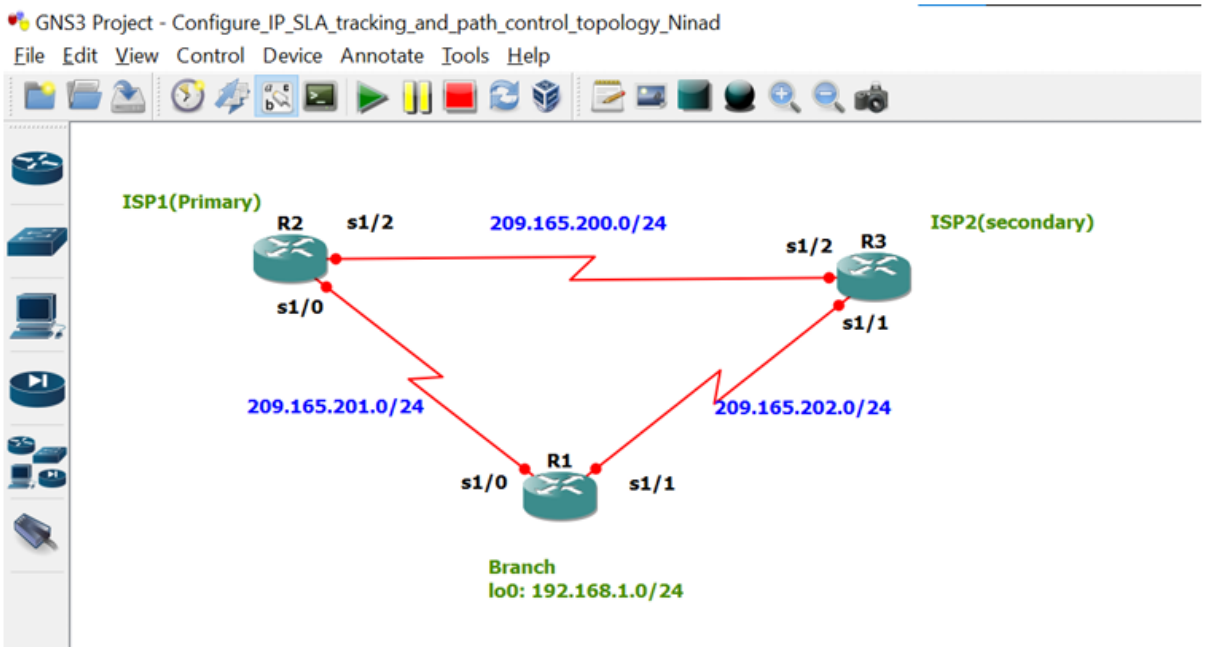
# Prc 1 MN

**Configure IP SLA tracking and path control topology.**




Take 3 routers -> Configure -> slots -> NM-4T

**Task 1: Configure IP SLA using GNS3 On router 1 console**

conf t

int s1/0

ip add 209.165.201.1 255.255.255.0

no sh

int s1/1

ip add 209.165.202.1 255.255.255.0

no sh

int lo0

ip add 192.168.1.1 255.255.255.0

do sh ip int br | include up

**On router 2 console**

conf t

int s1/0

ip add 209.165.201.2 255.255.255.0

no sh

int s1/2

ip add 209.165.200.2 255.255.255.0

no sh

do sh ip int br | include up

**On router 3 console**

conf t

int s1/1

ip add 209.165.202.3 255.255.255.0

no sh

int s1/2

ip add 209.165.200.3 255.255.255.0

no sh

do sh ip int br | include up

**Task 2: Configure static routing on branch router and dynamic routing using eigrp**

**On router 1 console**

conf t

ip route 0.0.0.0 0.0.0.0 209.165.201.2

**On router 2 console**

router eigrp 1

network 209.165.200.0 0.0.0.255

network 209.165.201.0 0.0.0.255

no auto-summary

**On router 3 console**

router eigrp 1

network 209.165.200.0 0.0.0.255

network 209.165.202.0 0.0.0.255

no auto-summary

**On router 2 console**

exit

ip route 192.168.1.0 255.255.255.0 209.165.201.1

**On router 3 console**

exit

ip route 192.168.1.0 255.255.255.0 209.165.202.1

**Ping other routers**

For R1: do ping 209.165.200.3

For R2: do ping 209.165.201.1

**Ping other routers**

For R2:  do ping 192.168.1.1

For R3:  do ping 192.168.1.1

**Give hostname**

R1(config) # hostname r1-branch

R2(config) # hostname r2-isp1

R3(config) # hostname r3-isp2

**Task 3: Configure IP SLA probes at branch router**

**On router 1 console**

ip sla 11

icmp-echo 209.165.201.2

frequency 10

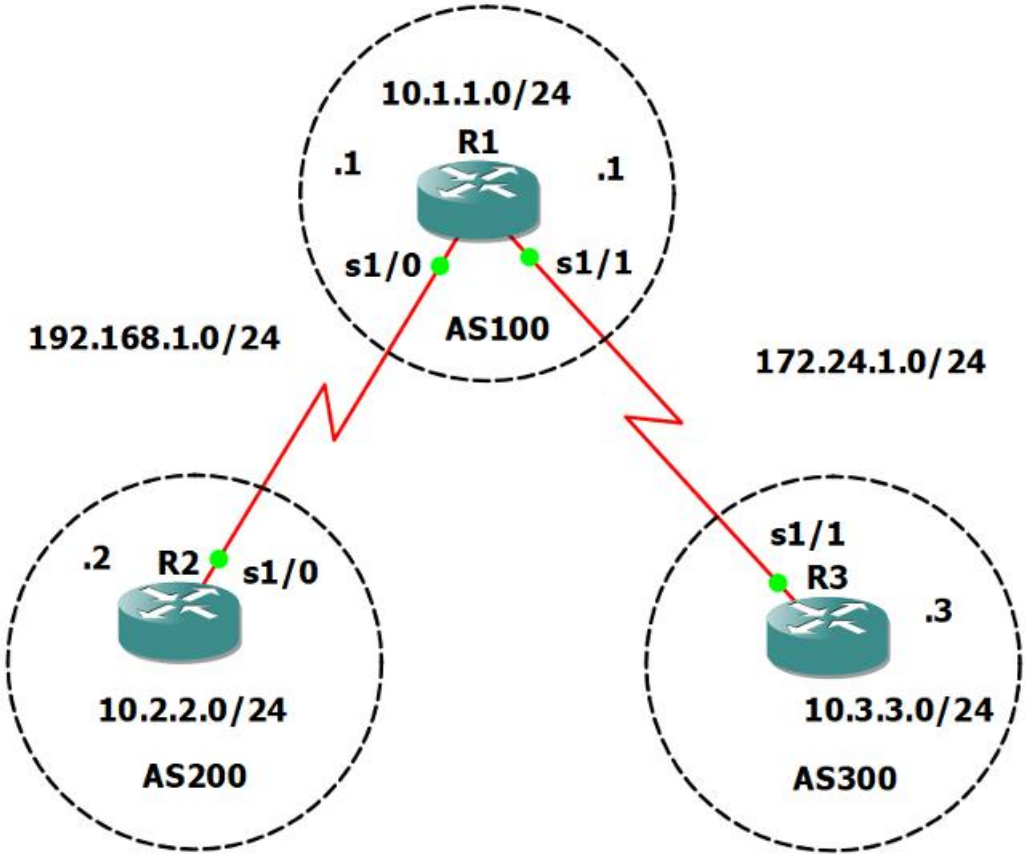
exit

ip sla schedule 11 life forever start-time now

do sh ip sla configuration 11

# Prc 2 MN

**Implementation of BGP using AS_path attribute.**




Take 3 routers -> Configure -> slots -> NM-4T

**R1 Console**

conf t

int s1/0

ip add 192.168.1.1 255.255.255.0

no sh int s1/1

ip add 172.24.1.1 255.255.255.0

no sh

**R2 Console**

conf t

int s1/0

ip add 192.168.1.2 255.255.255.0

no sh

**R3 Console**

conf t

int s1/1

ip add 172.24.1.3 255.255.255.0

no sh

**To add loopback address ,On Router console type following commands one by one.**

**R1 Console**

int lo0

ip add 10.1.1.1 255.255.255.0

**R2 Console**

int lo0

ip add 10.2.2.2 255.255.255.0

**R3 Console**

int lo0

ip add 10.3.3.3 255.255.255.0

**To add bgp protocol, On Router console type following commands one by one.**

**R1 Console**

router bgp 100

neighbor 192.168.1.2 remote-as 200

neighbor 172.24.1.3 remote-as 300

network 10.1.1.0 mask 255.255.255.0

**R2 Console**

router bgp 200

neighbor 192.168.1.1 remote-as 100

network 10.2.2.0 mask 255.255.255.0

**R3 Console**

router bgp 300

neighbor 172.24.1.1 remote-as 100

network 10.3.3.0 mask 255.255.255.0

**To show ip route type following command in each router console**

do sh ip route

**To verify output type following commands: (OUTPUT)**

**R2**

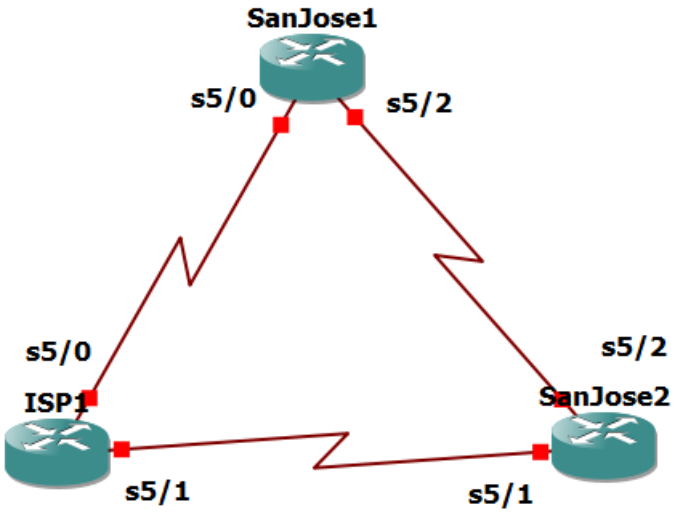
do ping 10.3.3.3 source lo0

**R3**

do ping 10.2.2.2 source lo0

# Prc 3 MN

## Practical 3: Configuring IBGP and EBGP Sessions, Local Preference, and MED




**put this step in each router**
no ip domain-lookup
line con 0
logging synchronous
exec-timeout 0 0

**R1**
conf t
interface Loopback0
ip address 192.168.100.1 255.255.255.0
exit
interface Serial5/0
ip address 192.168.1.5 255.255.255.252
clock rate 128000
no shutdown
exit
interface Serial5/1
ip address 192.168.1.1 255.255.255.252
no shutdown
end

**R2**
conf t
interface Loopback0
ip address 172.16.64.1 255.255.255.0
exit
interface Serial5/0
ip address 192.168.1.6 255.255.255.252
no shutdown
exit
interface Serial5/2
ip address 172.16.1.1 255.255.255.0
clock rate 128000
no shutdown
end

**R3**
conf t
interface Loopback0
ip address 172.16.32.1 255.255.255.0
exit
interface Serial5/1
ip address 192.168.1.2 255.255.255.252
clock rate 128000
no shutdown
exit
interface Serial5/2
ip address 172.16.1.2 255.255.255.0
no shutdown
end

**R1**
router eigrp 1
network 172.16.0.0

**R2**
router eigrp 1
network 172.16.0.0

**R2**
router bgp 64512
neighbor 172.16.32.1 remote-as 64512
neighbor 172.16.32.1 update-source lo0

**R2**
router bgp 64512
neighbor 172.16.64.1 remote-as 64512
neighbor 172.16.64.1 remote-as 64512

**R3**
show ip bgp neighbors

**R1**
router bgp 200
neighbor 192.168.1.6 remote-as 64512
neighbor 192.168.1.2 remote-as 64512
network 192.168.100.0

**R2**
ip route 172.16.0.0 255.255.0.0 null0

**R2**
router bgp 64512
neighbor 192.168.1.5 remote-as 200
network 172.16.0.0
**R2**
SanJose1# show ip bgp neighbors
**R3**

ip route 172.16.0.0 255.255.0.0 null0
router bgp 64512
neighbor 192.168.1.1 remote-as 200
network 172.16.0.0

**r3**
show ip bgp summary

**R1**
clear ip bgp *
**R1**
ping 172.16.64.1
**R1**
ping 172.16.1.1
**R1**
ping 172.16.32.1
**R1**
ping 172.16.1.2

**R1**
show ip bgp
**R1**
show ip bgp

**R1**
ping 172.16.1.1 source 192.168.100.1
ping 172.16.32.1 source 192.168.100.1
ping 172.16.1.2 source 192.168.100.1
ping 172.16.64.1 source 192.168.100.1

**R1**
ping
Target IP address: 172.16.64.1

**Extended commands [n]: y**

Source address or interface: 192.168.100.1

**R1**
router bgp 200
network 192.168.1.0 mask 255.255.255.252
network 192.168.1.4 mask 255.255.255.252

**R1**
show ip bgp

**R3**
show ip route

**R1**
router bgp 200
no network 192.168.1.0 mask 255.255.255.252
no network 192.168.1.4 mask 255.255.255.252
exit
interface serial5/1
shutdown

**R3**
show ip bgp
show ip route

**R2**

router bgp 64512
neighbor 172.16.32.1 next-hop-self

**R3**
router bgp 64512
neighbor 172.16.64.1 next-hop-self

**R2**
clear ip bgp *
**R3**
clear ip bgp *

**R3**
show ip bgp
show ip route

**R1**
no shutdown

**R3**
show ip route

**R2**
route-map PRIMARY_T1_IN permit 10
set local-preference 150
exit
router bgp 64512
neighbor 192.168.1.5 route-map PRIMARY_T1_IN in

**R3**
route-map SECONDARY_T1_IN permit 10
set local-preference 125
exit
router bgp 64512
neighbor 192.168.1.1 route-map SECONDARY_T1_IN in

**R2**
SanJose1# clear ip bgp * soft
**R3**
SanJose2# clear ip bgp * soft

**R2**
SanJose1# show ip bgp

**R3**
SanJose2# show ip bgp

**R1**
show ip bgp
show ip route
SanJose2# ping
Target IP address: 192.168.100.1

**Extended commands [n]: y**
Source address or interface: 172.16.32.1
Loose, Strict, Record, Timestamp, Verbose[none]: record

**R2**
route-map PRIMARY_T1_MED_OUT permit 10
set Metric 50
exit
router bgp 64512
neighbor 192.168.1.5 route-map PRIMARY_T1_MED_OUT out

**R3**
route-map SECONDARY_T1_MED_OUT permit 10
set Metric 75
exit
router bgp 64512
neighbor 192.168.1.1 route-map SECONDARY_T1_MED_OUT out

**R2**
clear ip bgp * soft
**R3**
clear ip bgp * soft
**R2**
show ip bgp
**R3**
show ip bgp

**R3**
ping
Target IP address: 192.168.100.1

**Extended commands [n]: y**

Source address or interface: 172.16.32.1

**R1**
show ip bgp
router bgp 200
neighbor 192.168.1.6 default-originate
neighbor 192.168.1.2 default-originate
exit
interface loopback 10
ip address 10.0.0.1 255.255.255.0

**R2**
show ip route
**R3**
show ip route

**R3**
show ip bgp
traceroute 10.0.0.1

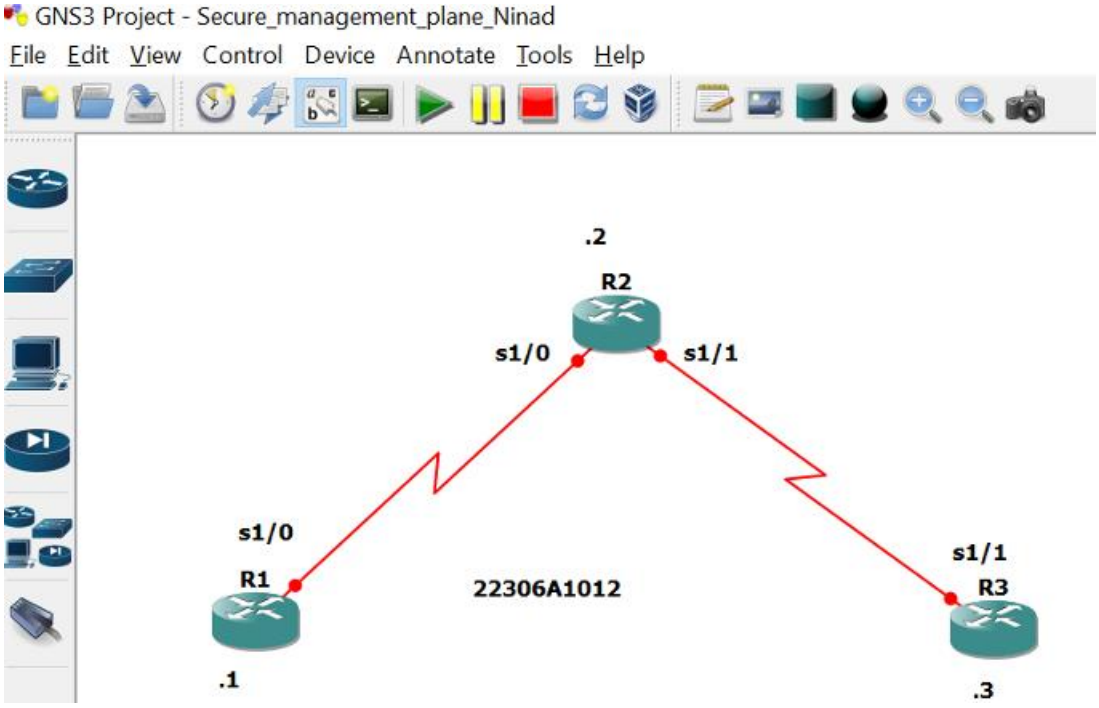
**R1**
interface serial 5/0
shutdown

**R2**
show ip route
**R3**
show ip route

**R2**
trace 10.0.0.1

# Prc 4 MN

**Secure management plane.**




Take 3 routers -> Configure -> slots -> NM-4T

**R1 Console**

conf t

int s1/0

ip add 10.1.1.1 255.255.255.0

no sh

int lo0

ip add 192.168.1.1 255.255.255.0

**R2 Console**

conf t

int s1/0

ip add 10.1.1.2 255.255.255.0

no sh

int s1/1

ip add 10.2.2.2 255.255.255.0

no sh

**R3 Console**

conf t

int s1/1

ip add 10.2.2.3 255.255.255.0

no sh

int lo0

ip add 192.168.3.3 255.255.255.0

**Part 2 : Routing**

**R1 Console**

exit

ip route 0.0.0.0 0.0.0.0 10.1.1.2

**R2 Console**

exit

ip route 192.168.1.0 255.255.255.0 10.1.1.1

ip route 192.168.3.0 255.255.255.0 10.2.2.3

**R3 Console**

exit

ip route 0.0.0.0 0.0.0.0 10.2.2.2

**Ping**

**R1 Console**

do ping 192.168.3.3

**R3 Console**

do ping 192.168.1.1

**Part 3: Security Management Access**

**R1 Console**

hostname r1

security password min-length 10

enable secret class12345

line console 0

password ciscoconpass

exec-timeout 5 0

login

logging synchronous

exit

line vty 0 4

password ciscovtypass

exec-timeout 5 0

login

exit

line aux 0

no exec

end

conf t

service password-encryption

banner motd $Unauthorized access not allowed$

exit

**R3 Console ( Same as R1)**

hostname r3

security password min-length 10

enable secret class12345

line console 0

password ciscoconpass

exec-timeout 5 0

login

logging synchronous

exit

line vty 0 4

password ciscovtypass

exec-timeout 5 0

login

exit

line aux 0

no exec

end

conf t

service password-encryption

banner motd $Unauthorized access not allowed$

exit

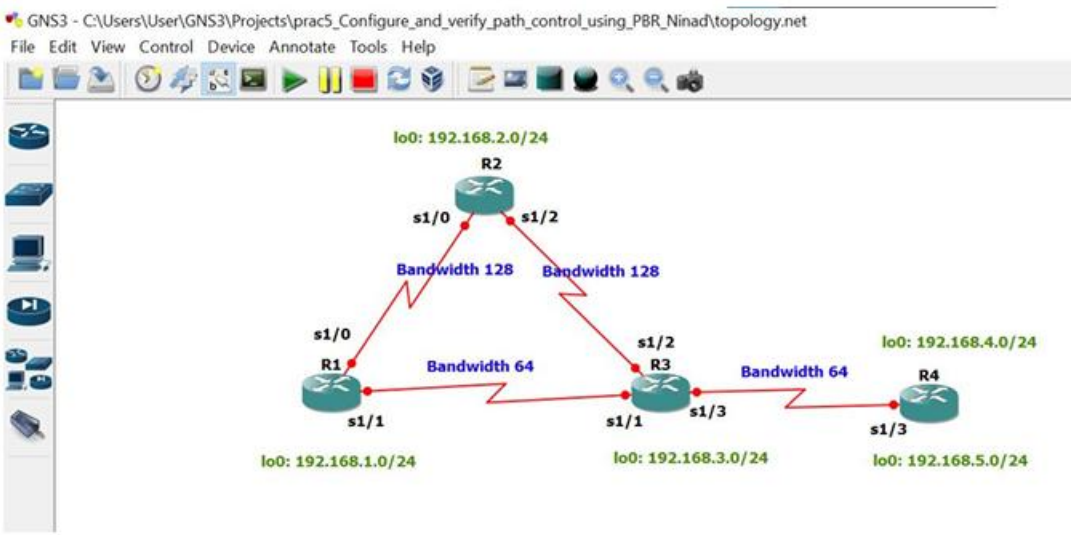
**R3 Console**

telnet 10.1.1.1

(password-> ciscovtypass)

# Prc 5 MN

**Configure and Verify Path Control**




Take 4 routers -> Configure -> slots -> NM-4T

## STEP 1: Perform IP configuration

### On router 1 console

conf t

hostname r1

int s1/0

ip add 172.16.12.1 255.255.255.0

bandwidth 128

no sh

int s1/1

ip add 172.16.13.1 255.255.255.0

bandwidth 64

no sh

int lo0

ip add 192.168.1.1 255.255.255.0

do sh ip int br | include up

**On router 2 console**

conf t

hostname r2

int s1/0

ip add 172.16.12.2 255.255.255.0

bandwidth 128

no sh

int s1/2

ip add 172.16.23.2 255.255.255.0

bandwidth 128

no sh

int lo0

ip add 192.168.2.2 255.255.255.0

do sh ip int br | include up

**On router 3 console**

conf t

hostname r3

int s1/1

ip add 172.16.13.3 255.255.255.0

bandwidth 64

no sh

int s1/2

ip add 172.16.23.3 255.255.255.0

bandwidth 128

no sh

int s1/3

ip add 172.16.34.3 255.255.255.0

bandwidth 64

no sh

int lo0

ip add 192.168.3.3 255.255.255.0

r3(config-if)#do sh ip int br | include up

**On router 4 console**

conf t

hostname r4

int s1/3

ip add 172.16.34.4 255.255.255.0

bandwidth 64

no sh

int lo0

ip add 192.168.4.1 255.255.255.0

int lo1

ip add 192.168.4.1 255.255.255.0

ip add 192.168.5.1 255.255.255.0

do sh ip int br | include up

**STEP 2 : Configure eigrp on all routers**

**On router 1 console**

router eigrp 1

network 172.16.12.0 0.0.0.255

network 172.16.13.0 0.0.0.255

network 192.168.1.0

no auto-summary

**On router 2 console**

router eigrp 1

network 172.16.12.0 0.0.0.255

network 172.16.23.0 0.0.0.255

network 192.168.2.0

no auto-summary

**On router 3 console**

router eigrp 1

network 172.16.13.0 0.0.0.255

network 172.16.13.0 0.0.0.255

network 172.16.23.0 0.0.0.255

network 172.16.34.0 0.0.0.255

network 192.168.3.0

no auto-summary

**On router 4 console**

router eigrp 1

network 172.16.34.0 0.0.0.255

network 192.168.4.0

network 192.168.5.0

no auto-summary

**STEP 3: Command on all routers**

do sh ip route

do ping 192.168.1.1

do ping 192.168.4.1

**R4**

do traceroute 192.168.1.1 source 192.168.4.1

do traceroute 192.168.1.1 source 192.168.5.1

**On router 3 console**

ip access-list standard pbr-acl

permit 192.168.5.0 0.0.0.255

exit

route-map r3-to-r1 permit

match ip address pbr-acl

set ip next-hop 172.16.13.1

exit

int s1/3

ip policy route-map r3-to-r1

end

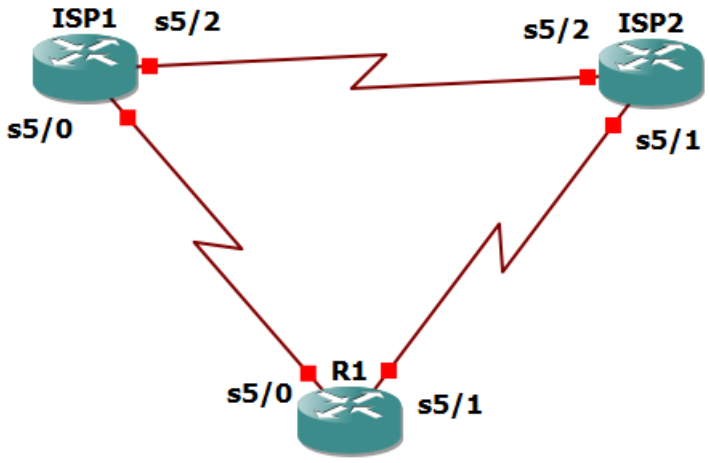
**On router 4 console**

do traceroute 192.168.1.1 source 192.168.4.1

do traceroute 192.168.1.1 source 192.168.5.1

# Prc 6 MN

## Practical 6: Configure IP SLA Tracking and Path Control with gateway




**Router R1**

config
interface Loopback 0
 description R1 LAN
 ip address 192.168.1.1 255.255.255.0

interface Serial5/0
 description R1 --> ISP1
 ip address 209.165.201.2 255.255.255.252
 clock rate 128000
 bandwidth 128
 no shutdown

interface Serial5/1
 description R1 --> ISP2
 ip address 209.165.202.130 255.255.255.252
 bandwidth 128
 no shutdown

**Router (R2)**

config
interface Loopback0
 description Simulated Internet Web Server
 ip address 209.165.200.254 255.255.255.255

```
interface Loopback1
 description ISP1 DNS Server
 ip address 209.165.201.30 255.255.255.255

interface Serial5/0
 description ISP1 --> R1
 ip address 209.165.201.1 255.255.255.252
 bandwidth 128
 no shutdown

interface Serial5/2
 description ISP1 --> ISP2
 ip address 209.165.200.225 255.255.255.252
 clock rate 128000
 bandwidth 128
 no shutdown
```

**Router (R3)**

```
config
interface Loopback0
 description Simulated Internet Web Server
 ip address 209.165.200.254 255.255.255.255

interface Loopback1
 description ISP2 DNS Server
 ip address 209.165.202.158 255.255.255.255

interface Serial5/1
 description ISP2 --> R1
 ip address 209.165.202.129 255.255.255.252
 clock rate 128000
 bandwidth 128
 no shutdown

interface Serial5/2
 description ISP2 --> ISP1
 ip address 209.165.200.226 255.255.255.252
 bandwidth 128
 no shutdown
```

**Router (R1)**
show interfaces description | include up
**Router (R1)**
ip route 0.0.0.0 0.0.0.0 209.165.201.1

**Router (R2)**
router eigrp 1
network 209.165.200.224 0.0.0.3
network 209.165.201.0 0.0.0.31
no auto-summary
exit

**Router (R2)**
router eigrp 1
ip route 192.168.1.0 255.255.255.0 209.165.201.2

**Router (R3)**
router eigrp 1
network 209.165.200.224 0.0.0.3
network 209.165.202.128 0.0.0.31
no auto-summary
exit

**Router (R3)**
ip route 192.168.1.0 255.255.255.0 209.165.202.130

**Router (R1)**
tclsh
foreach address {
209.165.200.254
209.165.201.30
209.165.202.158
} {
ping $address source 192.168.1.1
}

**R1**
foreach address {
209.165.200.254
209.165.201.30
209.165.202.158
} {
trace $address source 192.168.1.1

}

**Router (R1)**
ip sla 11
icmp-echo 209.165.201.30
frequency 10
exit

**Router (R1)**
ip sla schedule 11 life forever start-time now

**Router (R1)**
ip sla configuration 11

**Router (R1)**
show ip sla statistics

**Router (R1)**
ip sla 22
icmp-echo 209.165.202.158
frequency 10
exit

**Router (R1)**
ip sla schedule 22 life forever start-time now
end

**Router (R1)**
show ip sla configuration 22

**Router (R1)**
show ip sla configuration 22

**Router (R1)**
show ip sla statistics 22

**Router (R1)**
no ip route 0.0.0.0 0.0.0.0 209.165.201.1
ip route 0.0.0.0 0.0.0.0 209.165.201.1 5
exit

**Router (R1)**
show ip route | begin Gateway

**Router (R1)**
track 1 ip sla 11 reachability
delay down 10 up 1
exit

**Router (R1)**
debug ip routing

**Router (R1)**
ip route 0.0.0.0 0.0.0.0 209.165.201.1 2 track 1

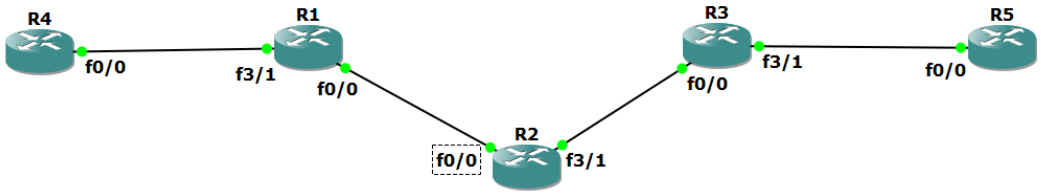
**Router (R1)**
track 2 ip sla 22 reachability
delay down 10 up 1
exit

**Router (R1)**
ip route 0.0.0.0 0.0.0.0 209.165.202.129 3 track 2

**Router (R1)**
show ip route | begin Gateway
**Router (R2)**
config
interface serial5/0
ISP1(config-if)# int lo1
shutdown
**Router (R1)**
show ip route | begin Gateway
**Router (R1)**
show ip sla statistics
**Router (R1)**
trace 209.165.200.254 source 192.168.1.1
**Router (R2)**
no shutdown
**Router (R1)**
show ip sla statistics
**Router (R1)**
show ip route | begin Gateway

# Prc 7 MN

## Practical 7: Configuring Basic MPLS Using OSPF




**R1**
conf t
hostname R1
int lo0
ip add 1.1.1.1 255.255.255.255
ip ospf 1 area 0
int f0/0
ip add 10.0.0.1 255.255.255.0
no shut
ip ospf 1 area 0

**R2**
hostname R2
int lo0
ip add 2.2.2.2 255.255.255.255
ip ospf 1 are 0
int f0/0
ip add 10.0.0.2 255.255.255.0
no shut
ip ospf 1 area 0
int f3/1
ip add 10.0.1.2 255.255.255.0
no shut
ip ospf 1 area 0

**R3**
hostname R3
int lo0
ip add 3.3.3.3 255.255.255.255
ip ospf 1 are 0

int f0/0
ip add 10.0.1.3 255.255.255.0
no shut
ip ospf 1 area 0

**R1**
ping 3.3.3.3 source lo0

**R1**
conf t
router ospf 1
mpls ldp autoconfig

**R2**
conf t
router ospf 1
mpls ldp autoconfig

**R3**
conf t
router ospf 1
mpls ldp autoconfig

**R2#**
sh mpls interface

**R2#**
sh mpls ldp neigh

**R1#**
trace 3.3.3.3

**R1#**
conf t
router bgp 1
neighbor 3.3.3.3 remote-as 1
neighbor 3.3.3.3 update-source Loopback0
no auto-summary
!
address-family vpnv4
neighbor 3.3.3.3 activate

**R3#**

conf t
router bgp 1
neighbor 1.1.1.1 remote-as 1
neighbor 1.1.1.1 update-source Loopback0
no auto-summary
!
address-family vpnv4
neighbor 1.1.1.1 activate

**R1#**
sh bgp vpnv4 unicast all summary

**R4**
int lo0
ip add 4.4.4.4 255.255.255.255
ip ospf 2 area 2
int f0/0
ip add 192.168.1.4 255.255.255.0
ip ospf 2 area 2
no shut

**R1**
conf t
int f3/1
no shut
ip add 192.168.1.1 255.255.255.0

**R1**
conf t
ip vrf RED
rd 4:4
route-target both 4:4

**R1**
conf t
int f3/1
ip vrf forwarding RED

**R1**
ip vrf fo

**R1**
ip vrf forwarding RED

**R1**
conf t
int f3/1
ip address 192.168.1.1 255.255.255.0

**R1#**
sh run int f3/1

**R1#**
sh ip route

**R1#**
sh ip route vrf red

**R1#**
sh ip route vrf RED

**R1**
conf t
int f3/1
ip ospf 2 area 2

**R1#**
sh ip route vrf RED

**R5**
conf t
int lo0
ip add 6.6.6.6 255.255.255.255
ip ospf 2 area 2
int f0/0
ip add 192.168.2.6 255.255.255.0
ip ospf 2 area 2
no shut

**R3**
conf t
int f3/1
no shut
ip add 192.168.2.3 255.255.255.0

**R3**

conf t
ip vrf RED
rd 4:4
route-target both 4:4

**R3**
conf t
int f3/1
ip vrf forwarding RED

**R3**
ip vrf forwarding RED

**R3**
conf t
int f3/1
ip address 192.168.2.1 255.255.255.0

**R3#**
sh run int f3/1

**R3**
conf t
int f3/1
ip ospf 2 area 2

**R3#**
sh ip route vrf RED

**R4#**
sh ip route

**R1#**
sh ip route

**R1#**
sh ip route vrf RED

**R1**
conf t
router bgp 1
address-family ipv4 vrf RED
redistribute ospf 2

**R3**
conf t
router bgp 1
address-family ipv4 vrf RED
redistribute ospf 2

**R1#**
sh ip bgp vpnv4 vrf RED

**R3#**
sh ip bgp vpnv4 vrf RED

**R1**
conf t
router ospf 2
redistribute bgp 1 subnets

**R3**
conf t
router ospf 2
redistribute bgp 1 subnets

**R4#**
sh ip route

**R5#**
sh ip route

**R4#**
ping 6.6.6.6

**R4#**
trace 6.6.6.6