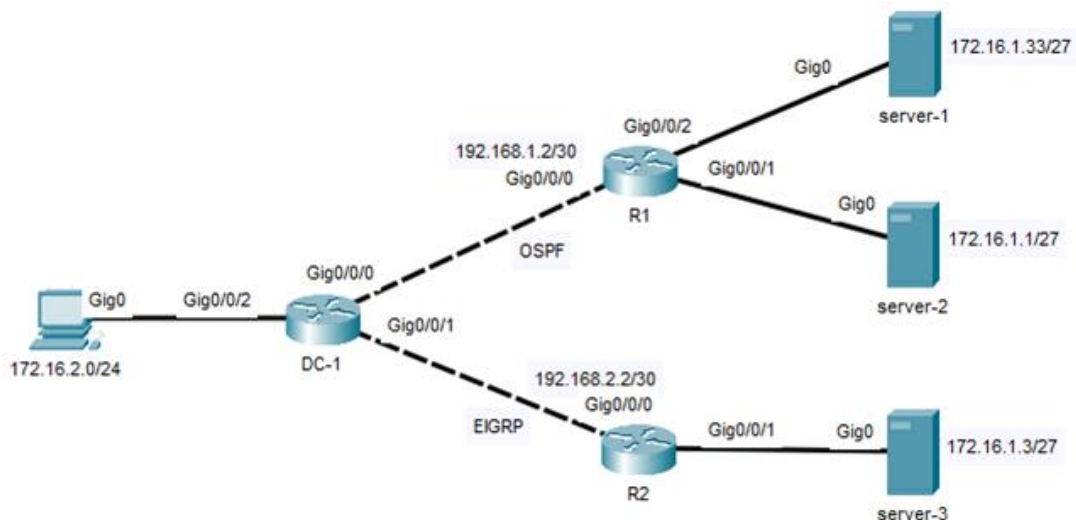


Interpret Routing Table - AD / LMR

Lab Summary

Learn how administrative distance and longest prefix match rule determine route selection based on EIGRP, OSPF, and static routes.

Figure 1 Lab Topology



Lab Configuration

Start Packet Tracer File: **interpret routing table.pkt**

Click on *DC-1* router and select *CLI* folder.

Step 1: Enter enable mode.

```
DC-1>enable
```

Step 2: Verify the forwarding path from DC-1 to each server with traceroute. Run traceroute command twice for proper results with Packet Tracer.

```
DC-1#traceroute 172.16.1.33 (yes)
```

Type escape sequence to abort.

Tracing the route to 172.16.1.33

```
 1  192.168.1.2    0 msec  0 msec  0 msec
 2  172.16.1.33   0 msec  0 msec  0 msec
```

DC-1#**traceroute 172.16.1.1** (no)

Type escape sequence to abort.

Tracing the route to 172.16.1.1

```
1  192.168.2.2    0 msec  0 msec  0 msec
2  *      *      *
3  *      *      *
```

Shift-Ctrl + 6

DC-1#**traceroute 172.16.1.3** (yes)

Type escape sequence to abort.

Tracing the route to 172.16.1.3

```
1  192.168.2.2    0 msec  0 msec  0 msec
2  172.16.1.3     0 msec  0 msec  0 msec
```

Step 3: Verify route to 172.16.1.0/27 is an EIGRP route and route to 172.16.1.32/27 (server-1) is an OSPF route. There is no connectivity to server-2 since EIGRP has a lower administrative distance than OSPF.

DC-1#**show ip route**

172.16.0.0/16 is variably subnetted, 4 subnets, 3 masks

D 172.16.1.0/27 [90/3072] via 192.168.2.2, 00:15:47, GigabitEthernet0/0/1

O 172.16.1.32/27 [110/2] via 192.168.1.2, 00:14:58, GigabitEthernet0/0/0

C 172.16.2.0/24 is directly connected, GigabitEthernet0/0/2

L 172.16.2.254/32 is directly connected, GigabitEthernet0/0/2

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/30 is directly connected, GigabitEthernet0/0/0

L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/0

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/30 is directly connected, GigabitEthernet0/0/1

L 192.168.2.1/32 is directly connected, GigabitEthernet0/0/1

S* 0.0.0.0/0 [1/0] via 192.168.1.2

Click on *R2* router and select *CLI* folder.

Step 4: Enter global configuration mode.

```
R2>enable
R2#configure terminal
```

Step 5: Perform a shutdown of R2 interface Gi0/0/1 to remove EIGRP route 172.16.1.0/27 from R2 routing table. This will allow install of OSPF route 172.16.1.0/27 (server-2) from R1 with higher administrative distance into the routing table of DC-1.

```
R2(config)#interface Gi0/0/1
R2(config-if)#shutdown
```

Step 6: Verify there is connectivity to 172.16.1.1/27 (server-2) with traceroute.

```
DC-1#traceroute 172.16.1.1 (yes)
```

Type escape sequence to abort.

Tracing the route to 172.16.1.1

```
 1  192.168.1.2    0 msec  0 msec  0 msec
 2  172.16.1.1     0 msec  0 msec  0 msec
```

Step 7: Verify the route to 172.16.1.1 (server-2) is via OSPF route 172.16.1.0/27 with 192.168.1.2 next hop address.

```
DC-1#show ip route
```

```
172.16.0.0/16 is variably subnetted, 4 subnets, 3 masks
O   172.16.1.0/27 [110/2] via 192.168.1.2, 00:44:10, GigabitEthernet0/0/0
O   172.16.1.32/27 [110/2] via 192.168.1.2, 00:44:10, GigabitEthernet0/0/0
C   172.16.2.0/24 is directly connected, GigabitEthernet0/0/2
L   172.16.2.254/32 is directly connected, GigabitEthernet0/0/2
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.1.0/30 is directly connected, GigabitEthernet0/0/0
L   192.168.1.1/32 is directly connected, GigabitEthernet0/0/0
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C   192.168.2.0/30 is directly connected, GigabitEthernet0/0/1
L   192.168.2.1/32 is directly connected, GigabitEthernet0/0/1
S*  0.0.0.0/0 [1/0] via 192.168.1.2
```

Step 8: Enable R2 interface Gi0/0/1 that was shutdown to reinstall EIGRP route 172.16.1.0/27 into the routing table of R2 and advertise to DC-1.

```
R2(config)#interface Gi0/0/1  
R2(config-if)#no shutdown
```

Step 9: Configure a static route on DC-1 router that will replace the EIGRP route 172.16.1.0/27 with a new next hop address that points to R1. The static route has a lower administrative distance than EIGRP.

```
DC-1(config)#ip route 172.16.1.0 255.255.255.224 192.168.1.2
```

Step 10: Verify the static route has replaced EIGRP route 172.16.1.0/27 to server-3 and changed next hop address to 192.168.1.2 for that route. The result is all packets are forwarded to server-2 for that network address.

```
DC-1#show ip route
```

```
172.16.0.0/16 is variably subnetted, 4 subnets, 3 masks  
S    172.16.1.0/27 [1/0] via 192.168.1.2  
O    172.16.1.32/27 [110/2] via 192.168.1.2, 00:18:13, GigabitEthernet0/0/0  
C    172.16.2.0/24 is directly connected, GigabitEthernet0/0/2  
L    172.16.2.254/32 is directly connected, GigabitEthernet0/0/2  
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks  
C    192.168.1.0/30 is directly connected, GigabitEthernet0/0/0  
L    192.168.1.1/32 is directly connected, GigabitEthernet0/0/0  
192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks  
C    192.168.2.0/30 is directly connected, GigabitEthernet0/0/1  
L    192.168.2.1/32 is directly connected, GigabitEthernet0/0/1  
S*  0.0.0.0/0 [1/0] via 192.168.1.2
```

Step 11: Verify there is connectivity to 172.16.1.1/27 (server-2) with traceroute.

```
DC-1#traceroute 172.16.1.1 (yes)
```

Type escape sequence to abort.

Tracing the route to 172.16.1.1

```
 1  192.168.1.2    0 msec   0 msec   0 msec  
 2  172.16.1.1    0 msec   0 msec   0 msec
```

Step 12: Verify there is NO connectivity to 172.16.1.3/27 (server-3) with traceroute.

DC-1#**traceroute 172.16.1.3** (no)

Type escape sequence to abort.

Tracing the route to 172.16.1.3

1 192.168.1.2 0 msec 0 msec 0 msec

2 * * *

3 * * *

Shift-Ctrl + 6

Step 13: Configure a static route on DC-1 for 172.16.1.0 network address with a longer prefix match (/28) than existing static route to that network address. Change the next hop address that will now point to R2 instead of R1.

DC-1(config)#**ip route 172.16.1.0 255.255.255.240 192.168.2.2**

Step 14: Verify the static route is installed in the routing table since it has a different subnet mask length (/28) from the existing static route (/27).

DC-1#**show ip route**

172.16.0.0/16 is variably subnetted, 5 subnets, 4 masks

S 172.16.1.0/27 [1/0] via 192.168.1.2

S 172.16.1.0/28 [1/0] via 192.168.2.2

O 172.16.1.32/27 [110/2] via 192.168.1.2, 00:42:21, GigabitEthernet0/0/0

C 172.16.2.0/24 is directly connected, GigabitEthernet0/0/2

L 172.16.2.254/32 is directly connected, GigabitEthernet0/0/2

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.1.0/30 is directly connected, GigabitEthernet0/0/0

L 192.168.1.1/32 is directly connected, GigabitEthernet0/0/0

192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.2.0/30 is directly connected, GigabitEthernet0/0/1

L 192.168.2.1/32 is directly connected, GigabitEthernet0/0/1

S* 0.0.0.0/0 [1/0] via 192.168.1.2

Step 15: Verify there is connectivity to 172.16.1.3 (server-3) with traceroute since next hop for 172.16.1.0/27 route is 192.168.2.2 based on longest prefix match rule.

DC-1#**traceroute 172.16.1.3** (yes)

Type escape sequence to abort.

Tracing the route to 172.16.1.3

```
1  192.168.2.2    0 msec  0 msec  0 msec
2  172.16.1.3     0 msec  0 msec  0 msec
```

Step 16: Verify there is NO connectivity to 172.16.1.1 (server-2) with traceroute.

DC-1#**traceroute 172.16.1.1**

Type escape sequence to abort.

Tracing the route to 172.16.1.1

```
1  192.168.2.2    0 msec  0 msec  0 msec
2  *      *      *
3  *      *      *
```

Shift-Ctrl + 6

Lab Notes

The purpose of administrative distance is to select a route to install in the routing table. This occurs only when multiple routes exist from different routing sources to the same destination. Routes with different subnet mask lengths are considered different destinations and are all installed. This was the case with OSPF route 172.16.1.0/32 on R1 to server-1. Conversely, EIGRP route 172.16.1.0/27 and OSPF route 172.16.1.0/27 have the same destination and subnet mask length. DC-1 will install the EIGRP route since it has a lower administrative distance. Removing the EIGRP route from DC-1 allows for install of OSPF route to server-2.

- R2 EIGRP route installed since lower AD for same subnet (172.16.1.0/27)
- R1 OSPF route 172.16.1.32/27 (server-1) installed since it is different subnet

There was a static route configured with step 9 that replaced the EIGRP route to 172.16.1.0/27 since static routes have a lower administrative distance (1). The next hop address was configured for R1 to make 172.16.1.1/27 (server-2) reachable.

Route Source	AD Value
Directly Connected	0
Static Route	1
Default Route	1
eBGP	20
EIGRP	90
OSPF	110
IS-IS	115
RIP	120

The traceroute to server-1 is unaffected as mentioned since it is as OSPF route to a different network address (subnet) as shown here.

server-2 / server-3 (same subnet)

network address:172.16.1.0/27

host IP address range: 172.16.1.1/27-172.16.1.30/27

broadcast address:172.16.1.31

server-1 (different subnet)

network address:172.16.1.32/27

host IP address range: 172.16.1.33/27-172.16.1.62/27

broadcast address:172.16.1.63

Subnet Mask	CIDR	Subnet Bits	Subnets	Subnet Multiple	Host Bits	*Hosts	Wildcard Mask
255.255.255.0	/24	none	1	none	8	254	0.0.0.255
255.255.255.128	/25	1	2	128	7	126	0.0.0.127
255.255.255.192	/26	2	4	64	6	62	0.0.0.63
255.255.255.224	/27	3	8	32	5	30	0.0.0.31
255.255.255.240	/28	4	16	16	4	14	0.0.0.15
255.255.255.248	/29	5	32	8	3	6	0.0.0.7
255.255.255.252	/30	6	64	4	2	2	0.0.0.3

*The number of host IP addresses does not include network address and broadcast address. They are reserved within each subnet and not assignable to interfaces. For example /28 = 4 host bits = $2^4 = 16 - 2 = 14$ host IP addresses.

The purpose of longest prefix match rule is to select a route from among multiple routes already in the routing table to the same destination. There was a static route to network address 172.16.1.0/27 configured with step 13. That was configured with a longer prefix (/28) subnet mask and installed automatically since it is considered a different destination. The router selected that route with longer prefix (/28) over the existing static route with shorter subnet mask (/27). Since my next hop address was configured for R2 (192.168.2.2), then traceroute to 172.16.1.0/27 only worked for server-3 instead of server-2.