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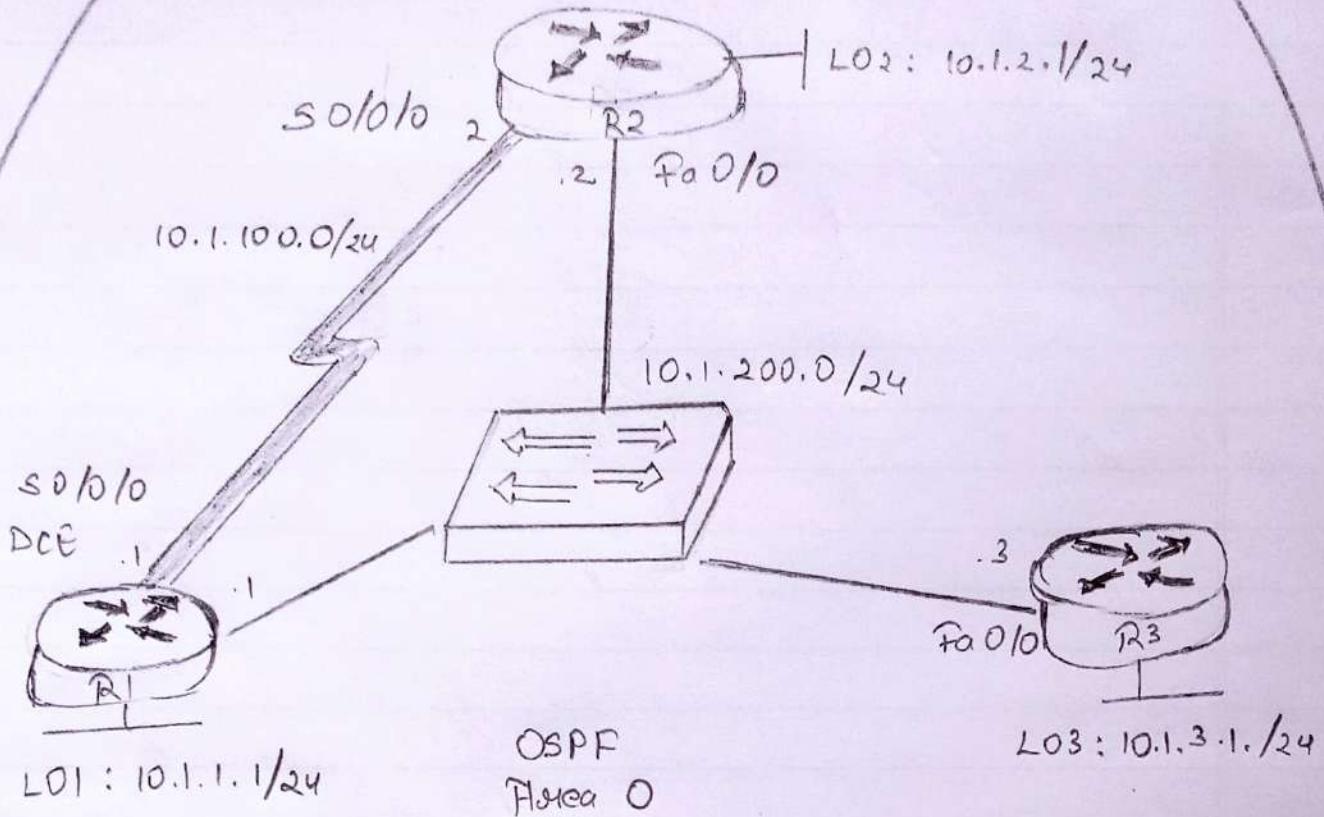
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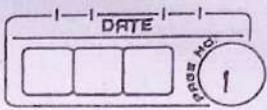
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9 Internal VLAN Routing

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PRACTICAL NO: 1



A] Single Area OSPF Link cost and Interface Priorities

Step 1 : Configuring addressing and loopbacks.

A] Apply IP addresses to FastEthernet interface
Create loopback 1, 2 and 3 and address them accordingly.

R1(config)# interface loopback 1

R1(config-if)# description engineering department

R1(config-if)# ip address 10.1.1.1 255.255.255.0

R1(config-if)# interface FastEthernet 0/0

R1(config-if)# ip address 10.1.200.1 255.255.255.0

R1(config-if)# no shutdown

R2(config-if)# interface loopback 2

R2(config-if)# description marketing department

R2(config-if)# ip address 10.1.2.1 255.255.255.0

R2(config-if)# interface FastEthernet 0/0

R2(config-if)# ip address 10.1.200.2 255.255.255.0

R3(config)# interface loopback 3

R3(config-if)# description accounting department

R3(config-if)# ip address 10.1.3.1 255.255.255.0

R3(config-if)# interface FastEthernet 0/0

R3(config-if)# ip address 10.1.200.3 255.255.255.0

R3(config-if)# no shutdown

R1# show ip protocols

Router ID 10.1.1.1

Routing for Networks :

10.1.100.0 0.0.0.255 area 0

10.1.200.0 0.0.0.~~255~~0 area 0

R1# show ip ospf

Routing Process "OSPF 1" with ID 10.1.1.1

R1# show ip ospf neighbor

Neighbor ID	Pri	State	DeadTime	Address	Interface
10.1.2.1	1	FULL/BDR	00:00:36	10.1.200.2	FastEthernet 0/0
10.1.3.1	1	FULL/DR	00:00:35	10.1.200.3	FastEthernet 0/0
10.1.1.1	0	FULL	00:00:36	10.1.100.2	Serial 0/0/0

R1# show ip ospf interface brief

Interface	PID	Area	IP Address/Mask	Cost	State	Nbrs	F/c
Fa 0/0	1	0	10.1.200.1/24	1	DROT	2/2	
Se 0/0/0	1	0	10.1.100.1/24	1	UP	1/1	

R1# show ip ospf interface FastEthernet 0/0

FastEthernet 0/0 is up, line protocol is up

Internet Address 10.1.200.1/24 Area 0

Process ID 1 Router ID 10.1.1.1 Network Type BDR cost:1

b) configure the serial interface on R1 and R3

```
R1(config)# interface serial 0/0/0
R1(config-if)# ip address 10.1.100.1 255.255.255.0
R1(config-if)# clockrate 64000
R1(config-if)# bandwidth 64
R1(config-if)# no shutdown
```

```
R2(config)# interface serial 0/0/0
R2(config)# ip address 10.1.100.2 255.255.255.0
R2(config-if)# bandwidth 64
R2(config-if)# no shutdown
```

Step 2 : Add Physical Interface to OSPF

```
R1# conf t
R1(config)# router ospf 1
R1(config)# network 10.1.100.0 0.0.0.255 area 0
R1(config-router)# network 10.1.200.0 0.0.0.255 area 0
R1(config-router)# end
R1# debug ip ospf adj
OSPF adjacency events debugging is on
```

```
R3(config)# router ospf 1
R3(config)# network 10.1.200.0 0.0.0.255
area 0
```

```
R2(config)# router ospf 1
R2(config-router)# network 10.1.100.0 0.0.0.255 area 0
R2(config-router)# network 10.1.200.0 0.0.0.255 area 0
```

Step 3 : Use OSPF show commands

- a] show ip protocols
- b] show ip ospf
- c] show ip ospf interface
- d] show ip ospf interface brief
- e] show ip ospf database

Step 4 : Add Loopback Interface to OSPF

R1(config)# router ospf 1

R1(config-router)# network 10.1.1.0 0.0.0.255 area 0

R2(config)# router ospf 1

R2(config-router)# network 10.1.2.0 0.0.0.255 area 0

R3(config)# router ospf 1

R3(config-router)# network 10.1.3.0 0.0.0.255 area 0

Verify that these network have been added to the routing table using the show ip route command.

R1(config)# interface loopback 1

R1(config)# ip address network point-to-point

R2(config)# interface loopback 2

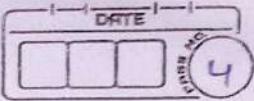
R2(config-if)# ip address network point-to-point

R1# show ip route

- o 10.1.2.1/32 [110/2] via 10.1.200.2 00:03 FastEthernet 0/0
- o 10.1.3.1/32 [110/2] via 10.1.200.3 00:03 FastEthernet 0/0

R1# show ip ospf interface 201

Process ID 1 Router ID 10.1.1.1 Network Type LOOPBACK cost: 1



Step 5 : Modify OSPF Link costs

R1(config)# ?interface FastEthernet 0/0
R1(config-if)# ?ip ospf cost 50

R2(config)# ?interface FastEthernet 0/0
R2(config-if)# ?ip ospf cost 50

R3(config)# ?interface FastEthernet 0/0
R3(config-if)# ?ip ospf cost 50

R1(config)# router ospf 1
R1(config-router)# auto-cost reference-bandwidth 1000

Step 6 : Modify interface priorities to control the DR and BDR election

R1(config)# ?interface FastEthernet 0/0
R1(config-if)# ?ip ospf priority 10

R2(config-if)# ?ip ospf priority 5

Now write the command show ip ospf neighbor detail.

R1# show ip ospf neighbor detail

Neighbor 10.1.2.1 Interface address 10.1.200.2

Neighbor priority is 5

DR is 10.1.200.1 BDR is 10.1.200.2

Neighbor 10.1.3.1 Interface address 10.1.200.3

Neighbor priority is 1

DR is 10.1.200.1 BDR is 10.1.200.2

challenge : Topology change

a) check the path from R3 to R1 by performing a traceroute on R3 to the loopback of R1

R3 # traceroute 10.1.1.1

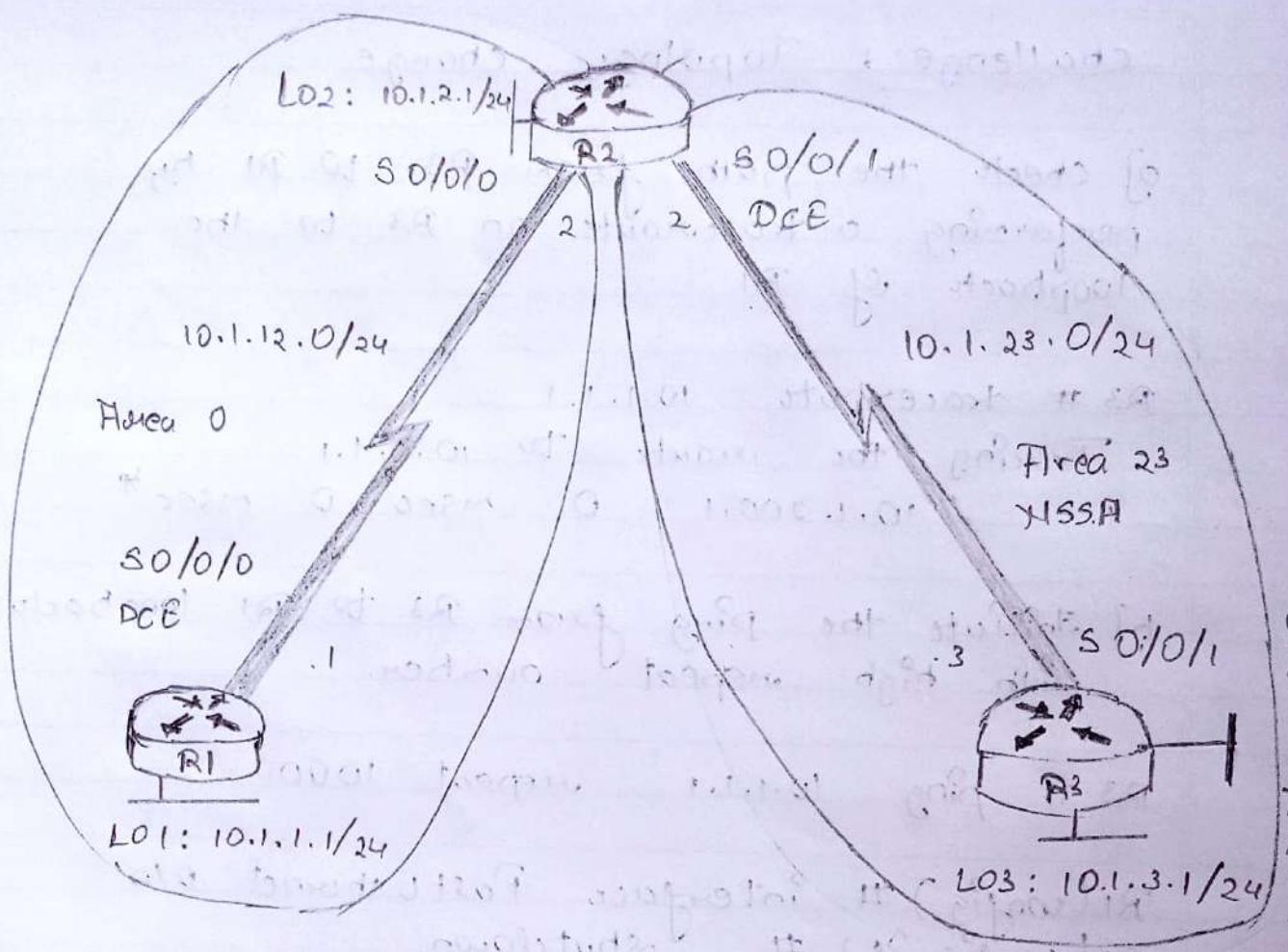
Tracing the route to 10.1.1.1

1. 10.1.200.1 0 msec 0 msec*

b) initiate the ping from R3 to R1 loopback with high repeat number

R3 # ping 10.1.1.1 repeat 10000

R1(config)# interface FastEthernet 0/0
R1(config-if)# shutdown



LO20: 172.20.200.1/24

B] Multi-area OSPF with Stub Areas and Authentication. Topology.

Step 1 : Configure addressing and loopbacks

```
R1(config)# ?interface loopback 1
R1(config-if)# description Engineering Department
R1(config-if)# ?ip address 10.1.1.1 255.255.255.0
R1(config-if)# ?interface serial 0/0/0
R1(config-if)# clockrate 64000
R1(config-if)# no shutdown
```

```
R2(config)# ?interface loopback 2
R2(config-if)# description Marketing Department
R2(config-if)# ?ip address 10.1.2.1 255.255.255.0
R2(config-if)# ?interface serial 0/0/0
R2(config-if)# ?ip address 10.1.2.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# ?interface serial 0/0/0
R2(config-if)# ?ip address 10.1.2.3.2 255.255.255.0
R2(config-if)# clockrate 64000
R2(config-if)# no shutdown
```

```
R3(config)# ?interface loopback 3
R3(config-if)# description Accounting Department
R3(config-if)# ?ip address 10.1.3.1 255.255.255.0
R3(config-if)# ?interface loopback 20
R3(config-if)# description connection to Another AS
R3(config-if)# ?ip address 172.20.200.1 255.255.255.0
```



R3(config-if) # interface serial 0/0/1
R3(config-if) # ip address 10.1.23.3 255.255.255.0
R3(config-if) # no shutdown

Step 2 : Add Interface into OSPF

R1(config) # router ospf 1
R1(config) # network 10.1.12.0 0.0.0.255 area 0
R1(config-router) # network 10.1.1.0 0.0.0.255 area 0
R1(config-router) # interface loopback 1
R1(config-if) # ip ospf network point-to-point

R2(config) # router ospf 1
R2(config-router) # network 10.1.12.0 0.0.0.255 area 0
R2(config-router) # network 10.1.2.0 0.0.0.255 area 0
R2(config-router) # exit
R2(config) # interface loopback 2
R2(config-if) # ip ospf network point-to-point

Verify using command show ip route

R2(config) # router ospf 1
R2(config-router) # network 10.1.23.0 0.0.0.255 area 23
R3(config) # router ospf 1
R3(config-router) # network 10.1.23.0 0.0.0.255 area 23
R3(config-router) # network 10.1.3.0 0.0.0.255 area 23
R3(config-router) # exit
R3(config) # interface loopback 3
R3(config-if) # ip ospf network point-to-point

R1# show ip route

0 * IP 0.0.0.0/0 [10/65] via 10.1.23.2 00:56 serial 0/0/0

R2# show ip ospf

Area 23

It is a stub area

R3# show ip ospf database

Summary net Link states (Area 23)

Link ID	Adv Router	Hop	Seq #	Checksum
0.0.0.0	10.1.2.1	68	0x800002	0x0039F5

Step 3 : Configure a stub area

- a] Make area 23 the stub area using the area <area> stub command

```
R2 (config) # router ospf 1
```

```
R2 (config-router) # area 23 stub
```

```
R3 (config) # router ospf 1
```

```
R3 (config-router) # area 23 stub
```

- b] Confirm it by using command show ip ospf command.

- c] Look at the output of the show ip ospf command.

Step 4 : Configure a totally stubby area

- a] Enter the stub no-summary command on R2 (the ABR) under the OSPF process.

```
R2 (config) # router ospf 1
```

```
R2 (config-router) # area 23 stub no-summary
```

- b] Look at the show ip ospf database output to see which routes are in area 23

R2# show ip ospf

Area 23

It is a NSSA area

R3# show ip route

0* IA 0.0.0.0/0 [110/65] via 10.1.23.2 00:20, Serial 0/0/1

R3# show ip ospf database

Summary Net Link states (Area 23)

Link ID	Adv Router	Type	Seq #	Checksum
0.0.0.0	10.1.2.1	34	0x80000001	0x00C265

Type-7 Ls External Link states (Area 23)

10.1.3.0	10.1.3.1	200	0x800001	0x0076FC
Type-5 Ls External Link states				

10.1.3.0	10.1.2.1	199	0x80000001	0x00CA2F
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Step 5 : configure a not-so-stubby area

a) change area 23 into an NSSA

```
R2(config)# router ospf 1
```

```
R2(config-router)# no area 23 nssa stub
```

```
R2(config-router)# area 23 nssa.
```

b) R3(config)# router ospf 1

```
R3(config)# no area 23 stub
```

```
R3(config-router)# area 23 nssa
```

```
R3(config-router)# redistribute connected subnt
```

b) In the output of the show ip ospf command on R2, notice that area 23 is an NSSA and that R2 is performing the LSA type 7 to type 5 translation.

c) Issue the area 23 nssa no-summary command on R2.

```
R2(config)# router ospf 1
```

```
R2(config-router)# area 23 nssa no-summary
```

d) Check the routing table on R3. Notice that the inter-area routes have been replaced by a single default route.

e) On R2, look at the show ip ospf database output to see the various LSA types.

R2# show ip ospf interface serial 0/0/1

Simple Password authentication enabled

R1# show ip ospf interface serial 0/0/0

Message digest authentication enabled

youngest key id is 1

Step 6 : Configure OSPF Interface authentication

a] configure the link between R2 and R3 for plain text authentication

```
R2(config)# interface serial 0/0/1
```

```
R2(config)# ip ospf authentication
```

```
R2(config-if)# ip ospf authentication-key cisco
```

```
R3(config)# interface serial 0/0/1
```

```
R3(config-if)# ip ospf authentication
```

```
R3(config-if)# ip ospf authentication-key cisco
```

b] Verify the authentication using the show ip ospf interface

c] MD5 authentication between the R2 and R1

```
R1(config)# interface serial 0/0/0
```

```
R1(config-if)# ip ospf authentication message-digest
```

```
R1(config-if)# ip ospf message-digest-key 1 md5 cisco
```

```
R2(config)# interface serial 0/0/0
```

```
R2(config-if)# ip ospf authentication message-digest
```

```
R2(config-if)# ip ospf message-digest-key 1 md5 cisco
```

d] Verify the configuration using the show ip ospf interface command on R1

Practical no. 2

Configuring OSPF - II

A) OSPF Virtual Links and Area Summarization

Step 1: Configuring addressing and loopbacks

```
R1(Config)# interface loopback 1
R1(Config)# description Engineering Department
R1(Config-if)# ip address 10.1.1.1 255.255.255.0
R1(Config-if)# interface loopback 30
R1(Config-if)# ip address 172.30.30.1 255.255.255.252
R1(Config-if)# ip address 10.1.12.1 255.255.255.0
R1(Config-if)# clockrate 640000
R1(Config-if)# no shutdown
```

```
R2(Config)# interface loopback 2
R2(Config-if)# description Marketing department
R2(Config-if)# ip address 10.1.2.1 255.255.255.0
R2(Config-if)# interface loopback 30/0/0
R2(Config-if)# ip address 10.1.12.2 255.255.255.0
R2(Config-if)# no shutdown
R2(Config-if)# interface 30/0/1
R2(Config-if)# ip address 10.1.23.2 255.255.255.0
R2(Config-if)# no shutdown
```

```
R3(config)# interface loopback 0
R3(config-if)# description Accounting Department
R3(config-if)# ip address 10.1.3.1 255.255.255.0
R3(config-if)# interface loopback 100
R3(config-if)# ip address 192.168.100.1 255.255.255.0
R3(config-if)# interface loopback 101
R3(config-if)# ip address 192.168.101.1 255.255.255.0
R3(config-if)# interface loopback 102
R3(config-if)# ip address 192.168.102.1 255.255.255.0
R3(config-if)# interface loopback 103
R3(config-if)# ip address 192.168.103.1 255.255.255.0
R3(config-if)# interface s0/0/1
R3(config-if)# ip address 10.1.23.3 255.255.255.0
R3(config-if)# no shutdown
```

Step 2: Add interfaces into OSPF

```
R1(config)# router ospf 1
R1(config-router)# network 10.1.12.0 0.0.0.255 area 0
R1(config-router)# network 10.1.1.0 0.0.0.255 area 0
R1(config-router)# interface loopback 1
R1(config-if)# ip ospf network point-to-point
```

```
R2(config)# router ospf 1
R2(config-router)# network 10.1.12.0 0.0.0.255 area 0
R2(config-router)# network 10.1.2.0 0.0.0.255 area 0
R2(config-router)# interface loopback 2
R2(config-if)# ip ospf network point-to-point
```

R2(config-router) # network 10.1.23.0 0.0.0.255 area 23

R3(config) # router ospf 1

R3(config-router) # network 10.1.23.0 0.0.0.255 area 23

R3(config-router) # network 10.1.23.0 0.0.0.255 area 23

R3(config-router) # interface loopback 3

R3(config-if) # ip ospf network point-to-point

Step 3: Create a virtual link

a] Add loopbacks 100 through 103 R3 to the OSPF process in area 100 using the network command. change the network type to advertise the correct subnet mask

R3(config) # router ospf 1

R3(config-router) # network 192.168.100.0 0.0.3.255 area 100

R3(config) # interface loopback 100

R3(config-if) # ip ospf network point-to-point

R3(config-if) # interface loopback 101

R3(config-if) # ip ospf network point-to-point

R3(config-if) # interface loopback 102

R3(config-if) # ip ospf network point-to-point

R3(config-if) # interface loopback 103

R3(config-if) # ip ospf network point-to-point

b] Create a virtual link using the area transit area virtual-link router-id OSPF configuration command on both R2 and R3

R2# show ip route

O IA 192.168.102.0/24 [110/65] via 10.1.23.3 Serial 0/0/1
O IA 192.168.103.0/24 [110/65] via 10.1.23.3 Serial 0/0/1
O IA 192.168.100.0/24 [110/65] via 10.1.23.3 Serial 0/0/1
O IA 192.168.101.0/24 [110/65] via 10.1.23.3 Serial 0/0/1

R2# show ip neighbor

192.168.103.1 O FULL - - 10.1.23.3

R2# show ip ospf interface

OSPF - VLO is up, line protocol is up

Router ID 10.1.2.1, Network Type Virtual-Link, Cost:64

R2# show ip route

O IA 192.168.100.0/22 [110/65] via 10.1.23.3, 0:00:01, Serial 0

R2# show ip ospf database

Summary Net link states (Area 0)

192.168.100.0 192.168.103.1 1 (DNA) 0x800002 0x009A04

R3# show ip route

O 192.168.100.0/22

Broadcast is a summary, 0:0:01:19, Null0

Networks

```
R2 (config) # router ospf 1  
R2 (config-router) # area 23 virtual-link R2.168.103.1
```

```
R3 (config) # router ospf 1  
R3 (config-router) # area 23 virtual-link 10.1.2.1
```

c) Issue the show ip route and see the routes from area 100. You can verify the link with the show ip ospf neighbor and show ip ospf interface.

Step 4: Summarize an area

a) Configure R3 to summarize this area using the area range network mask command

```
R3 (config) # router ospf 1  
R3 (config-router) # area 100 range 192.168.100.0 255.255.255.0
```

b) You can see the summary route on R2 with the show ip route and show ip ospf database commands

c) Notice R3 that OSPF has generated a summary route pointing toward Null0

Step 5: Generate a default route into OSPF

R2# show ip route

0* E2 0.0.0.0/0 [10/1] via 10.1.12.1, 00:00:02, Serial 0/0/0

R3# show ip route

0* E2 0.0.0.0/0 [10/1] via 10.1.23.2, 00:00:26, Serial 0/0/1

R3# ping 172.30.30.1

Sending 5, 100-byte ICMP Echoes to 172.30.30.1,
Timeout is 2 seconds : !!!!.

Success rate is 100 percent (5/5), round trip min/avg/max=

28/30/32 ms

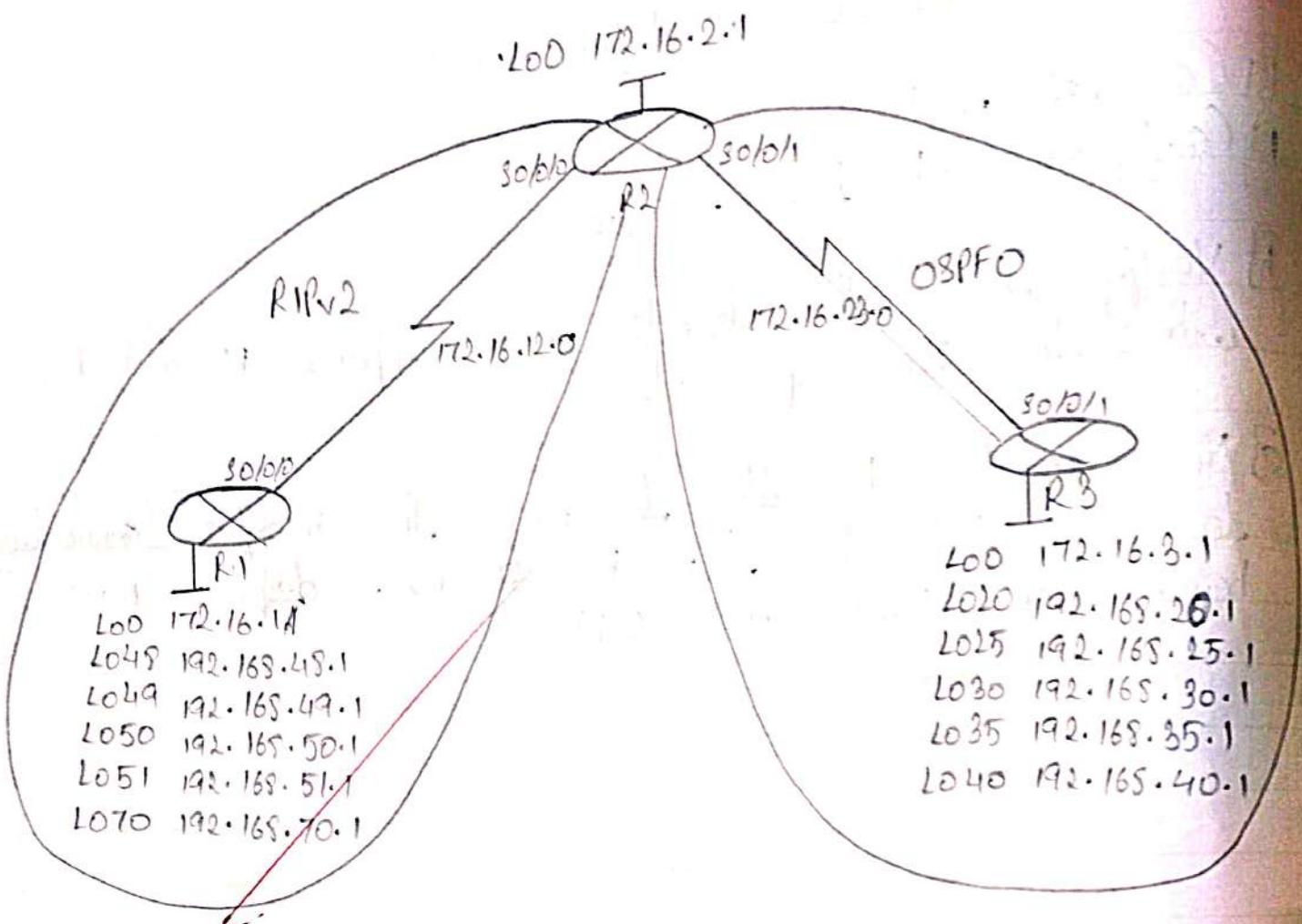
a] Have R1 generate a default route

R1 (config)# router ospf 1

R1 (config-router)# default-originate

b] Verify that the default route appears R2 and R3
with the show ip route

c] You should be able to ping the interface connecting
to the Internet from R2 or R3, despite never
being advertised into OSPF



Practical no. 3

Redistribution and Administrative Distances

A) Redistribution Between RIP and OSPF

Step 1: Configure loopbacks and assign addresses

a) Configure all loopback interfaces and DCE clockrate on the three routers

```
R1(config)# interface loopback 0
R1(config-if)# ip address 172.16.1.1 255.255.255.0
R1(config-if)# interface loopback 48
R1(config-if)# ip address 192.168.48.1 255.255.255.0
R1(config-if)# interface loopback 49
R1(config-if)# ip address 192.168.49.1 255.255.255.0
R1(config-if)# interface loopback 50
R1(config-if)# ip address 192.168.50.1 255.255.255.0
R1(config-if)# interface loopback 51
R1(config-if)# ip address 192.168.51.1 255.255.255.0
R1(config-if)# interface loopback 70
R1(config-if)# ip address 192.168.70.1 255.255.255.0
R1(config-if)# interface s0/0/0
R1(config-if)# clock rate 64000
R1(config-if)# bandwidth 64
R1(config-if)# no shutdown
```

```
R2(config)# interface loopback 0
R2(config-if)# ip address 172.16.2.1 255.255.255.0
R2(config-if)# interface s0/0/0
R2(config-if)# ip address 172.16.12.2 255.255.255.0
R2(config-if)# bandwidth 64
R2(config-if)# no shutdown
R2(config-if)# interface s0/0/1
R2(config-if)# clockrate 64000
R2(config-if)# bandwidth 64
R2(config-if)# no shutdown
```

```
R3(config-if)# interface loopback 0
R3(config-if)# ip address 172.16.3.1 255.255.255.0
R3(config-if)# interface loopback 20
R3(config-if)# ip address 192.168.20.1 255.255.255.0
R3(config-if)# interface loopback 25
R3(config-if)# ip address 192.168.25.1 255.255.255.0
R3(config-if)# interface loopback 30
R3(config-if)# ip address 192.168.30.1 255.255.255.0
R3(config-if)# ip address 192.168.35.1 255.255.255.0
R3(config-if)# interface loopback 40
R3(config-if)# ip address 192.168.40.1 255.255.255.0
R3(config-if)# interface s0/0/1
R3(config-if)# ip address 172.16.23.3 255.255.255.0
R3(config-if)# bandwidth 64
R3(config-if)# no shutdown
```

b] (optional) On each router , create an enable secret password

```
R1(config)# enable secret cisco  
R1(config)# line con 0  
R1(config)# logging synchronous  
R1(config-line)# exec-timeout 0 0  
R1(config-line)# line vty 0 4  
R1(config-line)# password cisco  
R1(config-line)# login
```

Step 2: Configure RIP v2

a] Apply the following commands to R1 and R2

```
R1(config)# router rip  
R1(config-router)# version 2  
R1(config-router)# no auto-summary  
R1(config-router)# network 172.16.0.0  
R1(config-router)# network 192.168.48.0  
R1(config-router)# network 192.168.49.0  
R1(config-router)# network 192.168.50.0  
R1(config-router)# network 192.168.51.0  
R1(config-router)# network 192.168.70.0
```

```
R2(config)# router rip  
R2(config-router)# version 2  
R2(config-router)# network 172.16.0.0
```

R1# show ip rip database

172.16.2.0/24

172.16.23.0/24

R1# show ip route

S 192.168.48.0/22 is directly connected, Null0

R2# show ip route

R 192.168.48.0/22 [120/1] via 172.16.12.1 ; Serial 0/0/0

b) You can also verify which routes are coming from RIP advertisements with the show ip rip database command

Step 3: Configure passive interfaces in RIP

```
R2 (config)# router rip
```

```
R2 (config)# passive-interface s0/0/1
```

```
R1 (config)# router rip
```

```
R1 (config-router)# passive-interface loopback 0
```

```
R1 (config-router)# passive-interface loopback 48
```

```
R1 (config-router)# passive-interface loopback 49
```

```
R1 (config-router)# passive-interface loopback 50
```

```
R1 (config-router)# no passive-interface loopback s0/0/0
```

Step 4: Summarize a supernet with RIP

```
R1 (config)# interface s0/0/0
```

```
R1 (config)# ip summary-address rip 192.168.48.0 255.255.255.
```

```
R1 (config)# ip route 192.168.48.0 255.255.252.0 null0
```

```
R1 (config)# router rip
```

```
R1 (config-router)# redistribute static
```

Verify that RIP supernet has been added to the routing table with the show ip route command

R3# show ip protocols

Passive Interface(s):

FastEthernet 0/0

Fast Ethernet 0/1

Serial 0/0/0

Serial 0/1/0

Serial 0/1/1

~~Serial 0~~

R2# Show ip protocols

Redistributing rip , ospf 1

R1# ping 192.168.30.1

Sending 5, 100-byte ICMP echos to 192.168.30.1

Success rate is 0 percent (0/5)

R1# traceroute 192.168.30.1

1 172.16.12.2 12 msec 12 msec 16 msec

Step 6 : Configure OSPF

R2 (config)# router ospf 1

R2 (config-router)# network 172.16.23.0 0.0.0.255 area 0

R3 (config)# router ospf 1

R3 (config-router)# network 172.16.0.0 0.0.0.255 area 0

R3 (config-router)# network 192.168.0.0 0.0.0.255 area 0

Step 7 : Configure passive interfaces in OSPF

~~R3 (config)# router ospf 1~~

~~R3 (config-router)# passive-interface default~~

~~R3 (config-router)# no passive-interface s0/0/1~~

Verify using show ip protocols command

Step 8 : Allow one-way redistribution

R2 (config)# router rip

R2 (config-router)# redistribute ospf 1 metric 4

Verify redistribution with the show ip protocols command
On R1 look, look at the routing table with show ip rip

Verify ping on loopback on R3 and also traceroute

R3# show ip route ospf

O* E2 0.0.0.0/0 [110/1] via 172.16.23.2, Serial 0/0/1

R3# show ip route ospf

O E2 172.16.12.0 [110/20] via 172.16.23.2

O E2 172.16.1.0 [110/20] via 172.16.23.2

O E2 172.16.2.0 [110/20] via 172.16.23.2

R2 (config)# router ospf 1

R2 (config-router)# default-information originate always

Verify that this route is present in the R3 routing table

Step 9: Redistribute between two routing protocols

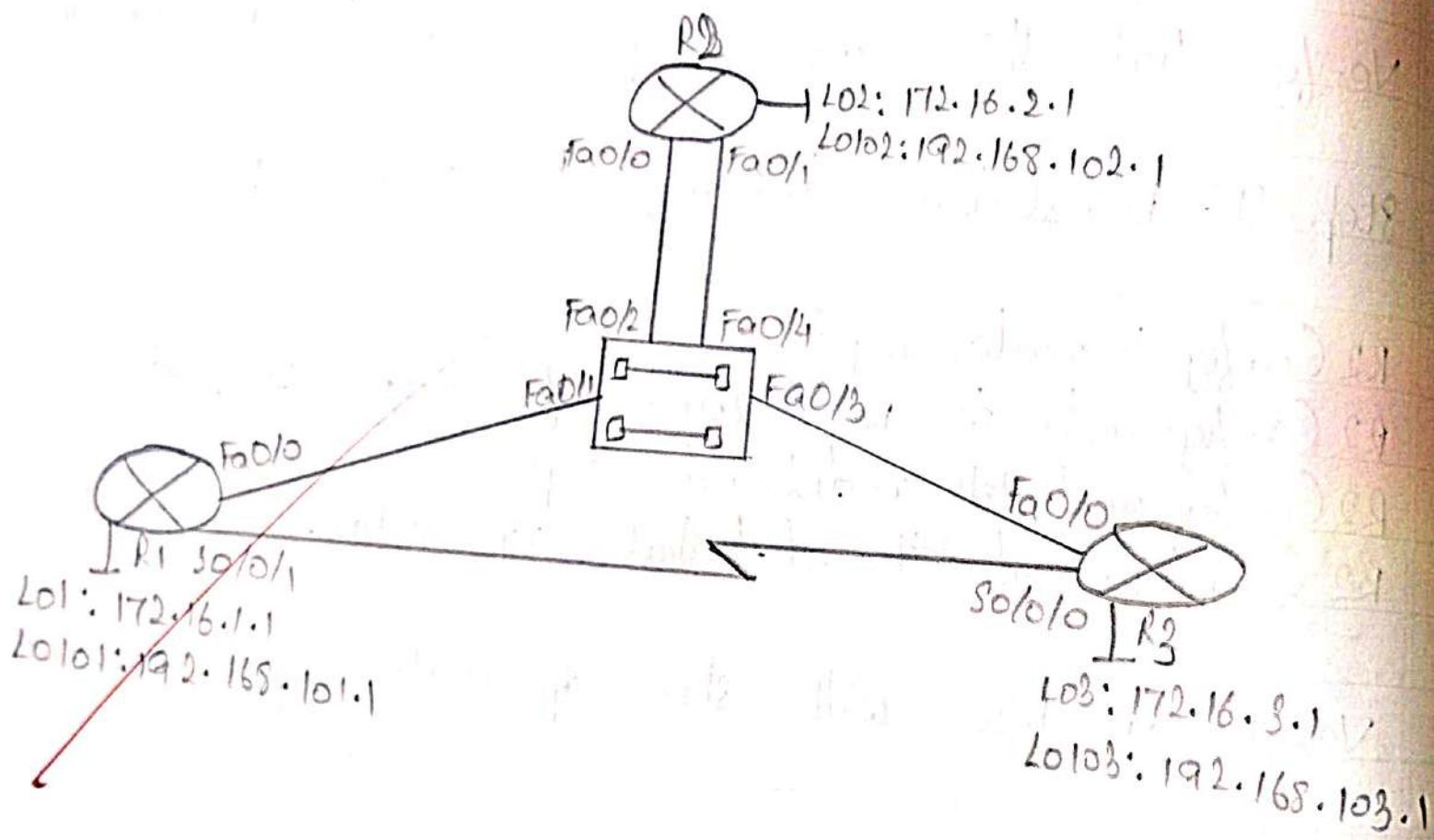
R2 (config)# router ospf 1

R2 (config-router)# no default-information originate

~~R2 (config-router)# redistribute rip~~

~~R2 (config-router)# redistribute rip subnets~~

Verify on R3 with show ip route ospf command



B] Manipulating Administrative Distances

Step 1: Review default administrative distances

Step 2: Configure router loopbacks and addressing

R1# Conf t

```
R1(config)# interface loopback 1
R1(config-if)# ip address 172.16.1.1 255.255.255.0
R1(config-if)# interface loopback 101
R1(config-if)# ip address 192.168.101.1 255.255.255.0
R1(config-if)# interface fastethernet 0/0
R1(config-if)# ip address 172.16.12.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# interface serial 0/0/1
R1(config-if)# bandwidth 64
R1(config-if)# ip address 172.16.13.1 255.255.255.0
R1(config-if)# no shutdown
```

R2(config-if)# interface loopback 2

```
R2(config-if)# ip address 192.168.102.1 255.255.255.0
R2(config-if)# interface loopback 102
R2(config-if)# ip address 192.168.102.1 255.255.255.0
R2(config-if)# interface fastethernet 0/0
R2(config-if)# ip address 172.16.12.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# interface fastethernet 0/1
R2(config-if)# ip address 172.16.23.2 255.255.255.0
```

R2(config-if)# no shutdown

R3(config)# interface loopback 3

R3(config-if)# ip address 172.16.3.1 255.255.255.0

R3(config-if)# interface loopback 103

R3(config-if)# ip address 172.168.103.1 255.255.255.0

R3(config-if)# interface loopback fastethernet 0/0

R3(config-if)# ip address 172.16.23.3 255.255.255.0

R3(config-if)# no shutdown

R3(config-if)# interface s 0/0/0

R3(config-if)# bandwidth 64

R3(config-if)# ip address 172.16.13.3 255.255.255.0

R3(config-if)# clock rate 64000

R3(config-if)# no shutdown

~~Step 3: Configure VLANs~~

Switch(config)# vlan 12

Switch(config-vlan)# name R1 - R2

Switch(config-vlan)# vlan 23

Switch(config-vlan)# name R2 - R3

Switch(config-vlan)# exit

Switch(config)# interface fastethernet 0/1

Switch(config)# description to R1 Fa0/0

Switch(config-if)# switchport mode access

Switch(config-if)# switchport access vlan 12

Switch(config-if)# interface fastethernet 0/2

Switch(config-if)# description to R2 Fa0/0

```
Switch(config-if)# switchport mode access  
Switch(config-if)# switchport access vlan 12  
Switch(config-if)# interface fastethernet 0/3  
Switch(config-if)# description to R3 Fa0/0  
Switch(config-if)# switchport mode access  
Switch(config-if)# switchport access vlan 23  
Switch(config-if)# interface fastethernet 0/4  
Switch(config-if)# description to R2 Fa0/1  
Switch(config-if)# switchport mode access  
Switch(config-if)# switchport access vlan 23
```

Step 4: Configure RIP

a) Configure RIP v2 on three routers

```
R1(config)# router rip  
R1(config)# version 2  
R1(config-router)# no auto-summary  
R1(config-router)# network 172.16.0.0  
R1(config-router)# network 192.168.101.0  
R1(config-router)##
```

```
R2(config)# router rip  
R2(config-router)# version 2  
R2(config-router)# no auto-summary  
R2(config-router)# network 172.16.0.0  
R2(config-router)# network 192.168.102.0
```

```
R3(config)# router rip  
R3(config)# version 2
```

R1# show ip route rip
R1 172.16.3.0 [120/1] via 172.16.13.3 , 00:02:29 , Serial 0/0/1

R2# show ip route rip
R2 172.16.3.0 [120/1] via 172.16.23.3 , 00:02:18 , fastEthernet 0/1

R3# show ip route rip
R3 172.16.1.0 [120/1] via 172.16.13.1 , 00:02:47 , Serial 0/0/0

R3 (config-router) # no auto-summary
R3 (config-router) # network 172.16.0.0
R3 (config-router) # network 192.168.103.0

b) Verify the configuration using the show ip route ospf command on each router

c) Verify that each routers is receiving RIP routes from other routers using the show ip protocols command

Step 5: Configuring OSPF

R1 (config) # interface loopback 1
R1 (config-if) # ip ospf network point-to-point
R1 (config-if) # interface loopback 101
R1 (config-if) # ip ospf network point-to-point
R1 (config-if) # router ospf 1
R1 (config-router) # network 172.16.0.0 0.0.255.255 area 0
~~R1 (config-router) # network 192.168.101.0 0.0.255.255 area 0~~

R2 (config) # interface loopback 2
R2 (config-if) # ip ospf network point-to-point
R2 (config-if) # interface loopback 102
R2 (config-if) # ip ospf network point-to-point
R2 (config-if) # router ospf 1
R2 (config-router) # network 172.16.0.0 0.0.255.255 area 0
R2 (config-router) # network 192.168.102.0 0.0.0.255 area 0

R# show ip protocols
Distance: (default is 100)

```
R3(config)# interface loopback 3  
R3(config-if)# ip ospf network point-to-point  
R3(config-if)# interface loopback 103  
R3(config-if)# ip ospf network point-to-point  
R3(config-if)# router ospf 1  
R3(config-router)# network 172.16.0.0 0.0.255.255 area 0  
R3(config-router)# network 192.168.103.0 0.0.0.255 area 0
```

Step 6 : Modify the routing protocol distance

```
R1(config)# router rip  
R1(config-router)# distance 100
```

```
R2(config)# router rip  
R2(config-router)# distance 100
```

```
R3(config)# router rip  
R3(config-router)# distance 100
```

You can verify the default distance for RIP using show ip protocols command

Step 7 : Modify distance between route source

```
R1(config)# router ospf 1  
R1(config-router)# distance 85 192.168.100.0 0.0.3.255
```

```
R2(config)# router ospf 1
```

R1# show ip protocols

Distance : (default is 110)

Address	wild mask	Distance	list
192.168.100.0	0.0.3.255	85	

R1# show ip protocols

Address	wild mask	Distance	list
0.0.0.0	255.255.255.255	65	1

R2# show ip protocols

Address	wild mask	Distance	list
0.0.0.0	255.255.255.255	65	1

R3# show ip protocols

Address	wild mask	Distance	list
0.0.0.0	255.255.255.255	65	1

```
R2(config-router)# distance 85 192.168.100.0 0.0.3.255
```

```
R3(config)# router ospf 1
```

```
R3(config-router)# distance 85 192.168.100.0 0.0.3.255
```

Verify the change with the show ip protocols and show ip route command.

Step 8: Modify distance based on an access-list

```
R1(config)# access-list 1 permit 172.16.0.0 0.0.255.255
```

```
R1(config)# router rip
```

```
R1(config-router)# distance 65 0.0.0.0 255.255.255.255 1
```

```
R2(config)# access-list 1 permit 172.16.0.0 0.0.255.255
```

```
R2(config)# router rip
```

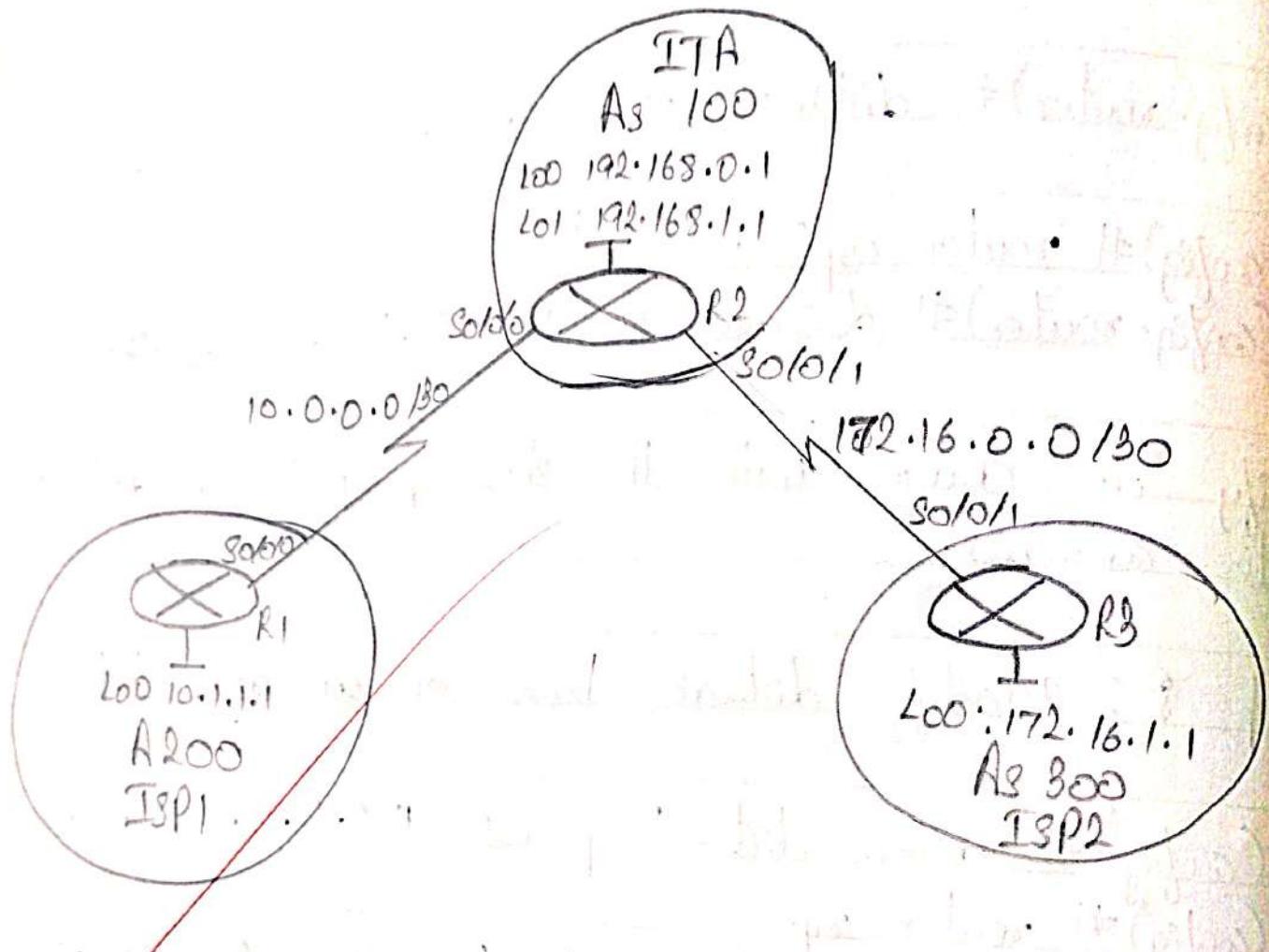
```
R2(config-router)# distance 65 0.0.0.0 255.255.255.255 1
```

```
R3(config)# access-list 1 permit 172.16.0.0 0.0.255.255
```

```
R3(config)# router rip
```

```
R3(config-router)# distance 65 0.0.0.0 255.255.255.255 1
```

Verify the change with show ip protocols and show ip route



Practical no. 4
BGP

A] Configuring BGP with default Routing

Step 1: Prepare the routers for the lab
Create the network as shown in the topology

Step 2: Configure the hostname and interface addresses

```
R1(config)# hostname ISP1
ISP1(config)# interface Lo0
ISP1(config-if)# ip address 10.1.1.1 255.255.255.0
ISP1(config-if)# interface Serial 0/0/0
ISP1(config-if)# ip address 10.0.0.1 255.255.255.252
ISP1(config-if)# clock rate 128000
ISP1(config-if)# no shutdown
```

```
R2(config)# hostname ITA
ITA(config)# interface Lo0
ITA(config-if)# ip address 192.168.0.1 255.255.255.0
ITA(config-if)# interface lo1
ITA(config-if)# ip address 192.168.1.1 255.255.255.0
ITA(config-if)# interface so/0/0
ITA(config-if)# ip address 10.0.0.2 255.255.255.252
ITA(config-if)# no shutdown
ITA(config-if)# interface so/0/1
ITA(config-if)# ip address 172.16.0.2 255.255.255.252
```

```
R3 (config)# hostname ISP2
ISP2 (config-if)# interface lo0
ISP2 (config-if)# ip address 172.16.1.1 255.255.255.0
ISP2 (config-if)# interface s0/0/1
ISP2 (config-if)# ip address 172.16.0.1 255.255.255.0
ISP2 (config-if)# no shutdown
```

Step 3: Configure BGP on the ISP routers

```
ISP1 (config)# router bgp 200
ISP1 (config)# neighbor 10.0.0.2 remote-as 100
ISP1 (config-router)# network 10.1.1.0 mask 255.255.255.0
```

```
ISP2 (config)# router bgp 300
ISP2 (config-router)# neighbor 172.16.0.2 remote-as 100
ISP2 (config-router)# network 10.1.1.0 mask 255.255.255.0
```

Step 4: Configure BGP on ITA boundary router

```
ITA (config)# router bgp 100
ITA (config-router)# neighbor 10.0.0.1 remote-as 200
ITA (config-router)# neighbor 172.16.0.1 remote-as 300
ITA (config-router)# network 192.168.0.0
ITA (config-router)# network 192.168.1.0
```

Step 5: Configure router filters

- a] On the TTA router, configure the following list
ITA(config)# access-list 1 permit 192.168.0.0 0.0.15.255
- b] Apply this access list as a route filter using the distribute-list keyword with the BGP neighbor statement

```
ITA(config)# router bgp 100
ITA(config-router)# neighbor 10.0.0.1 distribute-list 1 out
ITA(config-router)# neighbor 172.16.0.1 distribute-list 1 out
```

- c] Issue the clear ip bgp * command

```
ITA# clear ip bgp *
```

~~Step 6: Configure primary and backup routes using floating static routes~~

- a] ITA(config)# ip route 0.0.0.0 0.0.0.0 10.0.0.1 210
ITA(config)# ip route 0.0.0.0 0.0.0.0 172.16.0.1 210
- b] T8P1(config)# interface loopback 100
T8P1(config-if)# ip address 192.168.100.1 255.255.255.0

3

ITA # ping
protocol [ip]:

Target IP address : 192.168.100.1

Repeat count [5]:

Datagram size [100]:

TimeOut size [2]:

Extended commands [n]: y

Source address or interface : 192.168.1.1

Type of service [0]:

Set DF bit in IP header? [no]:

Validate reply data? [no]:

Data pattern [0xABCB]:

Loose, Strict, Record, Timestamp, Verbose [none]:

Swap range in sizes [n]:

Type escape sequence to abort

Sending 5, 100-byte ICMP Echos to 192.168.100.1
!!!!

~~Success rate is 100 percent~~

Step 7: Configure primary backup routes using a default network and a static route

a) remove the floating static routes

ITA (config)# no ip route 0.0.0.0 0.0.0.0 10.0.0.1 210

ITA (config)# no ip route 0.0.0.0 0.0.0.0 172.16.0.1 210

ITA# show ip route
Gateway of last resort is no set
B 192.168.100.0/24 [20/0] via 10.0.0.1, 00:02:33

ITA# show ip route
Gateway of last resort is 10.0.0.1 to network
192.168.100.0
B* 192.168.100.0/24 [20/0] via 10.0.0.1

ITA# show ip route
Gateway of last resort is 172.16.0.1 to network
0.0.0.0
S* 0.0.0.0/0 [220/0] via 172.16.0.1

ITA# show ip route
B* 192.168.100.0/24 [20/0] via 10.0.0.1

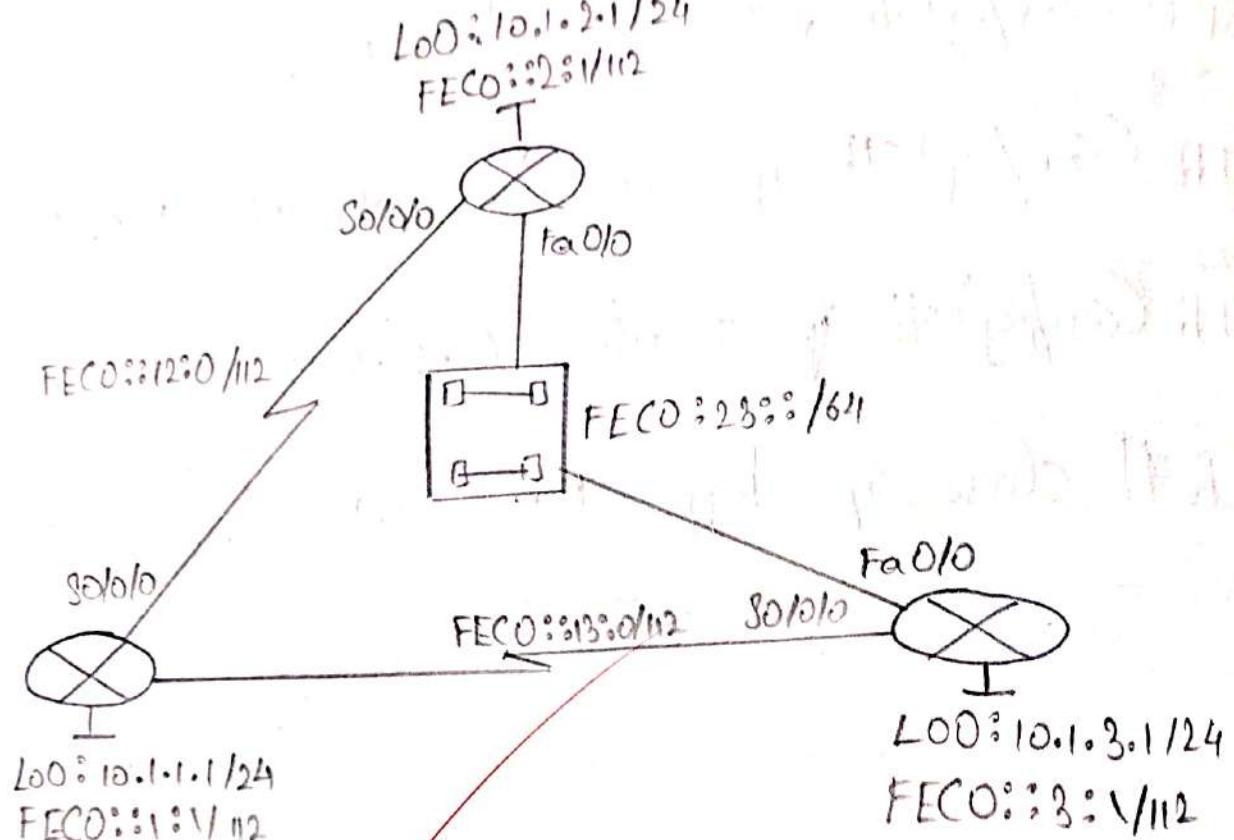
b) ISP1 (config) # router bgp 200

 # ISP1 (config) # network 192.168.100.0

c) ITA (config) # ip default-network 192.168.100.0

d) ITA (config) # ip route 0.0.0.0 0.0.0.0 172.16.0.1 220

e) ITA # clear ip bgp 10.0.0.1



Practical no. 5

IPv6

A) Configuring OSPF for IPv6

Step 1 : Configuring the hostname and loopback interfaces

R1(config)# hostname R1

R1(config)# interface lo0

R1(config-if)# ip address 10.1.2.1 255.255.255.0

R1(config-if)# ipv6 address FEC0::1:1/112

R2(config-if)# interface loopback0

R2(config-if)# ip address 10.1.2.1 255.255.255.0

R2(config-if)# ipv6 address FEC0::2:1/112

R3(config)# interface lo0

R3(config-if)# ip address 10.1.3.1 255.255.255.0

R3(config-if)# ipv6 address FEC0::3:1/112

Step 2: Configure static IPv6 addresses

R1(config)# interface s0/0/0

R1(config-if)# ipv6 address FEC0::12:1/112

R1(config-if)# clock rate 64000

R1(config-if)# bandwidth 64

R1(config-if)# no shutdown

R1# show ipv6 interface So1/0/0

IPv6 is enabled, link-local address is FE80::219:6FF:FE23:4380

R2# show ipv6 interface So1/0/0

IPv6 is enabled, link-local address is FE80::218:B9FF:FE92:2808

```
R1(config-if)# interface s0/0/1  
R1(config-if)# ipv6 address FEC0::13:1/112  
R1(config-if)# clock rate 64000  
R1(config-if)# bandwidth 64  
R1(config-if)# no shutdown
```

```
R2(config)# interface s0/0/1  
R2(config-if)# ipv6 bandwidth 64  
R2(config-if)# ipv6 address FEC0::12:2/112  
R2(config-if)# bandwidth 64  
R2(config-if)# no shutdown
```

```
R3(config)# interface s0/0/0  
R3(config)# ipv6 address FEC0::13:3/112  
R3(config)# bandwidth 64  
R3(config)# no shutdown
```

Step 3: change the link-local address on an interface

```
R1(config)# interface s0/0/0  
R1(config-if)# ipv6 address FE80::1 link-local
```

```
R2(config)# interface s0/0/0  
R2(config-if)# ipv6 address FE80::2 link-local
```

Verify the link-local addresses with the show
ipv6 interface command

R2# show ip v6 interface fastEthernet 0/0

Global unicast address (es.):

FEC0:23::218:B9FF:FE92:28D8, subnet is FEC0:23::164 [EUI]

R2# show ip v6 interface brief

FEC0:23::218:B9FF:FE92:28D8

R3# ping FEC0::218:B9FF:FE92:28D8

sending 5, 100 byte ICMP Echos

!!!!!

Success rate is 100 percent (5/5)

Step 4: Configure EUI-64 addresses

R2 (config)# interface Fa 0/0

R2 (config-if)# ipv6 address FEC0:23::164 eui-64

R2 (config-if)# no shutdown

R3 (config)# interface Fa 0/0

R3 (config-if)# ipv6 address FEC0:23::164 eui-64

R3 (config-if)# no shutdown

Step 5: Enable IPv6 routing and CEF

R1 (config)# ipv6 unicast-routing

R1 (config)# ipv6 cef

R2 (config)# ~~ipv6 unicast-routing~~

R2 (config)# ipv6 cef

Step 6: Configuring OSPFv3

R1 (config)# interface loopback 0

R1 (config)# ipv6 ospf 1 area 0

R1 (config)# interface s 0/0/0

R1 (config-if)# ipv6 ospf 1 area 0

R1 (config-if)# interface ~~s 0/0/1~~ s 0/0/1

R1 (config-if)# ipv6 ospf 1 area 0

R1# show ipv6 ospf neighbor

Neighbor ID	Pri	State
10.1.3.1	1	FULL/-
10.1.2.1	1	FULL/-

Dead Time

00:39

00:40

Interface ID

6

6

Interface

Serial 0/0/1

Serial 0/0/0

R2# show ipv6 ospf neighbor

Neighbor ID	Pri	State
10.1.3.1	1	FULL/BDR
10.1.1.1	1	FULL/-

Dead Time

00:39

00:32

Interface ID

4

6

Interface

FastEthernet 0/0

Serial 0/0/0

R3# show ipv6 ospf neighbor

Neighbor ID	Pri	State
10.1.2.1	1	FULL/BDR
10.1.1.1	1	FULL/-

Dead Time

00:39

00:39

Interface ID

4

7

Interface

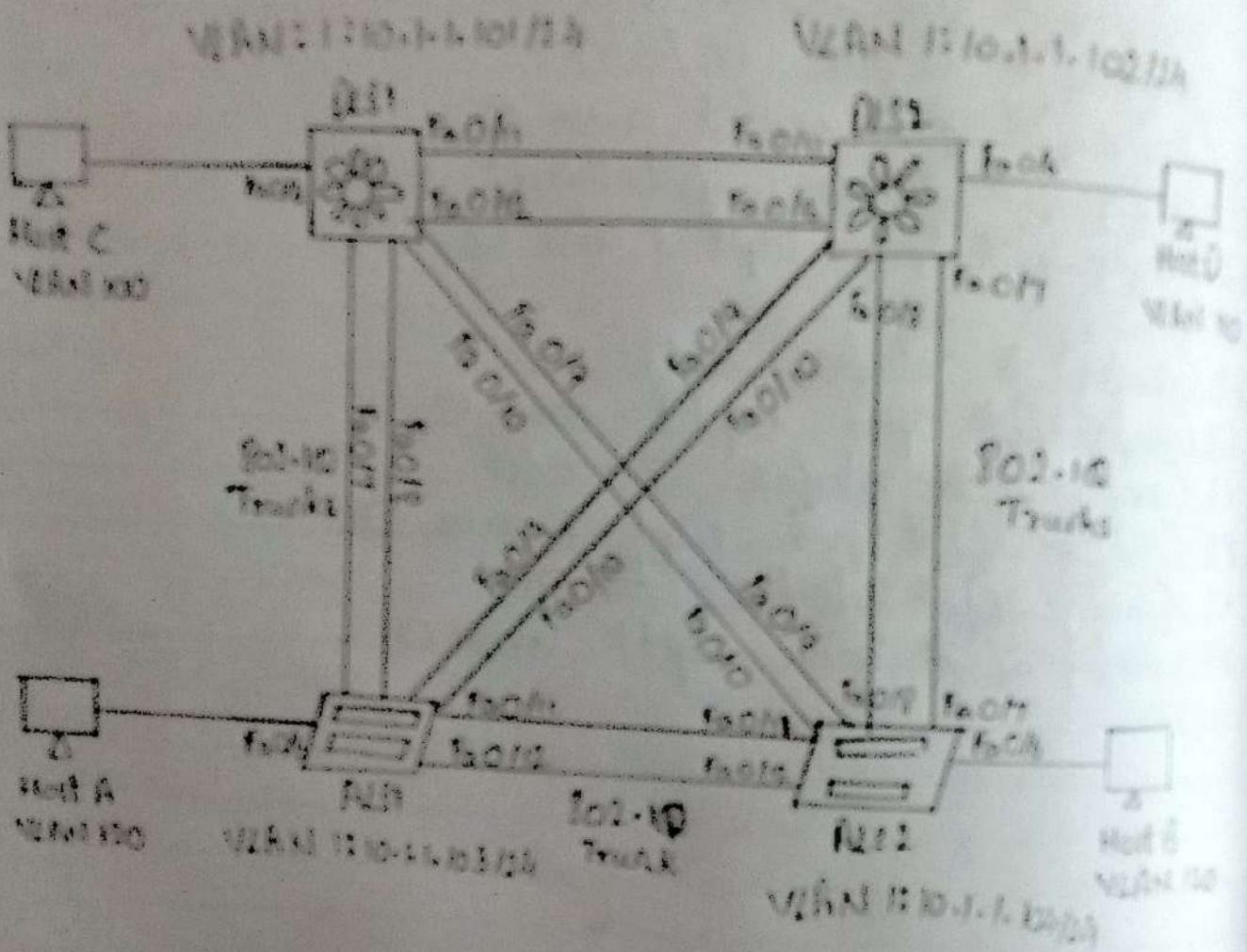
FastEthernet 0/0

Serial 0/0/0

Final
17/02/25

```
R2 (config) # interface lo0  
R2 (config-if) # ipv6 ospf 1 area 0  
R2 (config-if) # interface s0/0/0  
R2 (config-if) # ipv6 ospf 1 area 0  
R2 (config-if) # interface fastethernet 0/0  
R2 (config-if) # ipv6 ospf 1 area 0
```

```
R3 (config) # interface lo0  
R3 (config-if) # ipv6 ospf 1 area 0  
R3 (config-if) # interface s0/0/0  
R3 (config-if) # ipv6 ospf 1 area 0  
R3 (config-if) # interface fa 0/0  
R3 (config-if) # ipv6 ospf 1 area 0
```



Practical no. 6

VLANs and EtherChannel

Aim- Static VLANs , VLAN Trunking, and VTP domains and Modes

Step 1 : Configure basic switch parameters

```
DIS1(config)# interface vlan 1
DIS1(config-if)# ip address 10.1.1.101 255.255.255.0
DIS1(config-if)# no shutdown
DIS1(config)# enable secret cisco
DIS1(config)# line vty 0 4
DIS1(config-line)# password cisco
DIS1(config-line)# login
```

```
DIS2(config)# interface vlan 1
DIS2(config)# ip address 10.1.1.102 255.255.255.0
DIS2(config)# no shutdown
DIS2(config)# enable secret cisco
DIS2(config)# line vty 0 4
DIS2(config-line)# password cisco
DIS2(config-line)# login
```

```
AIS1(config)# interface vlan 1
AIS1(config-if)# ip address 10.1.1.103 255.255.255.0
AIS1(config-if)# no shutdown
```

0211# show vlns

VLAN	Area	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
1002	dot1x-default	act/func	Gi0/1, Gi0/2
1003	trunking-default	act/func	
1004	dot1x-dot1x-default	act/func	
1005	trunk-default	act/func	

013# show vtp status

Configuration Revision	VTP version	Running VTP1 (VTP2 capable)
0		
1005	0	
5		
Server		
Disabled		
Disabled		
Disabled		
x37 Or<0> Or<10> Or<65> Or<83> Or<59> Or<47> Or<80>		

```
AL31(Config)# interface vlan 1
```

```
AL31(Config-if)# ip address 10.1.1.101 255.255.255.0
```

```
AL31(Config-if)# no shutdown
```

Display the switch default VLAN information will be
show vlan command

Use the show vtp status command on any switch.

Step 2: Configure VTP on the switches

Change the VTP domain name on DLS1 to SWLAB using
the vtp domain command. If the VTP version defaults to
1 set it manually to version 2 using the vtp version
command

```
DLS1(Config)# vtp domain SWLAB
```

Changing domain name from NULL to SWLAB

```
DLS1(Config)# vtp version 2
```

```
AL31(Config)# vtp mode server
```

Device mode already VTP server

```
AL31(Config)# vtp mode client
```

Setting device to VTP CLIENT mode

ALS1# show interfaces fastEthernet 0/7 switchport

Port Fa0/7

switchport: Enabled

Administrative Trunking Encapsulation: dot1q,

Terminal Trunking Encapsulation: dot1q

Mode VLAN: 1 (default)

Protected: false

DLS1# show interfaces trunk

Port	Mode	Encapsulation	Status	Native VLAN
Fa0/7	on	802.1q	trunking	1
Fa0/8	on	802.1q	trunking	1
Fa0/9	on	802.1q	trunking	1
Fa0/10	on	802.1q	trunking	1
		102.1q	trunking	1

DLS2# show interfaces trunk

Port	Mode	Encapsulation	Status	Native VLAN
Fa0/7	on	802.1q	trunking	1
Fa0/8	on	802.1q	trunking	1
Fa0/9	auto	n-802.1q	trunking	1
Fa0/10	auto	n-802.1q	trunking	1

Step 3: Configure trunking

DL81(config)# interface range fastEthernet 0/7-10

DL81(config-if-range)# switchport trunk encapsulation dot1q

DL81(config-if-range)# switchport mode trunk

AL81(config)# interface range fastEthernet 0/7-12

AL81(config-if-range)# switchport mode trunk

DL82(config)# interface range fastEthernet 0/7-8

DL82(config-if-range)# switchport trunk encapsulation dot1q

DL82(config-if-range)# switchport mode trunk

Step 4: Verify trunk configuration

Use the show interfaces fastEthernet 0/7 switchport command on AL82

Use show interfaces trunk command on DL81

Use show interfaces trunk command on DL82

Step 5: Configure access ports

AL81(config)# interface fastEthernet 0/6

AL81(config-if)# switchport mode ?

DL81(config)# interface fastEthernet 0/6

DL81(config)# switchport mode ?

AL3# show vtp status

VTP version

Configuration Revision

Maximum VLANs supported
locally

Number of existing VLANs

VTP operating Mode

VTP Domain Mode

VTP Running Mode

VTP V2 Mode

VTP Trap Connection

Running VTP status

1

255

5

Client

SWLAB

Disabled

Enabled

Disabled

```
AL81 (config)# interface fastEthernet 0/6  
AL81 (config-if)# switchport mode access
```

~~#~~ Use the show interfaces command for fast Ethernet 0/6 to verify the configuration

Step 6: Verify VTP configuration

Before configuring the VLANs, verify the VTP configuration within the domain by using the show vtp status command

Step 7: Configure VLANs by assigning port membership

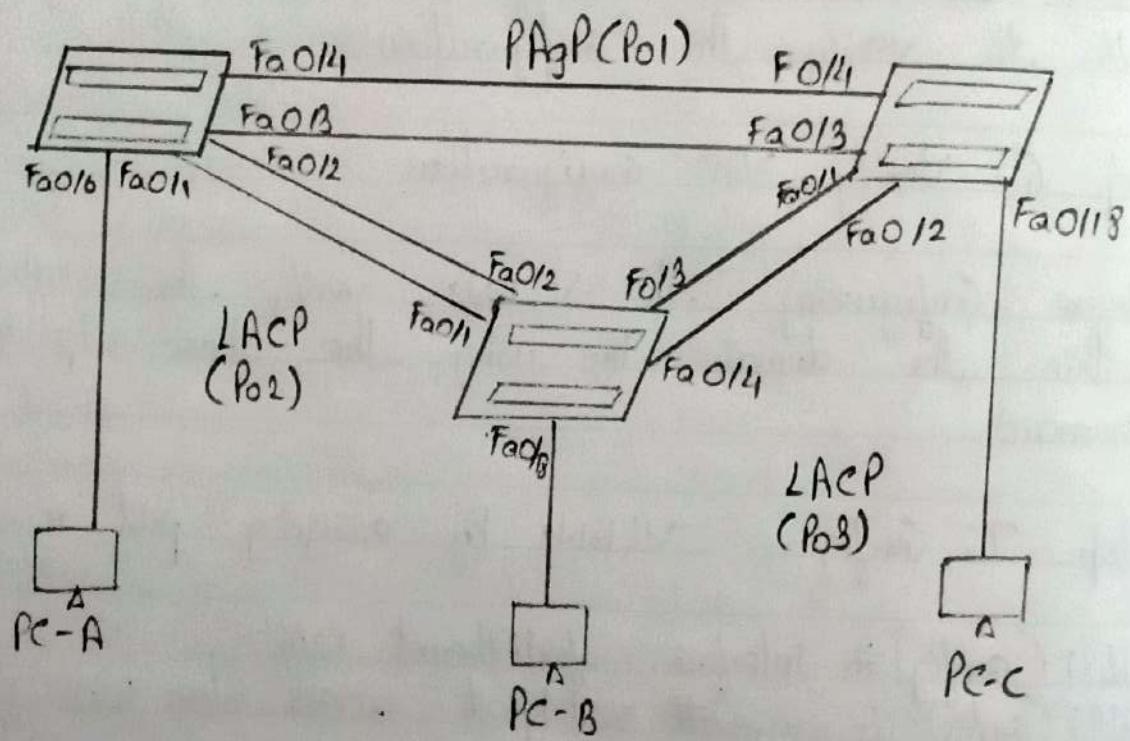
```
DL81 (config)# interface fastEthernet 0/6  
DL81 (config)-if-range# switchport access vlan 100
```

```
DL82 (config)# interface fastEthernet 0/6  
DL82 (config)# switchport mode access vlan 110
```

Step 8: Configure VLANs in configuration mode

```
DL81 (config)# vlan 120
```

```
AL81 (config)# interface fastEthernet 0/6  
AL81 (config-if)# switchport mode vlan 120  
AL82 (config)# interface fastEthernet 0/6  
AL82 (config)# switchport mode vlan 120
```



Practical no. 6 B

Aim - Configuring EtherChannel

Addressing Table

Device	Interface	IP Address	Subnet Mask
S1	VLAN 99	192.168.99.11	255.255.255.0
S2	VLAN 99	192.168.99.12	255.255.255.0
S3	VLAN 99	192.168.99.13	255.255.255.0
PC-A	NIC	192.168.10.1	255.255.255.0
PC-B	NIC	192.168.10.2	255.255.255.0
PC-C	NIC	192.168.10.3	255.255.255.0

Part 1 : Configure PAgP

Step 1: Configure PAgP on S1 and S3

S1 (config)# interface range f0/3-4

S1 (config-if-range)# channel-group 1 mode desirable

Creating a port-channel interface Port-channel 1

S1 (config-if-range)# no shutdown

S1 (config)# interface range f0/3-4

S1 (config-if-range)# channel-group 1 mode auto

Creating a port-channel interface Port-channel 1

S1 (config-if-range)# no shutdown

```
31# show run interface fa0/3  
Current configuration: 103 bytes  
!  
interface FastEthernet 0/3  
channel-group 1 mode desirable
```

```
31# show interfaces fa0/3 switchport  
Name: Fa 0/3  
Switchport: Enabled  
Administrative Mode: dynamic auto  
Operational Mode: static access (member of bundle Po1)  
Administrative Trunking Encapsulation: dot1q  
Operational Trunking Encapsulation: native
```

```
31# show etherchannel summary  
Number of channel-groups in use: 1  
Number of aggregators: 1
```

Group	Port-channel	Protocol	Ports
1	Po1 (su)	PAgP	Fa 0/3 (P) Fa 0/4 (P)

Step 2: Examine the Configuration on the ports

~~s1# show run int~~
we the show interfaces command on both s1 and s3

Step 3: Verify that the Ports have been aggregated

Step 4: Configure trunk ports

s1(config)# interface port-channel 1

s1(config-if)# switchport mode trunk

s1(config-if)# switchport mode trunk native vlan 99

s3(config)# interface port-channel 1

s3(config)# switchport mode trunk

s3(config)# switchport trunk native vlan 99

Part 2: Configure LACP

Step 1: Configure LACP between s1 and s2

s1(config)# interface range f0/1-2

s1(config-if-range)# switchport mode trunk

s1(config-if-range)# switchport trunk native vlan 99

s1(config-if-range)# channel-graph 2 mode active

s1(config-if-range)# no shutdown

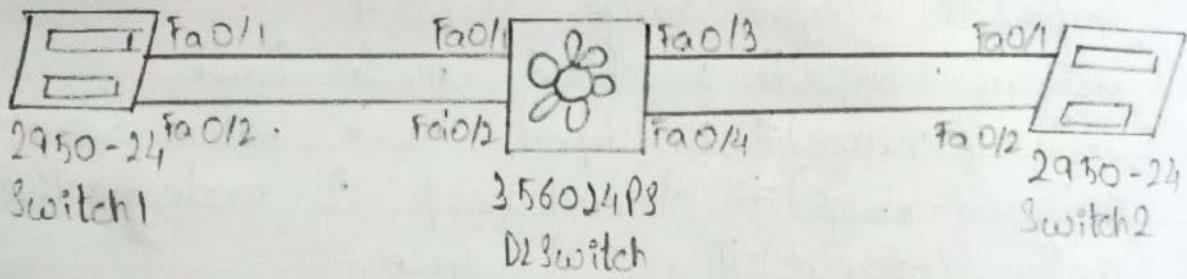
```
92(config)# interface range fo1/1-2  
92(config-if-range)# switchport mode trunk  
92(config-if-range)# switchport trunk native vlan 99  
92(config-if-range)# channel-group 2 mode passive  
92(config-if-range)# no shutdown
```

Step 2: Configure LACP between 92 and 93

```
92(config)# interface range fo1/3-4  
92(config-if-range)# switchport mode trunk  
92(config-if-range)# switchport trunk native vlan 99  
92(config-if-range)# channel-group 3 mode active  
92(config-if-range)# no shutdown
```

```
93(config)# interface range fo1/1-2  
93(config-if-range)# switchport mode trunk  
93(config-if-range)# switchport trunk native vlan 99  
93(config-if-range)# channel-group 3 mode passive  
93(config-if-range)# no shutdown
```

Step 3: Verify end-to-end connectivity



Practical no. 7

Spanning Tree Protocol

Spanning Tree Protocol (STP) Default Behavior

- Step 1: Delete the vlan.dat database file, power cycle and enable the startup configuration on each switch before configuring the switches
- Step 2: Issue the reload command. Cable and configure the switches with hostname, enable password and console security
- Step 3: Use cross-over cables to make the connections so the switches are like devices. After the cables are connected and the switch detects the redundant links, spanning tree will be initiated.
- Step 4: Verify STP with the show spanning-tree command on the D18 switch

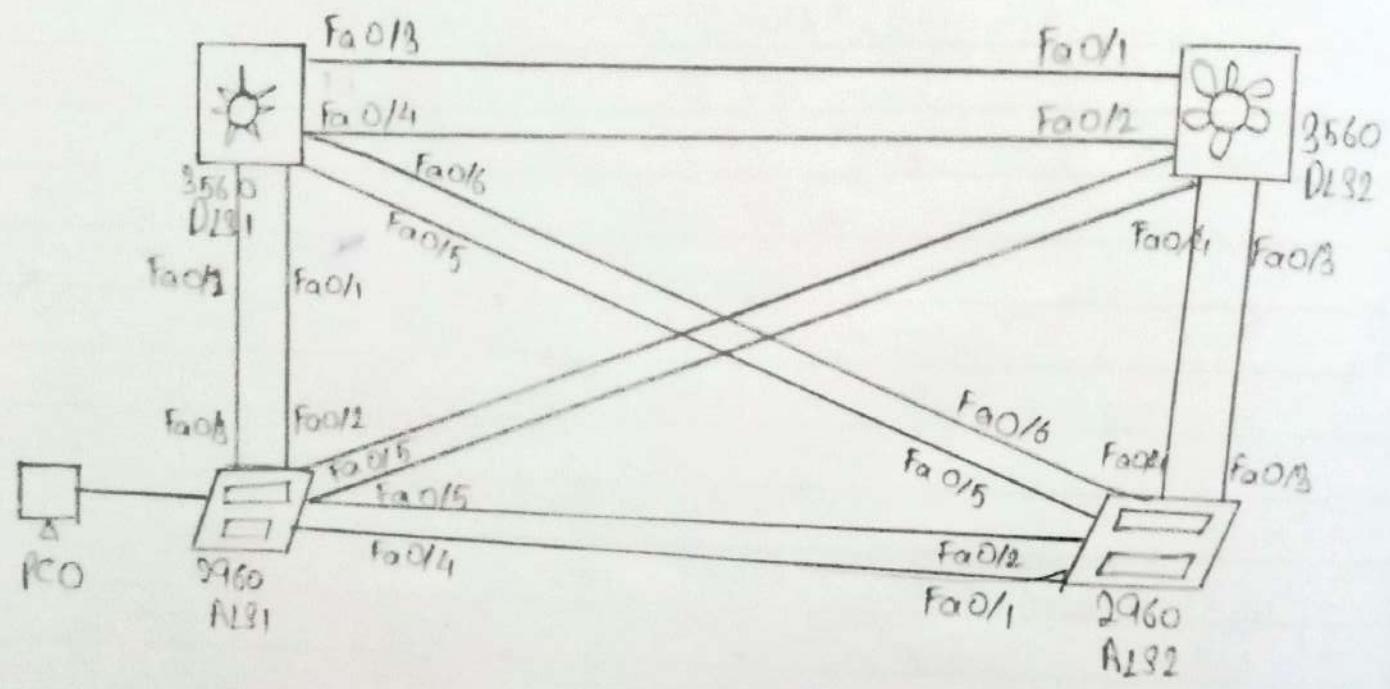
DLSwitch# show spanning-tree

VLAN 0001

Spanning tree enabled protocol ieee
Root ID Priority 32769
Address 0001.6413.0E15
This bridge is the root
Hello Time 2 sec Max Age 20 sec
Forward delay 15 sec

Bridge ID Priority 32769
Address 0001.6413.0E15
Hello Time 2 sec Max Age 20 sec
Forward delay 20 sec

Interface Aging time 20
Role Sts Cost Prio. Nbr Type
Fa 0/1 Desg FWD 19 128.1 P2p
Fa 0/2 Desg FWD 19 128.2 P2p
Fa 0/3 Desg FWD 19 128.3 P2p
Fa 0/4 Desg FWD 19 128.4 P2p



Modifying Default Spanning Tree Behavior

Step 1: Configure Ports Fa 0/1 through Fa 0/6 on all switches
↓ to be trunk

D181# conf t

D181(config)# interface range fa 0/1-6

D181(config-if-range)# switchport range fastEthernet 0/1-6

D181(config-if-range)# switchport mode trunk

Step 2: Display default spanning tree information for all switches

Step 3: Configure a specific switches to be primary and secondary root

D182# debug spanning-tree events

D181#(config)# spanning-tree vlan 1 root primary

A181#(config)# spanning-tree vlan 1 root secondary

View the priority modification with the show spanning-tree command

DL81# show spanning-tree

VLAN 0001

Spanning tree enabled protocol ieee

Root ID Priority 32769

Bridge ID Priority 32769

DL82# show spanning-tree

VLAN 0001

Spanning-tree enabled protocol ieee

Root ID Priority 32769

Bridge ID Priority 32769

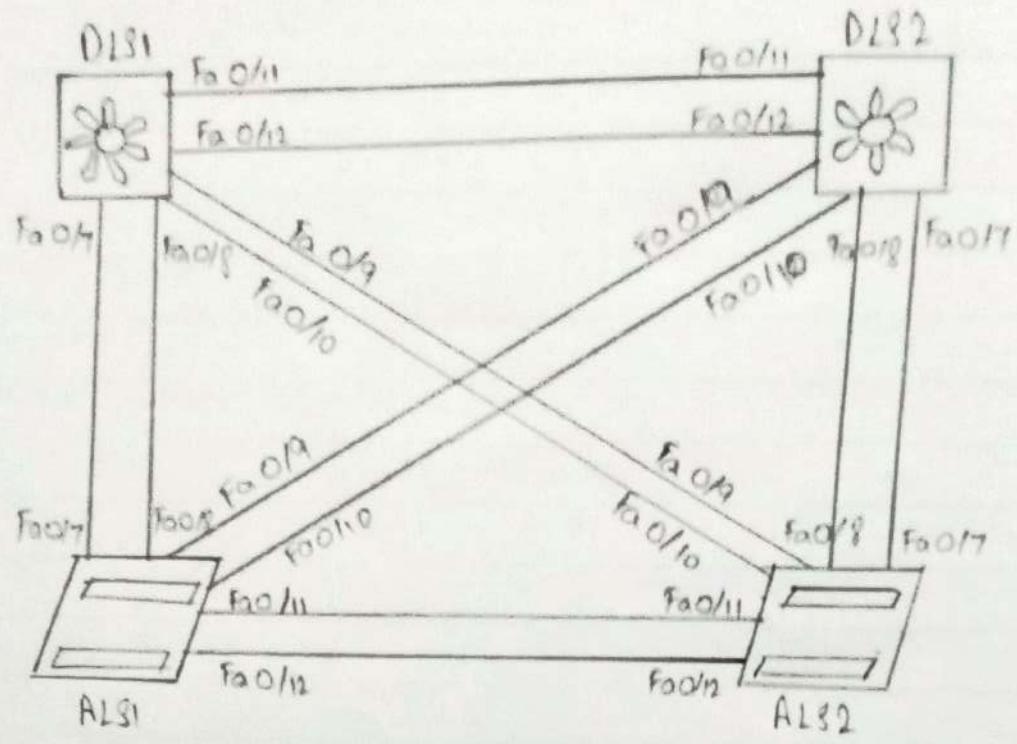
DL81# show spanning-tree

VLAN 0001

Spanning tree enabled protocol ieee

Root ID Priority 24577

Bridge ID Priority 24577



Factical 8

VLAN and Spanning Tree

A) Per-VLAN Spanning Tree Behavior

Step 1: Configure ports Fa 0/7 through Fa 0/12 on all switches to be trunk

D181(config)# interface range fastEthernet 0/7-12

D181(config-if-range)# switchport trunk encapsulation dot1q

D181(config-if-range)# switchport mode trunk

Step 2: Configure VTP

D181(config)# vtp mode transparent

D181(config)# vtp domain CISCO

D181(config)# vlan 10,20

D181(config)# end

~~D181~~

Step 3: Assign a root switch for each VLAN

D181(config)# spanning-tree vlan 10 priority 4096

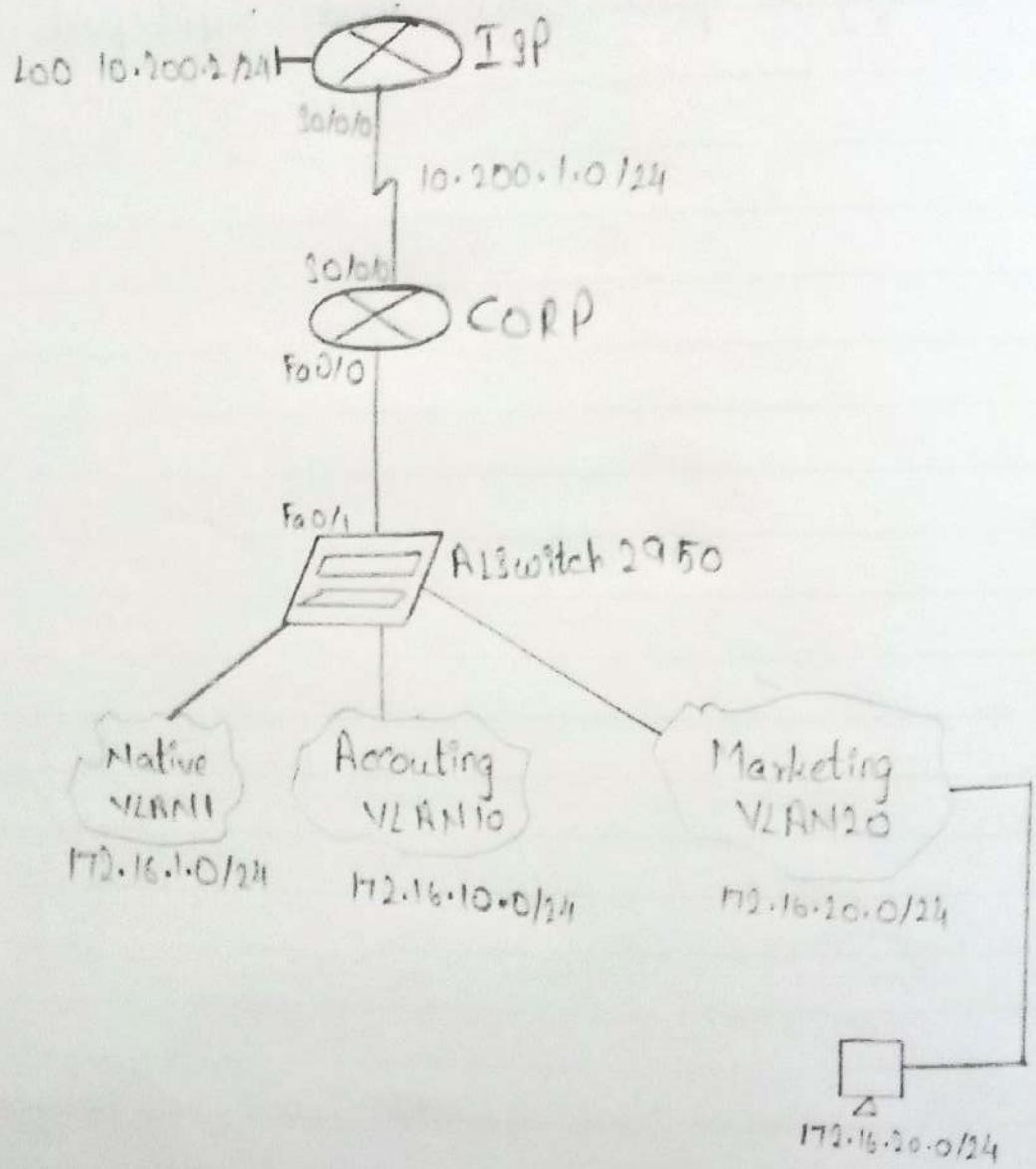
D182(config)# spanning-tree vlan 20 priority 4096

D181# show spanning-tree
Spanning tree enabled protocol ieee

D181# show spanning-tree
Spanning-tree enabled protocol rstp

Step 4: Configure RSTP

D181(config)# spanning-tree mode rapid-pvst



Practical no. 9
Internal VLAN Routing

A) Inter-VLAN Routing with an External Router

VTP Domain	VTP Mode
CORP	Server

VLAN ID	VLAN Name	VLAN Subnet	VLAN Gateway	Switch Ports
1	Native	172.16.1.0	172.16.1.1/24	Fa 0/1-4 13/24
10	Accounting	172.16.10.0	172.16.10.1/24	Fa 0/5-8
20	Accounting	172.16.20.0	172.16.20.1/24	Fa 0/9-12
Trunk				802.1Q

Interface	IP Address	VLAN
Fa 0/0.1	172.16.1.1	1 Native
Fa 0/0.10	172.16.10.1	10
Fa 0/0.20	172.16.20.1	20
Serial 0/0	10.200.1.2	

Step 1: Configure ISP for communication with CORP router

```

ISP(config)# interface loopback 0
ISP(config-if)# ip address 10.200.1.1 255.255.255.0
ISP(config)# interface serial 0/0/0
ISP(config)# ip address 10.200.1.1 255.255.255.0
ISP(config)# clockrate 56000

```

```
CORP(config)# interface Serial 0/0/0  
CORP(config-if)# ip address 10.200.1.2 255.255.255.0  
CORP(config-if)# no shutdown  
CORP(config)# ip route 10.200.2.0 255.255.0 10.200.1.1  
CORP(config)# exit
```

Step 2 : set the duplex mode to full to enable the interface

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

```
CORP(config)# interface fa 0/0/1  
CORP(config-subif)# description Management VLAN1  
CORP(config-subif)# encapsulation dot1q 1 native  
CORP(config-subif)# ip address 172.16.1.1 255.255.255.0
```

```
CORP(config)# interface fa 0/0/10  
CORP(config-subif)# description Accounting VLAN10  
CORP(config-subif)# encapsulation dot1q 10  
CORP(config-subif)# ip address 172.16.10.1 255.255.255.0
```

```
CORP(config)# interface fa 0/0/20  
CORP(config-subif)# description Marketing VLAN20  
CORP(config-subif)# encapsulation dot1q 20  
CORP(config-subif)# ip address 172.16.20.1 255.255.255.0
```

PC

C:\> ping 172.16.20.1

pinging 172.16.20.1

Reply from 172.16.20.1: bytes = 32, time = 18ms TTL = 117

Reply from 172.16.20.1: bytes = 32, time = 18ms TTL = 117

Reply from 172.16.20.1: bytes = 32, time = 18ms TTL = 117

Reply from 172.16.20.1: bytes = 32, time = 18ms TTL = 117

Packet: sent = 4, Received = 4, lost = 0 (0% loss)

C:\> ping 10.200.1.1

Ping 10.200.1.1

Reply from 10.200.1.1: bytes = 32, time = 18ms TTL = 117

Reply from 10.200.1.1: bytes = 32, time = 18ms TTL = 117

Reply from 10.200.1.1: bytes = 32, time = 18ms TTL = 117

Reply from 10.200.1.1: bytes = 32, time = 18ms TTL = 117

Packet: sent = 4, Received = 4, lost = 0 (0% loss)

Step 3: Configure the hostname, password and Telnet access for the switch

A18switch (config)# interface VLAN 1

A18switch (config-if)# ip address 172.16.1.2 255.255.255.0

A18switch (config-if)# no shutdown

A18switch (config-if)# exit

A18switch (config)# ip default-gateway 172.16.1.1

Step 4: Configure the switch for trunking and assign VLANs. Set the interface connected to the router to trunk the router

A18switch (config)# interface fa0/1

A18switch (config-if)# switchport mode trunk

A18switch (config)# interface range fastEthernet 0/5-8

A18switch (config-if)# switchport access vlan 10

A18switch (config-if)# spanning-tree portfast

A18switch (config-if)# interface range fastEthernet 0/9-12

A18switch (config-if)# switchport access vlan 20

A18switch (config-if)# spanning-tree portfast

Step 6: Verify