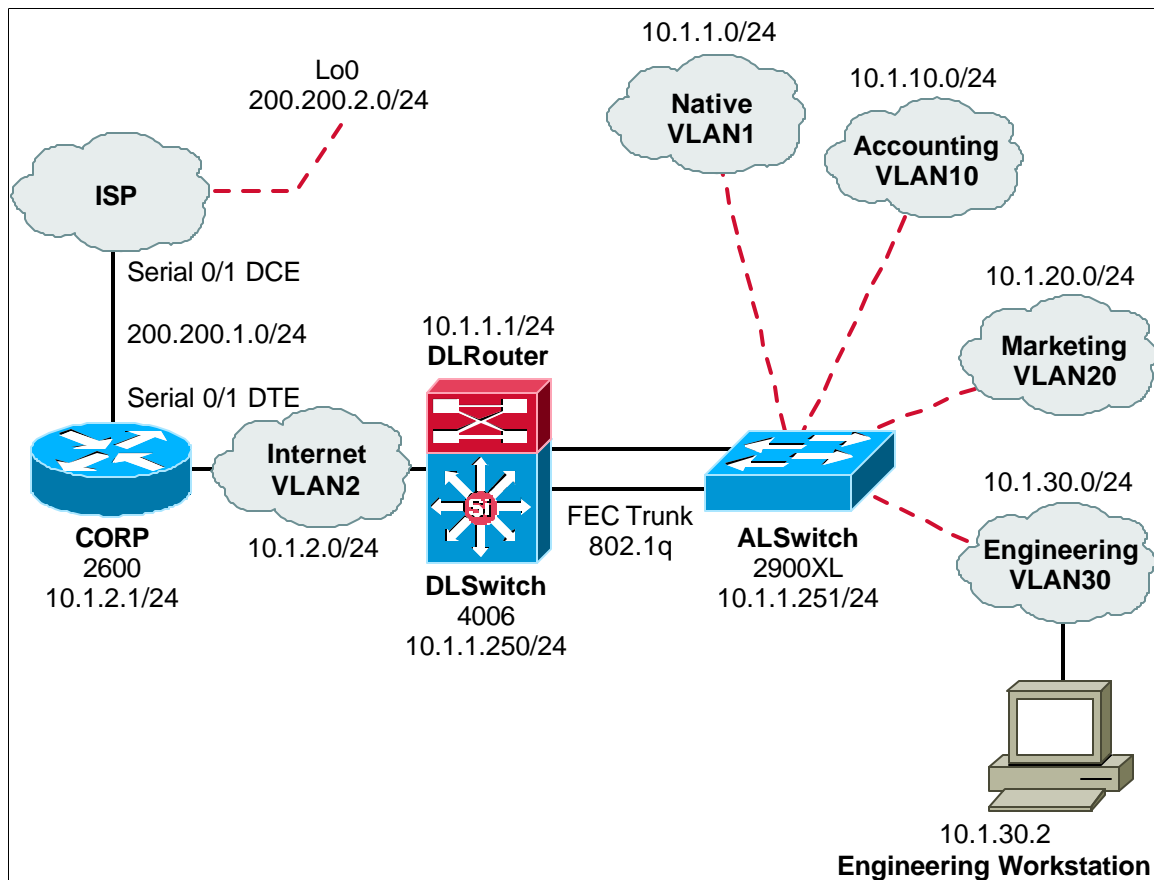


Lab 6.2.4: Configure Routing between the RSM and an External Router Connected to an ISP



Objective:

Configure routing between the RSM and an external router connected to an ISP

Scenario:

Current Environment

Your network switching equipment currently includes a 4006 Core switch and a 2900XL access switch. Your network is segmented into four functional VLANs for better network management. VLANs include "Accounting", "Marketing" and "Engineering" for the users and "default" used for the native VLAN network management. Inter-VLAN routing has been implemented using a Layer-3 routing switch module for the 4006 to allow individuals and servers on your Virtual LANs to exchange information. VLAN-trunking to the 2900XL has been implemented over a Fast-EtherChannel group.

Enhancement

Your LAN functions well and your company executives have now decided to implement outbound Internet connectivity using a 2600 series Cisco router connected as outlined in the diagram above. As part of this enhancement you will establish a new VLAN named Internet with VLAN ID 2. This new VLAN will carry all Internet traffic for the local network. Other decisions include the implementation of EIGRP between the 2600 series router and the 4006 Layer-3 module and

VLAN domain pruning enabled on the DLSwitch for trunk optimization. Your VTP and subnetwork information are as follows:

Design:

Switched Network VTP Configuration Information:

Switch	VTP Domain	VTP Mode	VTP Pruning
DLSwitch	CORP	Server	Enabled
ALSwitch	CORP	Client	N/A

VLAN Configuration Information:

VLAN ID	VLAN Name	VLAN Subnet	VLAN Gateway
1	Default "Native"	10.1.1.0/24	10.1.1.1
2	Internet	10.1.2.0/24	10.1.2.1
10	Accounting	10.1.10.0/24	10.1.10.1
20	Marketing	10.1.20.0/24	10.1.20.1
30	Engineering	10.1.30.0/24	10.1.30.1

Switch VLAN Port Assignments

Switch	VLAN 1	VLAN 2	VLAN 10	VLAN 20	VLAN 30	Trunk
DLSwitch	6-18	5	19-24	25-30	31-34	3,4
ALSwitch	3	N/A	4-6	7-9	10-12	1,2

Cisco 4006 DLRouter Interface Configuration Information:

Interface	IP Address	VLAN
PortChannel 1.1	10.1.1.1/24	Native 1
PortChannel 1.2	10.1.2.1/24	2
PortChannel 1.10	10.1.10.1/24	10
PortChannel 1.20	10.1.20.1/24	20
PortChannel 1.30	10.1.30.1/24	30

Cisco 2600 Internet Router Interface Configuration Information:

Interface	IP Address
Serial 0/0	None
Serial 0/1	200.200.1.2/24
FastEthernet 0/0	10.1.2.2/24
FastEthernet 0/1	None

Notes:

Lab Tasks:

If you have just completed the previous lab exercise (Configure RSM) then you are ready skip to step 10 and implementing the enhancements outlined in the scenario. Step 10 will again have you simply verify that all components are functioning properly before we begin. If you have started this lab without the immediate prior completion of the previous lab, simply begin at step 1 to configure your LAN foundation. In the steps starting from step 1 we will not explain the details as we did in the last lab.

1. Cable the lab as shown in the diagram.
2. The first device to be configured will be the distribution layer switch DLSwitch. Access the switch through the console port and enter privileged mode. Clear your NVRAM and reload.

```
Switch> (enable) clear config all  
Switch> (enable) reset
```

3. Configure the **DLSwitch** with the following information:

Configure the prompt DLSwitch on the 4006 switch.

```
Switch> (enable) set system name DLSwitch>
```

- a. Establish switch passwords. We will use “cisco” throughout this lab for all passwords.

```
DLSwitch> (enable) set enablepass <enter>  
DLSwitch> (enable) set password <enter>
```

*You will be prompted to enter and confirm the password

- b. Configure VTP information on the 4006 switch.

```
DLSwitch> (enable) set vtp domain CORP  
DLSwitch> (enable) set vtp mode server
```

- c. Set switch IP address information and gateway.

```
DLSwitch> (enable) set interface sc0 up  
DLSwitch> (enable) set interface sc0 1  
10.1.1.11/255.255.255.0 10.1.1.255  
DLSwitch> (enable) set ip route 0.0.0.0/0.0.0.0 10.1.1.1
```

- d. Create the port channel groups.

```
DLSwitch> (enable) set port channel 2/1-2 156  
DLSwitch> (enable) set port channel 2/3-4 157
```

- e. Now we need to prepare these interfaces for trunking.

```
DLSwitch> (enable) set trunk 2/1 nonegotiate dot1q 1-1005  
DLSwitch> (enable) set trunk 2/2 nonegotiate dot1q 1-1005  
DLSwitch> (enable) set trunk 2/3 nonegotiate dot1q 1-1005  
DLSwitch> (enable) set trunk 2/4 nonegotiate dot1q 1-1005
```

- f. Turn EtherChannel on.

```
DLSwitch> (enable) set port channel 2/1-2 mode on
DLSwitch> (enable) set port channel 2/3-4 mode on
```

- g. Create corporate VLAN's.

```
DLSwitch> (enable) set vlan 1 name default
DLSwitch> (enable) set vlan 10 name Accounting
DLSwitch> (enable) set vlan 20 name Marketing
DLSwitch> (enable) set vlan 30 name Engineering
```

- h. Assign ports to VLANs.

```
DLSwitch> (enable) set vlan 10 2/19-24
DLSwitch> (enable) set vlan 20 2/25-30
DLSwitch> (enable) set vlan 30 2/31-34
```

4. The next device to be configured will be the access layer switch **ALSwitch**.

```
Switch#show vlan
Switch#show vtp stat
```

5. Clear your NVRAM and reload.

```
Switch#clear start
Switch#reload
```

6. Now check VLAN and VTP information again.

```
Switch#show vlan
Switch#show vtp stat
```

7. Configure **ALSwitch** with the following information:

- a. Configure VTP trunking information.

```
Switch#vlan database
Switch(vlan)#vtp client
Switch(vlan)#vtp domain CORP
Switch(vlan)#exit
```

- b. Verify VTP information.

```
Switch#show vtp stat
```

- c. Configure the hostname **ALSwitch** on the 29000XL switch.

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

- d. Configure the privileged mode password. These passwords are necessary to establish VTY Telnet sessions so why not just put them in. ALL passwords for this lab will be "cisco" lower case.

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

- e. Configure Fast EtherChannel port group and trunking.

```
ALSwitch(config)#interface FastEthernet0/1
ALSwitch(config-if)#port group 1
ALSwitch(config-if)#switchport mode trunk
ALSwitch(config-if)#switchport trunk encapsulation dot1q

ALSwitch(config)#interface FastEthernet0/2
ALSwitch(config-if)#port group 1
ALSwitch(config-if)#switchport mode trunk
ALSwitch(config-if)#switchport trunk encapsulation dot1q
```

- f. Add ports to VLANs and implement spanning-tree PortFast. Here we are configuring the device connection parameters.

```
ALSwitch(config)#interface FastEthernet0/3
ALSwitch(config-if)#switchport access vlan 1
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 10
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/6
ALSwitch(config-if)#switchport access vlan 10
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/7
ALSwitch(config-if)#switchport access vlan 20
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/8
ALSwitch(config-if)#switchport access vlan 20
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/9
ALSwitch(config-if)#switchport access vlan 20
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/10
ALSwitch(config-if)#switchport access vlan 30
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/11
ALSwitch(config-if)#switchport access vlan 30
ALSwitch(config-if)#spanning-tree portfast

ALSwitch(config)#interface FastEthernet0/12
ALSwitch(config-if)#switchport access vlan 30
ALSwitch(config-if)#spanning-tree portfast
```

* Note: Verify using *ALSwitch#show run*

- g. Configure VLAN1 management interface IP address and default gateway for the switch.

```
ALSwitch(config)#ip default-gateway 10.1.1.1
ALSwitch(config)#interface VLAN1
ALSwitch(config-if)#ip address 10.1.1.12 255.255.255.0
```

- h. Configure telnet interface password.

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

* Note: Verify using *ALSwitch#show run*

- i. Verify complete configuration using *ALSwitch#show run*.

8. The next device to be configured will be the distribution layer router **DLRouter**.

```
DLSwitch> (enable) session 2
Router#clear start
Router#reload
```

After the card reset then go back into it:

```
DLSwitch> (enable) session 2
```

9. Configure the **DLRouter** with the following information:

- a. Configure the hostname **DLRouter** on the 4006 L3 module.

```
Router(config)#hostname DLRouter
```

- b. Configure the privileged mode password. Good idea and required for Telnet access.

```
DLRouter(config)#enable password cisco
```

* Note: Verify using *DLRouter#show run*

- c. Configure the VLAN interface addressing and trunking information.

```
DLRouter(config)#interface Port-channel1
DLRouter(config-if)#ip address 10.1.1.1 255.255.255.0
DLRouter(config-if)#no shutdown
```

```
DLRouter(config)#interface Port-channel1.10
DLRouter(config-if)#encapsulation dot1Q 10
DLRouter(config-if)#ip address 10.1.10.1 255.255.255.0
```

```
DLRouter(config)#interface Port-channel1.20
DLRouter(config-if)#encapsulation dot1Q 20
DLRouter(config-if)#ip address 10.1.20.1 255.255.255.0
```

```
DLRouter(config)#interface Port-channel1.30
DLRouter(config-if)#encapsulation dot1Q 30
DLRouter(config-if)#ip address 10.1.30.1 255.255.255.0
```

- d. Assign the gigabit interfaces to channel group.

```
DLRouter(config)#interface GigabitEthernet3
DLRouter(config-if)#channel-group 1
```

```
DLRouter(config)#interface GigabitEthernet4
DLRouter(config-if)#channel-group 1
```

- e. Configure your corporate routing protocol.

```
DLRouter(config)#router eigrp 1
DLRouter(config-router)#network 10.0.0.0
```

- f. Configure your telnet virtual terminal password information. Again recommended and necessary.

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

10. From the **DLRouter**, verify your connection to the **DLSwitch** through the Port Channels. Expected output is shown for verification but these may not match exactly.

- a. DLRouter#**show cdp neighbors**

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater
Device ID        Local Intrfce   Holdtme    Capability Platform Port ID
JAB04290BND      Port-channell    154        T S          WS-C4006  2/1
JAB04290BND      Port-channell    154        T S          WS-C4006  2/2
```

- b. DLRouter#**show ip interface brief**

Interface	IP-Address	OK?	Method	Status	Protocol
FX1000:1	unassigned	YES	unset	up	up
FastEthernet1	unassigned	YES	NVRAM	down	down
GigabitEthernet1	unassigned	YES	NVRAM	down	down
GigabitEthernet2	unassigned	YES	NVRAM	down	down
GigabitEthernet3	unassigned	YES	NVRAM	up	up
GigabitEthernet4	unassigned	YES	NVRAM	up	up
Controller5	unassigned	YES	unset	up	up
Port-channell	10.1.1.1	YES	NVRAM	up	up
Port-channell.10	10.1.10.1	YES	NVRAM	up	up
Port-channell.20	10.1.20.1	YES	NVRAM	up	up
Port-channell.30	10.1.30.1	YES	NVRAM	up	up

11. From **DLSwitch**, verify neighbors through CDP information. Expected output is shown for verification but these may not match exactly.

- a. DLSwitch> (enable) **show cdp neighbors**

```
* - indicates vlan mismatch.
# - indicates duplex mismatch.
Port    Device-ID          Port-ID          Platform
-----
2/1     DLRouter           GigabitEthernet3  cisco Cat4232
2/2     DLRouter           GigabitEthernet4  cisco Cat4232
2/2     DLRouter           Port-channell     cisco Cat4232
2/3     ALSwitch           FastEthernet0/1    cisco WS-C2912-XL
2/4     ALSwitch           FastEthernet0/2    cisco WS-C2912-XL
```

12. Test your connections from **ALSwitch**. Expected output is shown for verification but these may not match exactly.

a. **ALSwitch#ping 10.1.1.1**

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/6 ms
```

b. **ALSwitch#ping 10.1.1.11**

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.1.1.11, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 5/10/21 ms
```

c. **ALSwitch#ping 10.1.1.12**

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.1.1.12, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/5 ms
```

13. Test your connections from **DLSwitch**. Expected output is shown for verification but these may not match exactly.

a. **DLSwitch> (enable) ping 10.1.1.1**

```
10.1.1.1 is alive
```

b. **DLSwitch> (enable) ping 10.1.1.11**

```
10.1.1.11 is alive
```

c. **DLSwitch> (enable) ping 10.1.1.12**

```
10.1.1.12 is alive
```

14. Test your connections from **DLRouter**. Expected output is shown for verification but these may not match exactly.

a. **DLRouter#ping 10.1.1.1**

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.1.1.1, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

b. **DLRouter#ping 10.1.1.11**

```
Type escape sequence to abort.  
Sending 5, 100-byte ICMP Echos to 10.1.1.11, timeout is 2 seconds:  
!!!!  
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/7/8 ms
```


c. DLRouter#**ping 10.1.1.12**

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.1.12, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
```

15. Now that the LAN is completely configured and tested, we will focus on those items that are required to add Internet connectivity to the local LAN routed through the RSM. First lets take care of the **DLSwitch**.

- a. Configure **DLSwitch** parameters for Internet connectivity and VLAN 2. With the following commands we will enable pruning for VLAN traffic optimization. The network labeled Internet will be configured as VLAN 2. The CORP router will be connected to port 2/5 on the switch so we will set that port to VLAN 2 and then enable PortFast for instant connectivity.

```
DLSwitch> (enable) set vtp pruning enable
DLSwitch> (enable) set vlan 2 name Internet
DLSwitch> (enable) set vlan 2 2/5
DLSwitch> (enable) set spantree portfast 2/5 enable
```

* Note: Verify using *DLSwitch> (enable) show config*

- b. Lets check the running configuration information as well for verification. Showing the VLANs will let us check that VLAN 2 was configured properly as it should look like the other VLANs.

```
DLSwitch> (enable) show vlan
```

VLAN	Name	Status	IfIndex	Mod/Ports, Vlans
1	default	active	101	1/1-2 2/6-18
2	Internet	active	111	2/5
10	Accounting	active	106	2/19-24
20	Marketing	active	107	2/25-30
30	Engineering	active	108	2/31-34
1002	fddi-default	active	102	
1003	token-ring-default	active	105	
1004	fddinet-default	active	103	
1005	trnet-default	active	104	

- c. It is important now to verify the connectivity between Cisco network devices. Assuming items were configured properly, simply looking at CDP information reported by the neighbors will allow us to do exactly that.

```
DLSwitch> (enable) show cdp nei
```

Complete the following chart.

* - indicates vlan mismatch.
- indicates duplex mismatch.

Port	Device-ID	Port-ID	Platform
2/1	_____	GigabitEthernet3	cisco _____
2/2	_____	GigabitEthernet4	cisco _____
2/2	_____	Port-channell	cisco _____
2/3	_____	FastEthernet0/1	cisco _____
2/4	_____	FastEthernet0/2	cisco _____

- d. Lets check the VTP configuration information. Recall that we enabled pruning and it should display as well.

```
DLSwitch> (enable) show vtp domain
```

Complete the following chart.

Domain Name	Domain Index	VTP Version	Local Mode	Password
-----	1	2	-----	-

16. Next, lets take care of the **DLRouter**. Now that we have the VLAN information for VLAN 2 configured on the **DLSwitch**. We simply need to add it to the DLRouter PortChannel to participate in the Inter-VLAN Routing.

- a. Configure **DLRouter** parameters. Remember that encapsulation is 802.1Q.

```
DLRouter(config)#interface Port-channel1.2
DLRouter(config-if)# encapsulation dot1Q 2
DLRouter(config-if)# ip address 10.1.2.1 255.255.255.0
```

* Note: Verify using *DLRouter# show run*

- b. Now lets issue some commands to verify the **DLRouter** operation. We'll check the active interfaces and take a look at the neighbors. Make sure the new VLAN is routing and active. Enter the following commands.

```
DLRouter#show cdp nei
```

Complete the following chart.

Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge					
S - Switch, H - Host, I - IGMP, r - Repeater					
Device ID	Local Intrfce	Holdtime	Capability	Platform	Port ID
JAB04290BND(DLSSwPort-channel1		144	T S	-----	-----
JAB04290BND(DLSSwPort-channel1		144	T S	-----	-----

```
DLRouter#sh ip int brief
```

Does the output from the command illustrate the fact that VLAN 2 routing is active?

17. The next device to be configured will be the CORP Router. Now that we have the VLAN information for VLAN 2 configured on the DLSwitch and DLRouter, our next step is to configure the CORP router. This router will be connected to the DLSwitch on port 2/5.

- a. Clear your NVRAM and reload.

```
Router#clear start
Router#reload
```

Note: If asked to save system information select "N"

- b. Configure the router with the following information. As you can see we will be using simple *NAT* for the address translation from private to public (real world), and also EIGRP to establish default route and network communication to the **DLRouter**. Everything else is fairly standard such as the hostname, passwords, and default static route to the Internet. Here we go...

```
Router(config)#hostname CORP
CORP(config)#enable password cisco

CORP(config)#interface FastEthernet0/0
CORP(config-if)#ip address 10.1.2.2 255.255.255.0
CORP(config-if)#ip nat inside
CORP(config-if)#no shutdown

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

CORP(config)#router eigrp 1
CORP(config-router)#redistribute static metric 64 20000 255 1
1500
CORP(config-router)#passive-interface Serial0/1
CORP(config-router)#network 10.0.0.0

CORP(config)#ip route 0.0.0.0 0.0.0.0 200.200.1.1

CORP(config)#ip nat inside source list 1 interface Serial0/1
overload
CORP(config)#access-list 1 permit any

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

* Note: Verify using *CORP#show run* and verify using *CORP#show ip interface brief*

- c. Lets check some of our configurations. Take special note that we should see our **DLSwitch** as a neighbor and the EIGRP routing updates as well. Also, go back to the **DLRouter** and show the routing table. You should see the default origination of the gateway of last resort from the CORP router as shown below.

```
CORP#sh cdp nei
```

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater
Device ID         Local Intrfce   Holdtme    Capability  Platform  Port ID
JAB04290BND(DLSSwFas 0/0          139        T S          WS-C4006   2/5
```

```
CORP#sh ip route
```

Complete the following chart:

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 area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is _____ to network 0.0.0.0

```
____ 200.200.1.0/24 is directly connected, Serial0/1
      10.0.0.0/24 is subnetted, 5 subnets
____ 10.1.10.0 [90/28416] via 10.1.2.1, 01:10:14, FastEthernet0/0
____ 10.1.2.0 is directly connected, FastEthernet0/0
____ 10.1.1.0 [90/28416] via 10.1.2.1, 01:10:14, FastEthernet0/0
____ 10.1.30.0 [90/28416] via 10.1.2.1, 01:10:14, FastEthernet0/0
____ 10.1.20.0 [90/28416] via 10.1.2.1, 01:10:14, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via _____
```

```
DLRouter#sh ip route
```

Is the gateway of last resort established via EIGRP automatically? If so, how can you make that assumption?

18. The next device to be configured will be the ISP Router. Lastly, lets take care of the ISP Router. Nothing fancy but it provides a full testing environment simulation.

- a. Clear your NVRAM and reload.

```
Router#clear start
Router#reload
```

Note: If asked to save system information select "N"

- b. Configure the ISP router as follows and verify communication.

```
Router(config)#hostname ISP

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

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

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

* Note: Verify using *ISP#show run* and verify using *ISP#show ip interface brief*

19. Finally, lets do some testing. Again, nothing fancy but we should test some of the basic configurations

- a. Try to ping the ISP router from the DLRouter first.

```
DLRouter>ping 200.200.2.1
```

```
Type escape sequence to abort.
```

```
Sending 5, 100-byte ICMP Echos to 200.200.2.1, timeout is 2 seconds:
```

```
!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/32/36 ms
```

- b. Connect and configure various workstations on different VLANs and verify Internet connectivity.