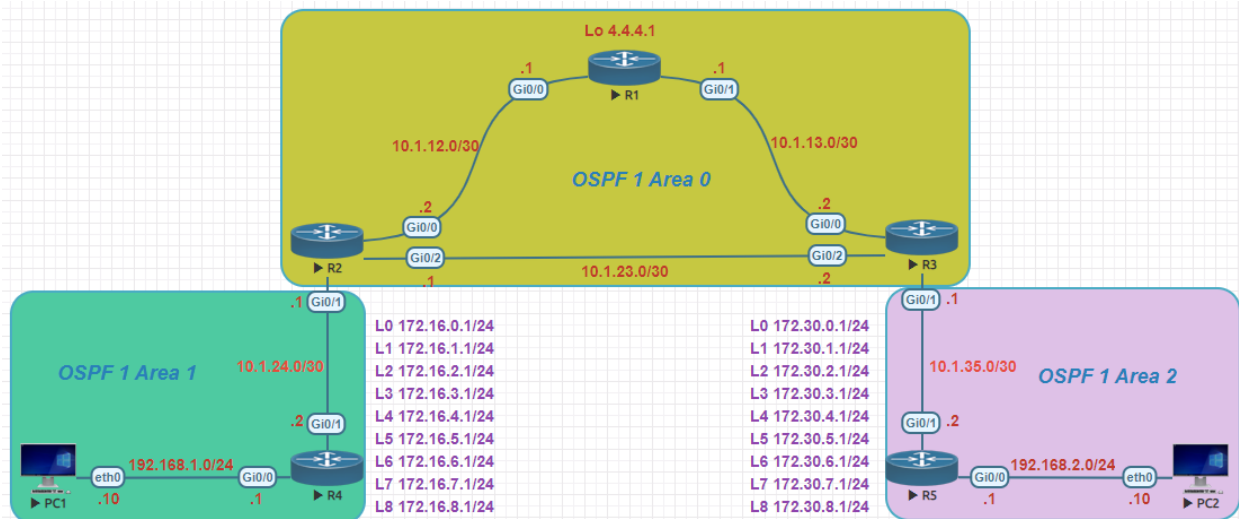
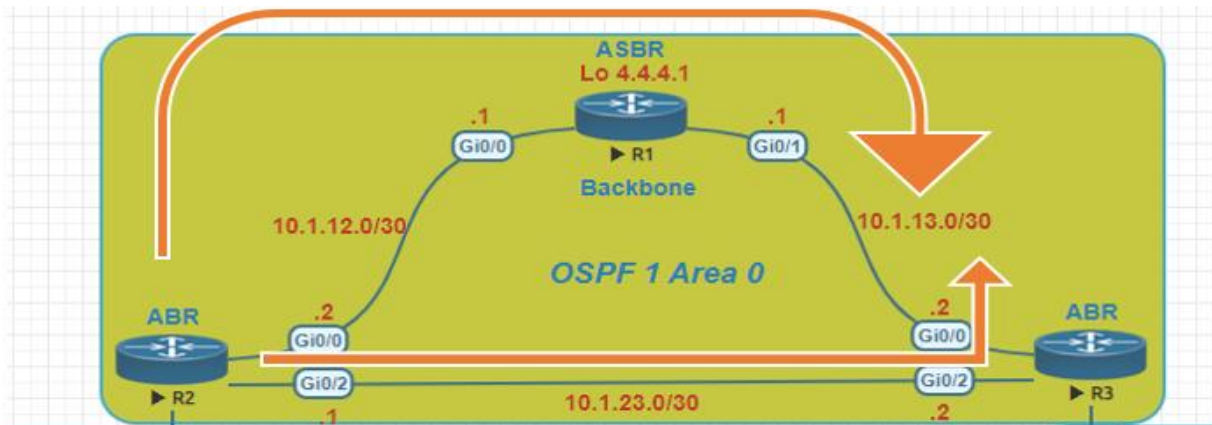


## OSPF Load Balance Lab:

- o Its name implies, is the balancing of a traffic load across redundant links of equal cost.
- o ECMP is strategy used in routing to forward traffic to a destination over multiple best paths.
- o These best paths have calculated the same metric according to the routing protocol in use.
- o The Load balancing occurs when the router receives a multiple path with the same AD.
- o Load balancing occurs when router receives multiple paths with same cost to destination.
- o Equal-cost multi-path allows router to insert more than one path to destination in routing.
- o OSPF protocol load balances across equal cost paths to the same destination by default.
- o By default, OSPF supports of four paths to install to single network with identical metric.
- o The maximum-paths command & specify how many equal-cost paths router should use.
- o In Open Shortest Path First protocol however can be changed to a maximum of 32 path.



Router Images	vios-adventerprisek9-m.spa.159-3.m2
Client PC	VPCS
Testing	OSPF
OSPF Process ID	1



### R1 Basic Configuration

```
R1(config)#hostname R1
R1(config)#no ip domain lookup
R1(config)#line con 0
R1(config-line)#exec-timeout 0 0
R1(config-line)#logging synchronous
R1(config-line)#exit
R1(config)#interface Loopback0
R1(config-if)#ip address 4.4.4.1 255.255.255.255
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/0
R1(config-if)#ip address 10.1.12.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#interface GigabitEthernet0/1
R1(config-if)#ip address 10.1.13.1 255.255.255.252
R1(config-if)#no shutdown
R1(config-if)#exit
```

### R2 Basic Configuration

```
R2(config)#hostname R2
R2(config)#no ip domain lookup
R2(config)#line con 0
R2(config-line)#exec-timeout 0 0
R2(config-line)#logging synchronous
R2(config-line)#exit
R2(config)#interface GigabitEthernet0/0
R2(config-if)#ip address 10.1.12.2 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface GigabitEthernet0/1
R2(config-if)#ip address 10.1.24.1 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#interface GigabitEthernet0/2
R2(config-if)#ip address 10.1.23.1 255.255.255.252
R2(config-if)#no shutdown
R2(config-if)#exit
```

### R3 Basic Configuration

```
R3(config)#hostname R3
R3(config)#no ip domain lookup
R3(config)#line con 0
R3(config-line)#exec-timeout 0 0
R3(config-line)#logging synchronous
R3(config-line)#exit
R3(config)#interface GigabitEthernet0/0
R3(config-if)#ip address 10.1.13.2 255.255.255.252
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface GigabitEthernet0/1
R3(config-if)#ip address 10.1.35.1 255.255.255.252
R3(config-if)#no shutdown
R3(config-if)#exit
R3(config)#interface GigabitEthernet0/2
R3(config-if)#ip address 10.1.23.2 255.255.255.252
R3(config-if)#no shutdown
R3(config-if)#exit
```

## R4 Basic Configuration

```
R4(config)#hostname R4
R4(config)#no ip domain lookup
R4(config)#line con 0
R4(config-line)#exec-timeout 0 0
R4(config-line)#logging synchronous
R4(config-line)#exit
R4(config)#interface Loopback0
R4(config-if)#ip address 172.16.0.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback1
R4(config-if)#ip address 172.16.1.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback2
R4(config-if)#ip address 172.16.2.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback3
R4(config-if)#ip address 172.16.3.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback4
R4(config-if)#ip address 172.16.4.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback5
R4(config-if)#ip address 172.16.5.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback6
R4(config-if)#ip address 172.16.6.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback7
R4(config-if)#ip address 172.16.7.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface Loopback8
R4(config-if)#ip address 172.16.8.1 255.255.255.0
R4(config-if)#exit
R4(config)#interface GigabitEthernet0/0
R4(config-if)#ip address 192.168.1.1 255.255.255.0
R4(config-if)#no shutdown
R4(config-if)#exit
R4(config)#interface GigabitEthernet0/1
R4(config-if)#ip address 10.1.24.2 255.255.255.252
R4(config-if)#no shutdown
R4(config-if)#exit
```

## R5 Basic Configuration

```
R5(config)#hostname R5
R5(config)#no ip domain lookup
R5(config)#line con 0
R5(config-line)#exec-timeout 0 0
R5(config-line)#logging synchronous
R5(config-line)#exit
R5(config)#interface Loopback0
R5(config-if)#ip address 172.30.0.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback1
R5(config-if)#ip address 172.30.1.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback2
R5(config-if)#ip address 172.30.2.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback3
R5(config-if)#ip address 172.30.3.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback4
R5(config-if)#ip address 172.30.4.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback5
R5(config-if)#ip address 172.30.5.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback6
R5(config-if)#ip address 172.30.6.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback7
R5(config-if)#ip address 172.30.7.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface Loopback8
R5(config-if)#ip address 172.30.8.1 255.255.255.0
R5(config-if)#exit
R5(config)#interface GigabitEthernet0/0
R5(config-if)#ip address 192.168.2.1 255.255.255.0
R5(config-if)#no shutdown
R5(config-if)#exit
R5(config)#interface GigabitEthernet0/1
R5(config-if)#ip address 10.1.35.2 255.255.255.252
R5(config-if)#no shutdown
R5(config-if)#exit
```

### PC1 Basic Configuration

```
VPCS> set pncame PC1  
PC1> ip 192.168.1.10 /24 192.168.1.1
```

### PC2 Basic Configuration

```
VPCS> set pncame PC2  
PC2> ip 192.168.2.10 /24 192.168.2.10
```

### R1 OSPF Configuration

```
R1(config)#router ospf 1  
R1(config-router)#router-id 1.1.1.1  
R1(config-router)#network 10.1.12.0 0.0.0.3 area 0  
R1(config-router)#network 10.1.13.0 0.0.0.3 area 0  
R1(config-router)#network 4.4.4.4 0.0.0.0 area 0
```

### R2 OSPF Configuration

```
R2(config)#router ospf 1  
R2(config-router)#router-id 2.2.2.2  
R2(config-router)#network 10.1.12.0 0.0.0.3 area 0  
R2(config-router)#network 10.1.23.0 0.0.0.3 area 0  
R2(config-router)#network 10.1.24.0 0.0.0.3 area 1
```

### R3 OSPF Configuration

```
R3(config)#router ospf 1  
R3(config-router)#router-id 3.3.3.3  
R3(config-router)#network 10.1.13.0 0.0.0.3 area 0  
R3(config-router)#network 10.1.23.0 0.0.0.3 area 0  
R3(config-router)#network 10.1.35.0 0.0.0.3 area 2
```

### R4 OSPF Configuration

```
R4(config)#router ospf 1  
R4(config-router)#router-id 4.4.4.4  
R4(config-router)#network 10.1.24.0 0.0.0.3 area 1  
R4(config-router)#network 192.168.1.0 0.0.0.255 area 1  
R4(config-router)#network 172.16.0.0 0.0.255.255 area 1
```

### R5 OSPF Configuration

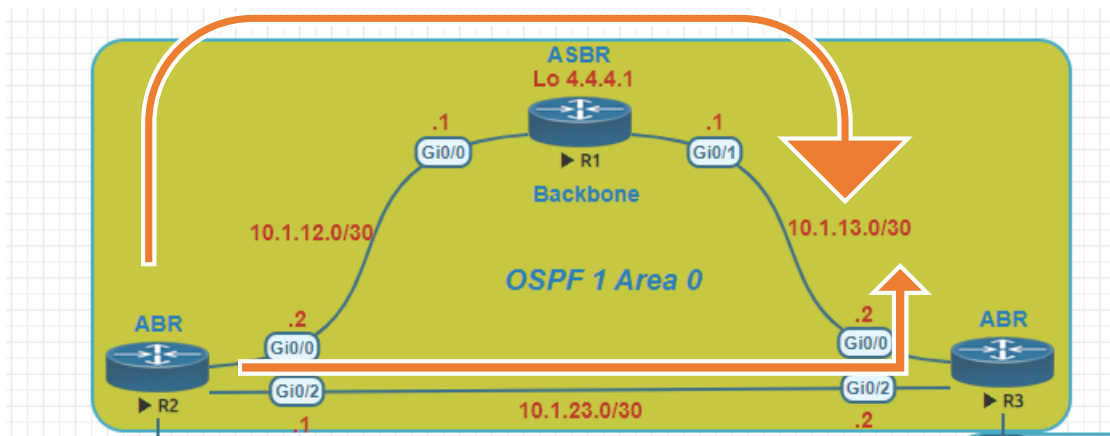
```
R5(config)#router ospf 1  
R5(config-router)#router-id 5.5.5.5  
R5(config-router)#network 10.1.35.0 0.0.0.3 area 2  
R5(config-router)#network 192.168.2.0 0.0.0.255 area 2  
R5(config-router)#network 172.30.0.0 0.0.255.255 area 2
```

## Show Commands

```

R1#show ip route ospf
R1#show ip ospf neighbor
R2#show ip ospf neighbor
R2#show ip route ospf
R3#show ip ospf neighbor
R4#show ip ospf neighbor
R5#show ip ospf neighbor
R5#show ip route ospf
PC1> ping 192.168.2.10
PC2> ping 192.168.1.10

```



```
R2#show ip route ospf
```

```

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
a - application route
+ - replicated route, % - next hop override, p - overrides from PfR

```

Gateway of last resort is not set

```

10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
O   10.1.13.0/30 [110/2] via 10.1.23.2, 00:02:03, GigabitEthernet0/2
    10.1.12.0/30 [110/2] via 10.1.12.1, 00:02:13, GigabitEthernet0/0
O IA 10.1.35.0/30 [110/2] via 10.1.23.2, 00:02:03, GigabitEthernet0/2
172.16.0.0/32 is subnetted, 9 subnets

```

```
R2#show ip route 10.1.13.0
Routing entry for 10.1.13.0/30
  Known via "ospf 1", distance 110, metric 2, type intra area
  Last update from 10.1.23.2 on GigabitEthernet0/2, 00:04:50 ago
  Routing Descriptor Blocks:
    10.1.23.2, from 3.3.3.3, 00:04:50 ago, via GigabitEthernet0/2
      Route metric is 2, traffic share count is 1
  * 10.1.12.1, from 3.3.3.3, 00:05:00 ago, via GigabitEthernet0/0
    Route metric is 2, traffic share count is 1
R2#
```

```
R2#traceroute 10.1.13.1
Type escape sequence to abort.
Tracing the route to 10.1.13.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.1.12.1 9 msec
   10.1.23.2 6 msec *
```

```
R2#traceroute 10.1.13.1
Type escape sequence to abort.
Tracing the route to 10.1.13.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.1.23.2 3 msec
   10.1.12.1 8 msec
   10.1.23.2 3 msec
```

```
R2#traceroute 10.1.13.1
Type escape sequence to abort.
Tracing the route to 10.1.13.1
VRF info: (vrf in name/id, vrf out name/id)
 1 10.1.12.1 3 msec
   10.1.23.2 4 msec
```