Name: Aizaz Ali Qureshi
ID: 0318959

AS-200

R- 201

```
interface lo
ip address 5.2.0.1/16
ip address 5.255.0.2/32

interface eth0
ip address 10.0.12.1/30

interface eth1
ip address 10.0.15.1/30

router ospf
router-id 5.255.0.2
network 5.2.0.0/16 area 1
network 5.255.0.2/32 area 1
network 10.0.12.0/30 area 1
network 10.0.15.0/30 area 1

router bgp 200
network 5.2.0.0/16
neighbor 5.255.0.4 remote-as 200
neighbor 5.255.0.4 update-source 5.255.0.2
neighbor 5.255.0.4 next-hop-self
neighbor 10.0.12.2 remote-as 100
neighbor 10.0.15.2 remote-as 200
!
address-family ipv4
neighbor 10.0.15.2 activate
exit-address-family
```

R- 202

```
interface lo
ip address 5.4.0.1/16
ip address 5.255.0.4/32
```

```
interface eth0
ip address 5.4.0.10/30

interface eth1
ip address 10.0.15.2/30

router ospf
router-id 5.255.0.4
network 5.4.0.0/16 area 1
network 5.255.0.4/32 area 1
network 10.0.15.0/30 area 1
network 5.4.0.8/30 area 1


router bgp 200
network 5.4.0.0/16
neighbor 5.255.0.2 remote-as 200
neighbor 5.255.0.2 update-source 5.255.0.4
neighbor 5.255.0.2 next-hop-self
neighbor 10.0.15.1 remote-as 200
!
address-family ipv4
neighbor 10.0.15.1 activate
exit-address-family
```

R-203

```
sysctl -w net.ipv4.ip_forward=1
ip addr add 20.0.0.1/24 dev eth1
ip addr add 5.4.0.9/30 dev eth0
ip route add default via 5.4.0.10
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
echo 1 > /proc/sys/net/ipv4/ip_forward

export LAN=eth1
export WAN=eth0

# Flush existing rules
iptables -F
iptables -t nat -F

# Set the default policies
iptables -P INPUT DROP
iptables -P FORWARD DROP
iptables -P OUTPUT ACCEPT
```

```
iptables -A INPUT -m state --state ESTABLISHED -j ACCEPT
iptables -A FORWARD -m state --state ESTABLISHED -j ACCEPT

iptables -A INPUT -p icmp -j ACCEPT
iptables -A FORWARD -p icmp -j ACCEPT
iptables -A FORWARD -i $LAN -o $WAN -j ACCEPT

# Perform dynamic NAT for outgoing connections
iptables -t nat -A POSTROUTING -o $WAN -j MASQUERADE

iptables -A FORWARD -i $LAN -p tcp --dport 80 -j ACCEPT
iptables -A FORWARD -i $LAN -p tcp --dport 443 -j ACCEPT
iptables -A FORWARD -i $LAN -p tcp --dport 22 -j ACCEPT
iptables -A FORWARD -i $LAN -p udp --dport 53 -j ACCEPT

# Enable IP forwarding in the kernel
echo 1 > /proc/sys/net/ipv4/ip_forward
```

AS-100

R - 101

```
interface lo
ip address 2.2.0.1/16
ip address 2.255.0.2/32

interface eth0
ip address 10.0.12.2/30

interface eth2
ip address 10.0.24.1/30

router ospf
router-id 2.255.0.2
network 2.2.0.0/16 area 0
network 2.255.0.2/32 area 0
network 10.0.24.0/30 area 0
network 10.0.12.0/30 area 0


router bgp 100
network 2.2.0.0/16
neighbor 2.255.0.4 remote-as 100
neighbor 2.255.0.4 update-source 2.255.0.2
neighbor 2.255.0.4 next-hop-self
neighbor 2.255.0.5 remote-as 100
neighbor 2.255.0.5 update-source 2.255.0.2
```

```
neighbor 2.255.0.5 next-hop-self
neighbor 10.0.12.1 remote-as 200
!
address-family ipv4 unicast
neighbor 2.255.0.4 next-hop-self
neighbor 2.255.0.5 next-hop-self
exit-address-family


# in vi /etc/sysctl.conf (put down command in this file)

net.mpls.conf.lo.input = 1
net.mpls.conf.eth2.input = 1
net.mpls.platform_labels = 100000

# actual MPLS

mpls ldp
router-id 2.255.0.2
ordered-control
address-family ipv4
discovery transport-address 2.255.0.2
interface eth2
interface lo
```

R- 103

```
interface lo
ip address 2.5.0.1/16
ip address 2.255.0.5/32

interface eth1
ip address 10.0.45.2/30


interface eth2
ip address 10.0.35.2/30

router ospf
router-id 2.255.0.5
network 2.5.0.0/16 area 0
network 2.255.0.5/32 area 0
network 10.0.45.0/30 area 0
network 10.0.35.0/30 area 0
```

```
router bgp 100
network 2.5.0.0/16
neighbor 2.255.0.2 remote-as 100
neighbor 2.255.0.2 update-source 2.255.0.5
neighbor 2.255.0.2 next-hop-self
neighbor 2.255.0.4 remote-as 100
neighbor 2.255.0.4 update-source 2.255.0.5
neighbor 2.255.0.4 next-hop-self
neighbor 10.0.35.1 remote-as 300
!
address-family ipv4 unicast
neighbor 2.255.0.4 next-hop-self
neighbor 2.255.0.2 next-hop-self
exit-address-family

# in vi /etc/sysctl.conf (put down command in this file)

net.mpls.conf.lo.input = 1
net.mpls.conf.eth1.input = 1
net.mpls.platform_labels = 100000

mpls ldp
router-id 2.255.0.5
ordered-control
address-family ipv4
discovery transport-address 2.255.0.5
interface eth1
interface lo
```

R-102

```
interface lo
ip address 2.4.0.1/16
ip address 2.255.0.4/32
interface eth0
ip address 10.0.24.2/30
interface eth1
ip address 10.0.45.1/30

router ospf
router-id 2.255.0.4
network 2.4.0.0/16 area 0
network 2.255.0.4/32 area 0
network 10.0.24.0/30 area 0
network 10.0.45.0/30 area 0

router bgp 100
network 2.4.0.0/16
```

```
neighbor 2.255.0.2 remote-as 100
neighbor 2.255.0.2 update-source 2.255.0.4
neighbor 2.255.0.2 next-hop-self
neighbor 2.255.0.5 remote-as 100
neighbor 2.255.0.5 update-source 2.255.0.4
neighbor 2.255.0.5 next-hop-self
!
address-family ipv4 unicast
neighbor 2.255.0.5 next-hop-self
neighbor 2.255.0.2 next-hop-self
exit-address-family



# in vi /etc/sysctl.conf (put down command in this file)


net.mpls.conf.lo.input = 1
net.mpls.conf.eth0.input = 1
net.mpls.conf.eth1.input = 1
net.mpls.platform_labels = 100000

mpls ldp
router-id 2.255.0.4
ordered-control
address-family ipv4
discovery transport-address 2.255.0.4
interface eth0
interface eth1
interface lo
```

AS – 300

R – 301

```
interface lo
ip address 3.2.0.1/16
ip address 3.255.0.2/32
interface eth0
ip address 10.0.35.1/30
interface eth1
ip address 10.0.37.1/30

router ospf
router-id 3.255.0.2
network 3.2.0.0/16 area 3
```

```
network 3.255.0.2/32 area 3
network 10.0.35.0/30 area 3
network 10.0.37.0/30 area 3

router bgp 300
network 3.2.0.0/16
neighbor 3.255.0.4 remote-as 300
neighbor 3.255.0.4 update-source 3.255.0.2
neighbor 3.255.0.4 next-hop-self
neighbor 10.0.35.2 remote-as 100
neighbor 10.0.37.2 remote-as 300
!
address-family ipv4
neighbor 10.0.37.2 activate
neighbor 10.0.37.2 next-hop-self
neighbor 10.0.35.2 activate
neighbor 10.0.35.2 next-hop-self

exit-address-family
```

R-302

```
interface lo
ip address 3.4.0.1/16
ip address 3.255.0.4/32
interface eth0
ip address 10.0.37.2/30

interface eth1
ip address 3.4.0.10/24


interface eth2
ip address 10.0.41.2/30

router ospf
router-id 3.255.0.4
network 3.4.0.0/16 area 3
network 3.255.0.4/32 area 3
network 10.0.37.0/30 area 3
network 10.0.41.0/30 area 3
network 3.4.0.0/24 area 3


router bgp 300
network 3.4.0.0/16
```

```
network 10.0.37.0/30
neighbor 3.255.0.2 remote-as 300
neighbor 3.255.0.2 update-source 3.255.0.4
neighbor 3.255.0.2 next-hop-self
neighbor 10.0.41.1 remote-as 400
neighbor 10.0.37.1 remote-as 300
!
address-family ipv4
neighbor 10.0.37.1 activate
neighbor 10.0.37.1 next-hop-self
neighbor 10.0.41.1 activate
neighbor 10.0.41.1 next-hop-self
exit-address-family
```

AS – 400

R – 401

```
interface lo
ip address 4.2.0.1/16
ip address 4.255.0.2/32
interface eth2
ip address 10.0.41.1/30

interface eth0
ip address 4.2.0.10/24

router ospf
router-id 4.255.0.2
network 4.2.0.0/16 area 4
network 4.255.0.2/32 area 4
network 10.0.41.0/30 area 4
network 4.2.0.0/24 area 4

router bgp 400
network 4.2.0.0/16
neighbor 10.0.41.2 remote-as 300
!
address-family ipv4
neighbor 10.0.41.2 activate
neighbor 10.0.41.2 next-hop-self
exit-address-family
```

GW-300 # Server

```
sysctl -w net.ipv4.ip_forward=1
ip addr add 3.4.0.9/24 dev eth0
ip addr add 10.0.31.1/30 dev eth1
iptables -F  # Flush existing iptables rules
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
echo 1 > /proc/sys/net/ipv4/ip_forward
ip route add default via 3.4.0.10
10.0.31.0/30 dev eth1 proto kernel scope link src 10.0.31.1

cd /usr/share/easy-rsa/
./easyrsa init-pki
./easyrsa build-ca nopass
# Provide a Common Name (eg: your user, host, or server name)
[Easy-RSA CA]:OVPN_PRO_CA

Generate certificate & key for server and clients

./easyrsa build-server-full server nopass
./easyrsa build-client-full client1 nopass
./easyrsa build-client-full client2 nopass

./easyrsa gen-dh


root@GW-300:~/CA/server# cat server.ovpn
port 1194
proto udp
dev tun
ca ca.crt
cert server.crt
key server.key
dh dh.pem
server 192.168.100.0 255.255.255.0
push "route 40.0.0.0 255.255.255.0"
push "route 10.0.31.0 255.255.255.252"
route 40.0.0.0 255.255.255.0
client-config-dir ccd
client-to-client
keepalive 10 120
cipher AES-256-GCM
```

R-402 # Client2

```
sysctl -w net.ipv4.ip_forward=1
ip addr add 40.0.0.1/24 dev eth1
ip addr add 4.2.0.9/24 dev eth0
ip route add default via 4.2.0.10
iptables -t nat -A POSTROUTING -o eth0 -j MASQUERADE
echo 1 > /proc/sys/net/ipv4/ip_forward


root@R-402:~/ovpn# cat client2.ovpn
client
dev tun
proto udp
remote 3.4.0.9 1194
resolv-retry infinite
ca ca.crt
cert client2.crt
key client2.key
remote-cert-tls server
cipher AES-256-GCM
```

CLIENT-200 # client1

```
ip addr add 20.0.0.100/24 dev eth0
ip route add default via 20.0.0.1


root@client-200:~/ovpn# cat client1.ovpn
client
dev tun
proto udp
remote 3.4.0.9 1194
resolv-retry infinite
ca ca.crt
cert client1.crt
key client1.key
remote-cert-tls server
cipher AES-256-GCM
```

CLIENT-400

```
ip addr add 40.0.0.100/24 dev eth0
ip route add default via 40.0.0.1
```

DC-NETWORK VXLAN/EVPN

Leaf-1

```
net add bridge bridge ports swp3,swp4
net add interface swp3 bridge access 10
net add interface swp4 bridge access 20

net add interface swp1 ip add 10.1.1.1/30
net add interface swp2 ip add 10.1.2.1/30
net add interface swp6 ip add 10.0.31.2/30
net add loopback lo ip add 1.1.1.1/32



net add ospf router-id 1.1.1.1
net add ospf network 10.1.1.0/30 area 9
net add ospf network 10.1.2.0/30 area 9
net add ospf network 1.1.1.1/32 area 9
net add ospf network 10.0.31.0/30 area 9
net add ospf passive-interface swp3,swp4


net add vxlan vni100 vxlan id 100
net add vxlan vni100 vxlan local-tunnelip 1.1.1.1
net add vxlan vni100 bridge access 10

net add vxlan vni200 vxlan id 200
net add vxlan vni200 vxlan local-tunnelip 1.1.1.1
net add vxlan vni200 bridge access 20

net add bgp autonomous-system 65001
net add bgp router-id 1.1.1.1
net add bgp neighbor swp1 remote-as 65000
net add bgp neighbor swp2 remote-as 65000
net add bgp evpn neighbor swp1 activate
net add bgp evpn neighbor swp2 activate
net add bgp evpn advertise-all-vni

net add vlan 10 ip address 10.0.0.254/24
net add vlan 20 ip address 10.1.1.254/24
```

```
net add vlan 50
net add vxlan vni-1020 vxlan id 1020
net add vxlan vni-1020 vxlan local-tunnelip 1.1.1.1
net add vxlan vni-1020 bridge access 50
net add vrf TEN1 vni 1020
net add vlan 50 vrf TEN1
net add vlan 10 vrf TEN1
net add vlan 20 vrf TEN1
ip route add default via 10.0.31.1
```

Leaf-2

```
net add bridge bridge ports swp3,swp4
net add interface swp3 bridge access 10
net add interface swp4 bridge access 20

net add interface swp1 ip add 10.2.1.1/30
net add interface swp2 ip add 10.2.2.1/30
net add loopback lo ip add 2.2.2.2/32

net add ospf router-id 2.2.2.2
net add ospf network 10.2.1.0/30 area 9
net add ospf network 10.2.2.0/30 area 9
net add ospf network 2.2.2.2/32 area 9
net add ospf passive-interface swp3,swp4


net add vxlan vni100 vxlan id 100
net add vxlan vni100 vxlan local-tunnelip 2.2.2.2
net add vxlan vni100 bridge access 10

net add vxlan vni200 vxlan id 200
net add vxlan vni200 vxlan local-tunnelip 2.2.2.2
net add vxlan vni200 bridge access 20

net add bgp autonomous-system 65002
net add bgp router-id 2.2.2.2
net add bgp neighbor swp1 remote-as 65000
net add bgp neighbor swp2 remote-as 65000
net add bgp evpn neighbor swp1 activate
net add bgp evpn neighbor swp2 activate
```

```
net add bgp evpn advertise-all-vni

net add vlan 10 ip address 10.0.0.254/24
net add vlan 20 ip address 10.1.1.254/24
net add vlan 50 ip address 10.0.31.1/30
net add vxlan vni-1020 vxlan id 1020
net add vxlan vni-1020 vxlan local-tunnelip 1.1.1.1
net add vxlan vni-1020 bridge access 50
net add vrf TEN1 vni 1020
net add vlan 50 vrf TEN1
net add vlan 10 vrf TEN1
net add vlan 20 vrf TEN1
```

Spine-1

```
net add interface swp1 ip add 10.1.1.2/30
net add interface swp2 ip add 10.2.1.2/30
net add loopback lo ip add 4.4.4.4/32

net add ospf router-id 4.4.4.4
net add ospf network 0.0.0.0/0 area 9

net add bgp autonomous-system 65000
net add bgp router-id 4.4.4.4
net add bgp neighbor swp1 remote-as external
net add bgp neighbor swp2 remote-as external
net add bgp evpn neighbor swp1 activate
net add bgp evpn neighbor swp2 activate
net add bgp evpn neighbor swp3 activate
```

Spine-2

```
net add interface swp1 ip add 10.1.2.2/30
net add interface swp2 ip add 10.2.2.2/30
net add loopback lo ip add 5.5.5.5/32

net add ospf router-id 5.5.5.5
net add ospf network 0.0.0.0/0 area 9
```

```
net add bgp autonomous-system 65000
net add bgp router-id 5.5.5.5
net add bgp neighbor swp1 remote-as external
net add bgp neighbor swp2 remote-as external
net add bgp evpn neighbor swp1 activate
net add bgp evpn neighbor swp2 activate
```

A1

```
ip addr add 10.0.0.1/24 dev eth0
ip route add default via 10.0.0.254
```

B1

```
ip addr add 10.1.1.1/24 dev eth0
ip route add default via 10.1.1.254
```

A2

```
ip addr add 10.0.0.2/24 dev eth0
ip route add default via 10.0.0.254
```

B2

```
ip addr add 10.1.1.2/24 dev eth0
ip route add default via 10.1.1.254
```