip address 200.200.2.1 255.255.255.0
```

- c. Configure the serial connection to CORP.

```
ISP(config)#interface Serial0/1
ISP(config-if)#ip address 200.200.1.1 255.255.255.0
ISP(config-if)#clock rate 56000
ISP(config-if)#no shutdown
```

- d. Configure a default route on ISP pointing to CORP.

```
ISP(config)#ip route 0.0.0.0 0.0.0.0 200.200.1.2
```

* Note: Verify using ISP#show run

4. Show the brief interface configuration to verify configured IP addresses.

```
ISP#show ip interface brief
```

What is the status of the loopback 0 interface?

What is the status of the serial0/1 interface?

Note: serial0/1 might be in a DOWN state because the CORP router is not yet configured. The Loopback 0 should always be in an UP state by default.

5. After clearing NVRAM and reloading, configure the **CORP** router as follows:

- a. Configure the hostname CORP on the 2600 router.

```
Router(config)#hostname CORP
```

- b. Configure the serial connection to the ISP.

```
CORP(config)#interface Serial0/1
CORP(config-if)#ip address 200.200.1.2 255.255.255.0
CORP(config-if)#no shutdown
CORP(config-if)#exit
CORP(config)#exit
```

Note: Verify using CORP#show run

- c. The router will now need to talk to the switch using a standardized trunking protocol. Standardized meaning that both devices that are connected together must understand each other. There are of course two primary trunking protocols including ISL and 802.1q. In this lab we will use ISL trunking. To get started just enable the interface and set the duplex mode to full.

```
CORP(config)#interface FastEthernet0/0
CORP(config-if)#full-duplex
CORP(config-if)#no shutdown
```

Note: It is not necessary to assign an IP address to this interface.

- d. Now create a sub-interface for each VLAN. Enable the sub-interface with the proper trunking protocol and tie it to a particular VLAN using the **encapsulation** command. Finally give the sub-interface an IP address that hosts on the VLAN can use for a default gateway.

VLAN 1 Interface

```
CORP(config)#interface FastEthernet0/0.1
CORP(config-subif)#description Management VLAN 1
CORP(config-subif)#encapsulation isl 1
CORP(config-subif)#ip address 10.1.1.1 255.255.255.0
```

VLAN 10 Interface

```
CORP(config)#interface FastEthernet0/0.10
CORP(config-subif)#description Accounting VLAN 10
CORP(config-subif)#encapsulation isl 10
CORP(config-subif)#ip address 10.1.10.1 255.255.255.0
```

VLAN 20 Interface

```
CORP(config)#interface FastEthernet0/0.20
CORP(config-subif)#description Marketing VLAN 20
CORP(config-subif)#encapsulation isl 20
CORP(config-subif)#ip address 10.1.20.1 255.255.255.0
```

VLAN 30 Interface

```
CORP(config)#interface FastEthernet0/0.30
CORP(config-subif)#description Engineering VLAN 30
CORP(config-subif)#encapsulation isl 30
CORP(config-subif)#ip address 10.1.30.1 255.255.255.0
```

* Note: Verify using CORP#show run

6. Show the brief interface configuration to verify configured IP sub interface addresses.

```
CORP#show ip interface brief
```

Are all the interfaces in an up state?

7. It is time we verify our Internet connection. Lets ping the ISP interface and the ISP's Loopback 0 interface. Both should function prior to continuing with this exercise. If there is a problem verify your cable connections and IP address assignments. Also check your static routes in the ISP router and the CORP router.

```
CORP#ping 200.200.1.2
```

```
CORP#ping 200.200.1.1
```

```
CORP#ping 200.200.2.1
```

Were all pings successful?

8. Finally, assign a default route for CORP pointing to the ISP.

```
CORP(config)#ip route 0.0.0.0 0.0.0.0 200.200.1.1
```

* Note: Verify using CORP#show run

9. Now it's time to configure the switch. Catalyst switches, like Cisco routers, utilize startup configuration files. It is always a good idea to clear any existing configuration before starting a new configuration. For the 2900XL, this is a two-step process as described below:

- a. From a console session, enter privileged mode by entering **enable** (you may have to provide a password if one was already assigned).
- b. Clear the current startup configuration file.

```
Switch#erase start  
Switch#reload
```

- c. Check flash for any VLAN settings. If vlan.dat exists, delete it.

```
Switch#show flash  
Switch#delete flash  
Delete filename [flash]?
```

Enter vlan.dat at the Delete prompt.

- d. Restart the switch

```
Switch#reload
```

- e. Enter **enable** and **config t** to get to global config mode and then configure the hostname for the switch.

```
Switch(config)#hostname ALSwitch
```

- f. Configure the secret password "**cisco**" on the 2900XL switch.

```
ALSwitch(config)#enable secret cisco
```

* Note: Verify using **ALSwitch#show run**

- g. Create a virtual interface on the switch for VLAN 1 and give it an IP address. This will be the IP address for the switch. The switch will be set to 10.1.1.2 because the router has a gateway address already set to 10.1.1.1.

```
ALSwitch(config)#interface VLAN 1
ALSwitch(config-if)#ip address 10.1.1.2 255.255.255.0
ALSwitch(config-if)#exit
```

- h. Of course, a gateway will also be necessary as on all multi-network networks.

```
ALSwitch(config)#ip default-gateway 10.1.1.1
```

- i. Next we enable the switch for telnet access.

```
ALSwitch(config)#line vty 0 4
ALSwitch(config-line)#password cisco
ALSwitch(config-line)#login
ALSwitch(config-line)#exit
ALSwitch(config)#exit
```

* Note: Verify using **ALSwitch#show run**

10. Configure VLAN database on the 2900XL. This should be done prior to any added configuration. The VLAN database is NOT cleared when the NVRAM is cleared using the "erase start" or "clear start" commands. Use the show flash and delete flash to eliminate historic VLAN information.

- a. Let's start by displaying the VLANs currently on the switch.

```
ALSwitch#show vlan
```

What VLANs (ID's) display?

- b. VLAN ID's 1, 1002, 1003, 1004, 1005 are typically defaults. But as your instructor may see there are others from old configurations, your switch may have many others as well. We must remove them and then add the necessary ones. Lets now enter the VLAN configuration mode.

```
ALSwitch#vlan database
```

Does your new command prompt look like this? `ALSwitch(vlan)#`

- c. Now, for each unwanted vlan you must do the following, in my case there is only one...VLAN 31.

```
ALSwitch(vlan)#no vlan 31
```

- d. We will now set the VTP information. If they are already set then they will simply verify.

```
ALSwitch(vlan)#vtp domain CORP
ALSwitch(vlan)#vtp server
```

- e. Let's add our corporate VLANs to the database.

```
ALSwitch(vlan)#vlan 10 name Accounting
ALSwitch(vlan)#vlan 20 name Marketing
ALSwitch(vlan)#vlan 30 name Engineering
```

- f. Let's verify our VLAN information with the following command.

```
ALSwitch(vlan)#show {there are no parameters}
```

What VLANs display?

What is the common MTU?

What are the FDDI VLAN ID's for each ISL ID?

- g. Let's verify our VLAN statistic information. Enter the following commands:

```
ALSwitch(vlan)#exit
ALSwitch#show vtp stat
```

Please fill in the following:

VTP Version	:	_____
Configuration Revision	:	_____
Maximum VLANs supported locally	:	_____
Number of existing VLANs	:	_____
VTP Operating Mode	:	_____
VTP Domain Name	:	_____
VTP Pruning Mode	:	_____
VTP V2 Mode	:	_____
VTP Traps Generation	:	_____

11. We will now configure our switch for trunking and assign VLANs to identified interfaces per the table in the start of the lab.

- a. Let us set the interface connected to the router to trunk with the router. You may recall that the router is already set to trunk with the VLAN subinterfaces. The default is ISL and therefore the command `switchport trunk encapsulation isl` is not necessary.

```
ALSwitch(config)#interface FastEthernet0/1
ALSwitch(config-if)#switchport mode trunk
```

* Note: Verify using `ALSwitch#show run`

- b. To verify the trunking is working properly lets look at the CDP information.

```
ALSwitch#show cdp neighbor detail
```

What is the IP address of the neighbor?

- c. Lets go ahead and assign the correct VLANs to each port and additionally set the ports to portfast.

```
ALSwitch(config)#interface FastEthernet0/2
ALSwitch(config-if)#switchport access vlan 1
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/3
ALSwitch(config-if)#switchport access vlan 10
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/4
ALSwitch(config-if)#switchport access vlan 10
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/5
ALSwitch(config-if)#switchport access vlan 20
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/6
ALSwitch(config-if)#switchport access vlan 20
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/7
ALSwitch(config-if)#switchport access vlan 30
ALSwitch(config-if)#spanning-tree portfast
```

```
ALSwitch(config)#interface FastEthernet0/8
ALSwitch(config-if)#switchport access vlan 30
ALSwitch(config-if)#spanning-tree portfast
```

* Note: Verify using `ALSwitch#show run`

12. Our configuration is complete. Let us verify the configuration and host access.

- a. Ensure your workstation is connected to a port on the switch that is set to VLAN 30 (ports 7 and 8). The workstation IP address should be set to 10.1.30.2/24 with a gateway of 10.1.30.1.
- b. From a command prompt on the workstation, ping the following addresses:

Inter-VLAN Gateway

```
C:\>ping 10.1.30.1
```

ALSwitch Switch

```
C:\>ping 10.1.1.2
```

CORP Router Public Interface

```
C:\>ping 200.200.1.2
```

ISP Router

```
C:\>ping 200.200.1.1
```

ISP loopback

```
C:\>ping 200.200.2.1
```

Did any of them fail?

13. Finally, verify that the switch can be managed from a workstation on a VLAN. Remember that VLAN 1 is the management VLAN. Our switch as you recall is set to 10.1.1.2, as the router gateway for VLAN 1 is 10.1.1.1.

- a. From the DOS command prompt on your workstation, telnet to the switch. Log on using password “cisco”

```
C:\>telnet 10.1.1.2
```