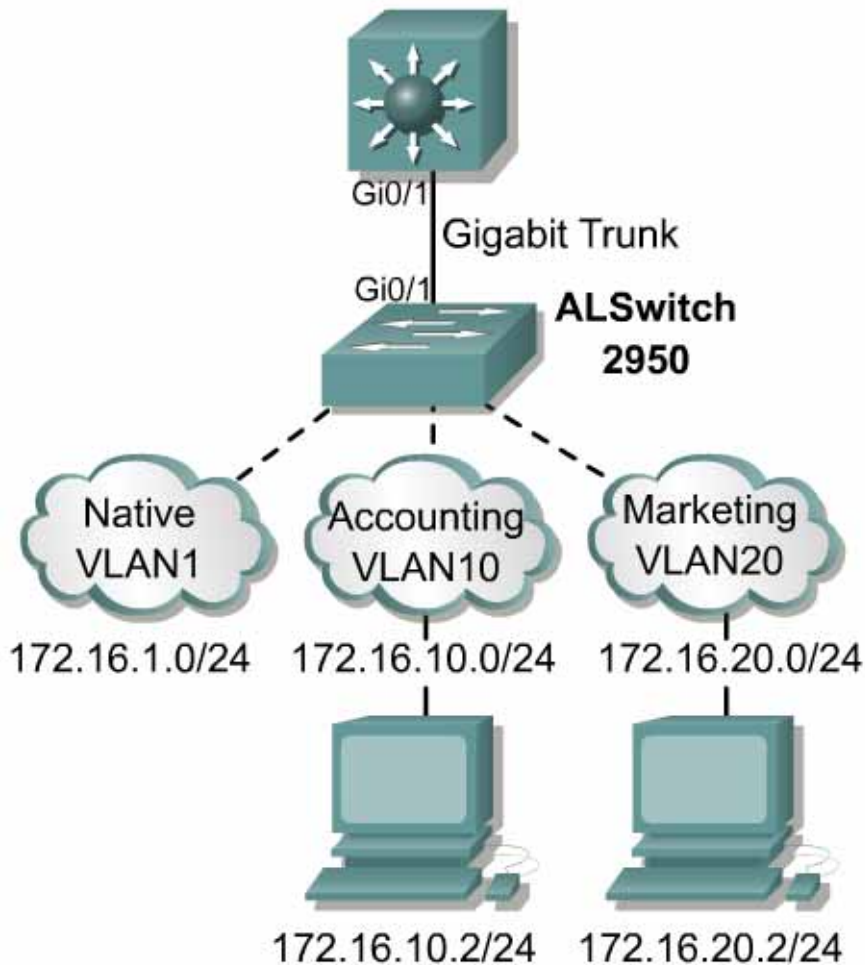


Lab 5.3.4.1 Inter-VLAN Routing with the Internal Route Processor



Objective

The purpose of this lab is to configure Inter-VLAN routing using a switch with an internal route processor.

Scenario

The network switching equipment currently includes a 3550 distribution layer switch and a 2950 access switch. The network is segmented into three functional VLANs for better network management. The VLANs include Accounting and Marketing for the users and the default name is used for the native VLAN network management. After the subnet ranges and VTP configuration have been determined, Inter-VLAN routing will be implemented. Inter-VLAN routing will allow individuals and servers on the Virtual LANs to exchange information. The internal route processor will be used for routing on the 3550 and VLAN-trunking will be established over a gigabit Ethernet link to the 2950.

The VTP design information is as follows:

Switch	VTP Domain	VTP Mode
DLSwitch	CORP	Server
ALSwitch	CORP	Client

The VLAN configuration information is as follows:

VLAN ID	VLAN Name	VLAN Subnet	DLSwitch	ALSwitch Ports
1	Native	172.16.1.0	Gi0/1-2 Fa0/1-4	Gi0/1-2 Fa0/1-4
10	Accounting	172.16.10.0	Fa0/5-14	Fa0/5-8
20	Marketing	172.16.20.0	Fa0/15-24	FA0/9-12
Trunk				802.1Q

The internal router processor interface configuration information is as follows:

Interface	IP Address	VLAN
VLAN1	172.16.1.1	1 Native
VLAN10	172.16.10.1	10
VLAN20	172.16.20.1	20

Step 1

Do not cable the lab until all switch configurations and vlan.dat files have been erased.

Delete the vlan database if it exists on any switches and clear the configuration.

```
Switch#delete flash:vlan.dat
Delete filename [vlan.dat]?
Delete flash:vlan.dat? [confirm]
Switch#
Switch#erase startup-config
Erasing the nvram filesystem will remove all files! Continue? [confirm]
Switch#reload

System configuration has been modified. Save? [yes/no]:n
Proceed with reload? [confirm]
```

Cable the lab according to the diagram.

Configure the hostname, passwords, and Telnet access on the switches.

```
Switch#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#hostname DLSwitch
DLSwitch(config)#enable secret class
```

```

DLSwitch(config)#line console 0
DLSwitch(config-line)#password cisco
DLSwitch(config-line)#login
DLSwitch(config-line)#line vty 0 15
DLSwitch(config-line)#password cisco
DLSwitch(config-line)#login
DLSwitch(config-line)#^Z
DLSwitch#

```

```

Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname ALSwitch
ALSwitch(config)#enable secret class
ALSwitch(config)#line console 0
ALSwitch(config-line)#password cisco
ALSwitch(config-line)#login
ALSwitch(config-line)#line vty 0 15
ALSwitch(config-line)#password cisco
ALSwitch(config-line)#login
ALSwitch(config-line)#^Z
ALSwitch#

```

Step 2

Configure the VLANs on DLSwitch.

Create the VLANs on DLSwitch and place the switch in **vtp server** mode. The default switch mode is server.

```

DLSwitch#vlan database
DLSwitch(vlan)#vtp domain CORP
DLSwitch(vlan)#vlan 10 name Accounting
DLSwitch(vlan)#vlan 20 name Marketing
DLSwitch(vlan)#exit

DLSwitch#vlan database
DLSwitch(vlan)#vtp domain CORP
Changing VTP domain name from NULL to CORP
DLSwitch(vlan)#vlan 10 name Accounting
VLAN 10 added:
    Name: Accounting
DLSwitch(vlan)#vlan 20 name Marketing
VLAN 20 added:
    Name: Marketing

```

Verify the VTP and VLAN configuration with the **show vlan** and **show vtp status** commands.

```
DLSwitch#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Fa0/13, Fa0/14, Fa0/15, Fa0/16 Fa0/17, Fa0/18, Fa0/19, Fa0/20 Fa0/21, Fa0/22, Fa0/23, Fa0/24 Gi0/2
10 Accounting	active	
20 Marketing	active	
1002 fddi-default	active	

```

1003 token-ring-default      active
1004 fddinet-default         active
1005 trnet-default           active

```

VLAN Trans1 Trans2

```

-----
1   enet  100001  1500 - - - - - 0 0
10  enet  100010  1500 - - - - - 0 0
20  enet  100020  1500 - - - - - 0 0
1002 fddi  101002  1500 - - - - - 0 0

```

```

VLAN Type  SAID      MTU Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
1003 tr     101003  1500 - - - - - srbrb 0 0
1004 fdnet  101004  1500 - - - - - ieee 0 0
1005 trnet  101005  1500 - - - - - ibm 0 0

```

Remote SPAN VLANs

```

-----
Primary Secondary Type          Ports
-----
Type      SAID      MTU   Parent RingNo BridgeNo Stp  BrdgMode

```

DLSwitch#show vtp status

```

VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
VTP Operating Mode          : Server
VTP Domain Name             : CORP
VTP Pruning Mode            : Disabled
VTP V2 Mode                 : Disabled
VTP Traps Generation        : Disabled
MD5 digest                  : 0x31 0x31 0xF4 0x65 0x66 0x67 0x37 0x63
Configuration last modified by 0.0.0.0 at 3-1-93 00:01:18
Local updater ID is 0.0.0.0 (no valid interface found)

```

Configure the DLSwitch ports for the proper VLAN. The **interface range** command can be used to configure several interfaces at the same time. By default, all ports are in VLAN 1. The ports that belong to VLAN 10 and 20 need to be moved.

```

DLSwitch(config)#interface range fastethernet 0/5 - 14
DLSwitch(config-if-range)#switchport mode access
DLSwitch(config-if-range)#switchport access vlan 10

DLSwitch(config-if-range)#interface range fastethernet 0/15 - 24
DLSwitch(config-if-range)#switchport mode access
DLSwitch(config-if-range)#switchport access vlan 20
DLSwitch(config-if-range)#^Z

```

Verify the port configuration with the **show vlan** command.

```

DLSwitch#show vlan
VLAN Name                Status      Ports
-----
1   default                active      Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                   Gi0/2
10  Accounting             active      Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                   Fa0/9, Fa0/10, Fa0/11, Fa0/12

```

```

20    Marketing                                active    Fa0/13, Fa0/14
                                           Fa0/15, Fa0/16, Fa0/17, Fa0/18
                                           Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                           Fa0/23, Fa0/24
1002 fddi-default                            active
1003 token-ring-default                      active
1004 fddinet-default                         active
1005 trnet-default                          active

VLAN Type  SAID    MTU    Parent RingNo BridgeNo  Stp  BrdgMode Trans1 Trans2
----
1    enet   100001  1500   -       -       -       -    -         0      0
10   enet   100010  1500   -       -       -       -    -         0      0
20   enet   100020  1500   -       -       -       -    -         0      0
1002 fddi   101002  1500   -       -       -       -    -         0      0
1003 tr     101003  1500   -       -       -       -    srb        0      0

VLAN Type  SAID    MTU    Parent RingNo BridgeNo  Stp  BrdgMode Trans1 Trans2
----
1004 fdnet  101004  1500   -       -       -       ieee -         0      0
1005 trnet  101005  1500   -       -       -       ibm  -         0      0

Remote SPAN VLANs
-----

Primary Secondary Type          Ports
-----

```

Step 3

Configure the VLANs on the ALSwitch.

```
ALSwitch#show vlan
```

```

VLAN Name                Status    Ports
-----
1    default              active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                           Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                           Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                           Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                           Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                           Gi0/1, Gi0/2
1002 fddi-default        active
1003 token-ring-default  active
1004 fddinet-default     active
1005 trnet-default       active

VLAN Type  SAID    MTU    Parent RingNo BridgeNo  Stp  BrdgMode Trans1 Trans2
----
1    enet   100001  1500   -       -       -       -    -         0      0
1002 fddi   101002  1500   -       -       -       -    -         0      0
1003 tr     101003  1500   -       -       -       -    -         0      0
1004 fdnet  101004  1500   -       -       -       ieee -         0      0
1005 trnet  101005  1500   -       -       -       ibm  -         0      0

Remote SPAN VLANs
-----

Primary Secondary Type          Ports
-----

```

The ALSwitch is the client. It must join the domain in client mode.

```
ALSwitch(vlan)#vtp client
ALSwitch(vlan)#exit
```

Verify the VLAN configuration with the **show vlan** command.

1. Can VLAN 10 and VLAN 20 be seen?
2. Why or why not?

Step 4

Create a trunk link between DLSwitch and ALSwitch.

Set the port to trunking with 802.1Q encapsulation on DLSwitch.

Note: The encapsulation in some IOS versions may be set to auto, which will not allow the user to set the switchport mode to trunking. If this is the case, the encapsulation will need to be configured first.

```
DLSwitch(config)#interface gigabitethernet 0/1
DLSwitch(config-if)#switchport trunk encapsulation dot1q
DLSwitch(config-if)#switchport mode trunk
DLSwitch(config-if)#^Z
```

The 2950 switches do not need the encapsulation configured. These switches default to 802.1Q. Some IOS versions do not include any other options. Console into ALSwitch switch and configure trunking.

```
ALSwitch(config)#interface gigabitethernet 0/1
ALSwitch(config-if)#switchport mode trunk
ALSwitch(config-if)#^Z
```

Verify the VLAN configuration with the **show vlan** command.

```
ALSwitch#show vlan
```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Fa0/5, Fa0/6, Fa0/7, Fa0/8 Fa0/9, Fa0/10, Fa0/11, Fa0/12 Gi0/2
10	Accounting	active	
20	Marketing	active	
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0

20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Move the ports into the appropriate VLANs.

```

ALSwitch(config)#interface range fastethernet 0/5 - 8
ALSwitch(config-if-range)#switchport access vlan 10
ALSwitch(config-if-range)#exit

ALSwitch(config)#interface range fastethernet 0/9 - 12
ALSwitch(config-if-range)#switchport access vlan 20
ALSwitch(config-if-range)#^Z

```

Verify the port configuration with **show vlan** command.

```

ALSwitch#show vlan

```

VLAN	Name	Status	Ports
1	default	active	Fa0/1, Fa0/2, Fa0/3, Fa0/4 Gi0/2
10	Accounting	active	Fa0/5, Fa0/6, Fa0/7, Fa0/8
20	Marketing	active	Fa0/9, Fa0/10, Fa0/11, Fa0/12
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

VLAN	Type	SAID	MTU	Parent	RingNo	BridgeNo	Stp	BrdgMode	Trans1	Trans2
1	enet	100001	1500	-	-	-	-	-	0	0
10	enet	100010	1500	-	-	-	-	-	0	0
20	enet	100020	1500	-	-	-	-	-	0	0
1002	fddi	101002	1500	-	-	-	-	-	0	0
1003	tr	101003	1500	-	-	-	-	srb	0	0
1004	fdnet	101004	1500	-	-	-	ieee	-	0	0
1005	trnet	101005	1500	-	-	-	ibm	-	0	0

Remote SPAN VLANs

Primary	Secondary	Type	Ports
---------	-----------	------	-------

The **show vtp status** and **show vtp counters** commands can also be used to verify and troubleshoot trunking issues.

```

ALSwitch#show vtp status
VTP Version                : 2
Configuration Revision      : 1
Maximum VLANs supported locally : 250
Number of existing VLANs    : 7
VTP Operating Mode          : Client
VTP Domain Name              : CORP
VTP Pruning Mode             : Disabled
VTP V2 Mode                  : Disabled
VTP Traps Generation        : Disabled
MD5 digest                   : 0xB4 0x57 0x1A 0x95 0x99 0x85 0x6D 0x49
Configuration last modified by 0.0.0.0 at 3-1-93 00:13:27

```

```
ALSwitch#show vtp counters
```

```
VTP statistics:
```

```
Summary advertisements received      : 4
Subset advertisements received       : 1
Request advertisements received      : 0
Summary advertisements transmitted  : 5
Subset advertisements transmitted    : 1
Request advertisements transmitted   : 2
Number of config revision errors     : 0
Number of config digest errors       : 0
Number of V1 summary errors          : 0
```

```
VTP pruning statistics:
```

Trunk	Join Transmitted	Join Received	Summary advts received from non-pruning-capable device
-----	-----	-----	-----
Gi0/1	0	0	0

Step 5

Verify the VLAN trunking at Layer 3.

Connect one workstation to VLAN 10 on ALSwitch. Connect a second workstation to VLAN 10 on ALSwitch. Wait until the ports are in forwarding mode (green light). Test connectivity with the **ping** command.

Note	Change the workstation IP address when connecting to different VLANs.
-------------	---

3. Did the **ping** work?

Now move both workstations to VLAN 20 on ALSwitch. Wait until the ports are in forwarding mode (green light). Use **ping** to test the connection.

4. Did the **ping** work?

Test the connections between VLANs. Connect one workstation to VLAN 10 and the other to VLAN 20. Wait until the ports are in forwarding mode (green light). Use **ping** to test the connection.

5. Did the ping work?

Step 6

Create the Layer 3 VLAN interfaces to route between VLANs.

In the 3550, the IOS consists of a single image instead of a separate CatOS image for the switching engine and an IOS image for the route processor. Inter-VLAN routing is configured from a command-line interface. There is no need to configure internal trunks or internal EtherChannels. No internal Layer 2 ports and internal Layer 3 interfaces are connecting through the switch backplane..

Use the **interface vlan vlan-id** command to create the interface. Then use the **ip routing** command to enable routing between VLANs.

```
DLSwitch(config)#interface vlan 1
DLSwitch(config-if)#ip address 172.16.1.1 255.255.255.0
DLSwitch(config-if)#no shutdown
```



```
DLSwitch(config-)#interface vlan 10
DLSwitch(config-if)#ip address 172.16.10.1 255.255.255.0

DLSwitch(config)#interface vlan 20
DLSwitch(config-if)#ip address 172.16.20.1 255.255.255.0

DLSwitch(config)#ip routing
```

Use the **show ip interface brief** command to verify the IP interface configuration.

```
DLSwitch#show ip interface brief
```

Interface	IP-Address	OK?	Method	Status	Protocol
Vlan1	172.16.1.1	YES	manual	up	up
Vlan10	172.16.10.1	YES	manual	up	up
Vlan20	172.16.20.1	YES	manual	up	up
FastEthernet0/1	unassigned	YES	unset	administratively down	down
FastEthernet0/2	unassigned	YES	unset	administratively down	down

<Output omitted>

Step 7

Verify routing between VLANs.

Connect one workstation to VLAN 10 and one to VLAN 20. Use **ping** to test connectivity. Remember to change the workstation IP address and gateway to match the subnet.

6. Did the **ping** work?

7. Why is a routing protocol unnecessary in this network?

Save the configurations for use in the next lab.