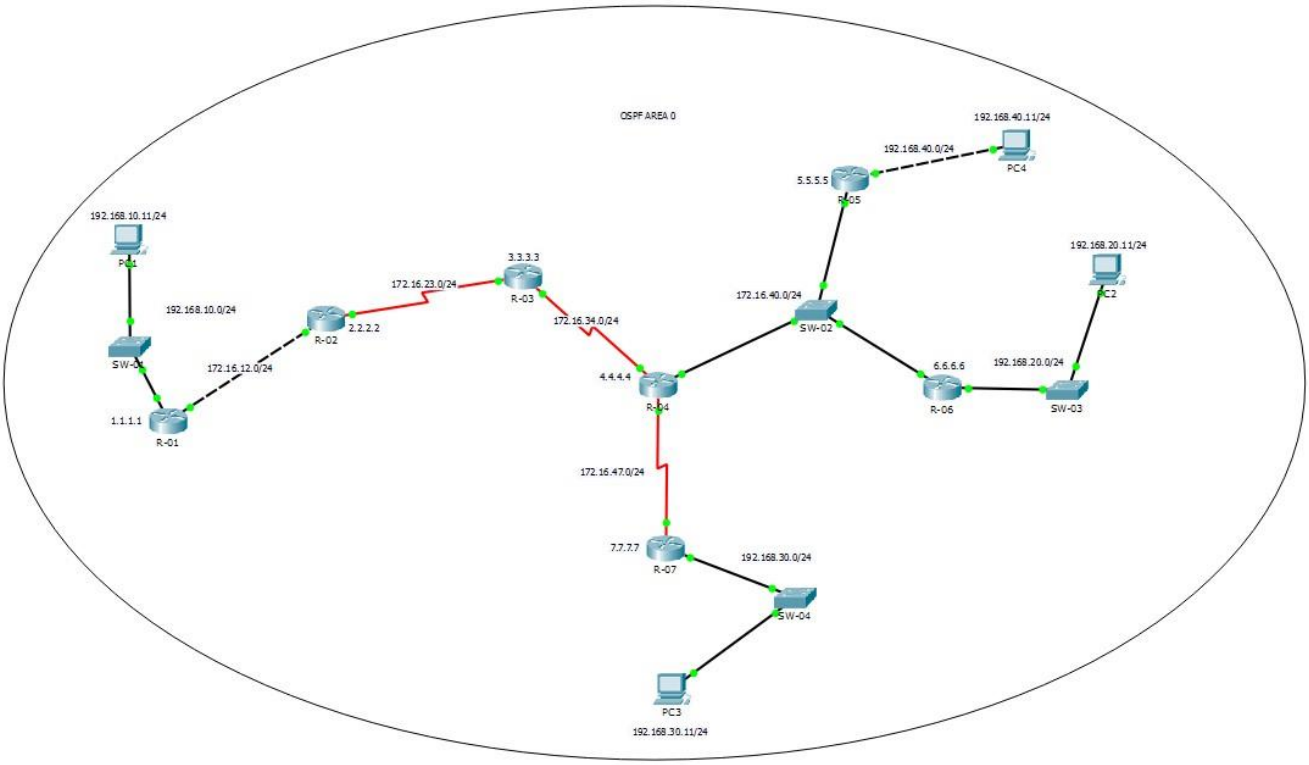
LAB-231



Hedef

Router'larda Single Area OSPF konfigurasyonu gerçekleştirerek farklı networklerin haberleşmesini sağlamak.

PC'lerin IP konfigurasyonları

PC1	VLAN 10	192.168.10.11/24	Default GateWay 192.168.10.1
PC2	VLAN 10	192.168.20.11/24	Default GateWay 192.168.20.1
PC3	VLAN 10	192.168.30.11/24	Default GateWay 192.168.30.1
PC4	VLAN 10	192.168.40.11/24	Default GateWay 192.168.40.1

Çalışma-01

Bu çalışmamızda batının en yaygın ve en popüler routing protokolü olan OSPF'i tek **bir area** (area 0) altında konfigure edeceğiz.

OSPF konfigurasyonu yaparken router'larda dikkat edeceğimiz hususlar şunlar olacaktır: **network** komutu ile interfaceleri OSPF'e dahil ederken **WildCard Mask**'ı en fazla örtüşme sağlayacak şekilde yani **0.0.0.0** olarak tanımlayacağız. Cihazların **loopback** interfacelerini dağıtırken aynı zamanda bu interface IP adreslerini **Router-ID** olarak kullanacaz. Stub networkleri **passive-interface** olarak tanımlayarak bu interfacelerden OSPF *Hello* paketlerinin gitmesini engelleyeceğiz. Bunun hem gereksiz trafiği engellediğini hemde ilgi networklerden yapılabilecek OSPF ataklarına karşı bir güvenlik tedbiri olduğunu belirtmek isterim.

OSPF konfigurasyonu sayesinde router'lar üzerlerindeki ve öğrendikleri networklerin bilgilerini, birbirleriyle paylaşacaklar. Bu paylaşım neticesinde PC'lerin haberleşmesi de sağlanmış olacaktır.

Router'larda OSPF'i enable ederken kullandığımız numara **Process-ID** olarak adlanır. Bunun router'lar arasında hiç bir önemi yoktur. Bu numara aynı router içinde birden fazla OSPF çalıştırabilmemize olanak tanırken farklı process'leri de birbirinden ayırır. Bunu vurgulamak için her router'da farklı bir process-id seçimi yaptık.

İlgili interface'i OSPF'e dahil etmenin bir diğer yöntemide interface altında konfigurasyon yapmaktır. Biz çalışmamızda **network** komutunu kullanarak bu ihtiyacı gidersek de böyle bir seçeneğinde mevcut olduğunu bilmeniz gerekmektedir.

```
R(config)#interfaces serial 0/0/0
R(config-if)# ip ospf 1 area 0
```

Bu konfigurasyon ile Serial 0/0/0 interface'i OSPF'e dahil edilmiştir.

```
R-01#configure terminal
R-01(config)#
R-01(config)#router ospf 1
R-01(config-router)#
R-01(config-router)#router-id 1.1.1.1
R-01(config-router)#passive-interface gigabitEthernet 0/0
R-01(config-router)#network 192.168.10.1 0.0.0.0 area 0
R-01(config-router)#network 1.1.1.1 0.0.0.0 area 0
R-01(config-router)#network 172.16.12.1 0.0.0.0 area 0
R-01(config-router)#end
R-01#
```

```
R-02#configure terminal
R-02(config)#
R-02(config)#router ospf 22
R-02(config-router)#
R-02(config-router)#router-id 2.2.2.2
R-02(config-router)#network 172.16.12.2 0.0.0.0 area 0
R-02(config-router)#network 2.2.2.2 0.0.0.0 area 0
R-02(config-router)#network 172.16.23.2 0.0.0.0 area 0
R-02(config-router)#end
R-02#

R-03#configure terminal
R-03(config)#
R-03(config)#router ospf 3
R-03(config-router)#
R-03(config-router)#router-id 3.3.3.3
R-03(config-router)#network 172.16.23.3 0.0.0.0 area 0 R-03(config-
router)#network 3.3.3.3 0.0.0.0 area 0
R-03(config-router)#network 172.16.34.3 0.0.0.0 area 0
R-03(config-router)#end
R-03#

R-04#configure terminal
R-04(config)#
R-04(config)#router ospf 4
R-04(config-router)#
R-04(config-router)#router-id 4.4.4.4
R-04(config-router)#network 172.16.47.4 0.0.0.0 area 0 R-04(config-
router)#network 4.4.4.4 0.0.0.0 area 0
R-04(config-router)#network 172.16.34.4 0.0.0.0 area 0
R-04(config-router)#network 172.16.40.4 0.0.0.0 area 0
R-04(config-router)#end
R-04#


R-05#configure terminal
R-05(config)#
R-05(config)#router ospf 5
```

```
R-05(config-router)#
R-05(config-router)#router-id 5.5.5.5
R-01(config-router)#passive-interface gigabitEthernet 0/1
R-05(config-router)#network 5.5.5.5 0.0.0.0 area 0
R-05(config-router)#network 192.168.40.1 0.0.0.0 area 0 R-05(config-
router)#network 172.16.40.5 0.0.0.0 area 0
R-05(config-router)#end
R-05#
R-06#configure terminal
R-06(config)#
R-06(config)#router ospf 6
R-06(config-router)#
R-06(config-router)#router-id 6.6.6.6
R-01(config-router)#passive-interface gigabitEthernet 0/1
R-06(config-router)#network 6.6.6.6 0.0.0.0 area 0
R-06(config-router)#network 192.168.20.1 0.0.0.0 area 0 R-06(config-
router)#network 172.16.40.6 0.0.0.0 area 0
R-06(config-router)#end
R-06#

R-07#configure terminal
R-07(config)#
R-07(config)#router ospf 77
R-07(config-router)#
R-07(config-router)#router-id 7.7.7.7
R-01(config-router)#passive-interface gigabitEthernet 0/0
R-07(config-router)#network 7.7.7.7 0.0.0.0 area 0
R-07(config-router)#network 192.168.30.1 0.0.0.0 area 0 R-07(config-
router)#network 172.16.47.7 0.0.0.0 area 0
R-07(config-router)#end
R-07#
```

Router R-04'de IP Routing tablosuna bakalım.

```
R-04#show ip route
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, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2        * -
candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     1.0.0.0/32 is subnetted, 1 subnets
O       1.1.1.1/32 [110/130] via 172.16.34.3, 00:13:59, Serial0/0/0
     2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2/32 [110/129] via 172.16.34.3, 00:13:59, Serial0/0/0
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3/32 [110/65] via 172.16.34.3, 00:13:59, Serial0/0/0
     4.0.0.0/32 is subnetted, 1 subnets
C       4.4.4.4/32 is directly connected, Loopback0
     5.0.0.0/32 is subnetted, 1 subnets
O        5.5.5.5/32 [110/2] via 172.16.40.5, 00:12:24, GigabitEthernet0/0
6.0.0.0/32 is subnetted, 1 subnets
O       6.6.6.6/32 [110/2] via 172.16.40.6, 00:11:04, GigabitEthernet0/0
     7.0.0.0/32 is subnetted, 1 subnets
O       7.7.7.7/32 [110/65] via 172.16.47.7, 00:01:39, Serial0/0/1
     172.16.0.0/16 is variably subnetted, 8 subnets, 2 masks
O       172.16.12.0/24 [110/129] via 172.16.34.3, 00:13:59, Serial0/0/0
O       172.16.23.0/24 [110/128] via 172.16.34.3, 00:13:59, Serial0/0/0
C       172.16.34.0/24 is directly connected, Serial0/0/0
L       172.16.34.4/32 is directly connected, Serial0/0/0
C       172.16.40.0/24 is directly connected, GigabitEthernet0/0
L       172.16.40.4/32 is directly connected, GigabitEthernet0/0
```

```
C       172.16.47.0/24 is directly connected, Serial0/0/1
L       172.16.47.4/32 is directly connected, Serial0/0/1
O    192.168.10.0/24 [110/130] via 172.16.34.3, 00:13:59, Serial0/0/0
O    192.168.20.0/24 [110/2] via 172.16.40.6, 00:11:04, GigabitEthernet0/0 O
192.168.30.0/24 [110/65] via 172.16.47.7, 00:01:39, Serial0/0/1
O    192.168.40.0/24 [110/2] via 172.16.40.5, 00:12:24, GigabitEthernet0/0
R-04#
```

Bu tablo bize bütün loopback IP'lerinin, bütün router'lar arasındaki bağlantı IP'lerinin ve en arkadaki PC networklerinin başarılı bir şekilde routerlar arasında taşındığını göstermektedir. Tabloya göre R-04 **1.1.1.1/32** networküne **130 cost** değeri ile erişmekteymiş. OSPF bu hesabı yaparken aşağıdaki formülü kullanmaktadır.

Cost = 100,000,000 / Bandwidth (bps)

Bu formülde bahsi geçen **Bandwidth** değerleri efektif/güncel/anlık değer değildir. Bilginin gelmiş olduğu ilgili interface'in sabit değeridir. Tabiki değiştirilebilir.

```
R-04#show interfaces serial 0/0/0
Serial0/0/0 is up, line protocol is up (connected)
  Hardware is HD64570
  Internet address is 172.16.34.4/24
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
     Available Bandwidth 1158 kilobits/sec
  5 minute input rate 54 bits/sec, 0 packets/sec
  5 minute output rate 54 bits/sec, 0 packets/sec
     163 packets input, 11372 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
```

```
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0
abort
     148 packets output, 10432 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
R-04#
```

Peki bu **130** değerine nasıl ulaşıldı. En başta R-01 **1.1.1.1/32** networküne (bu bir loopback interface networkü olduğu için) cost 1 ile erişmekte olduğunu R-02'ye bildirir. R-02 gelen bu bilgiye (cost=1'e) bilgiyi aldığı interface'in cost değeri olan 1'i ekler (R-02'nin Gig 0/1 interface'inin cost değeri 1'dir). Böylelikle R-02 1.1.1.1/32 networküne cost=2 ile erişmekte olduğunu routing tablosuna ekler. R-02 bu bilgiyi R-03'e gönderdiğinde R-03 aldığı cost=2 değerinin üzerine, bilgiyi aldığı interface'in yani Serial 0/0/0'ın cost değeri olan 64'ü ekler (Serial interface'lerin cost değerleri 64'dür). Böylelikle R-03 artık 1.1.1.1/32 networküne cost=66 ile erişmekte olduğunu routing tablosuna ekler. R-03 bu bilgiyi R-04'e gönderdiğinde R-04 aldığı cost=66 değerinin üzerine, bilgiyi aldığı interface'in yani Serial 0/0/0'ın cost değeri olan 64'ü ekler. Böylelikle R-04 artık 1.1.1.1/32 networküne **cost=130** ile erişmekte olduğunu routing tablosuna eklemiş olur.

Popüler Interface bandwidth değerleri için **Cost** karşılıkları aşağıdaki gibidir.

Interface Type	10^8/bps = Cost
Fast Ethernet and faster	10^8/100,000,000 bps = 1
Ethernet	10^8/10,000,000 bps = 10
E1	10^8/2,048,000 bps = 48
T1	10^8/1,544,000 bps = 64
128 kbps	10^8/128,000 bps = 781
64 kbps	10^8/64,000 bps = 1562
56 kbps	10^8/56,000 bps = 1785

Referance Bandwidth değerinin **100 Mbps** olması ne yazık ki Gigabit ve ötesi interface'lerinde cost karşılıklarının 1 olmasını gerektirmektedir. Bu problemi gidermek için yani Gigabit ve ötesi interface'lerin farklı cost değerleri alması için üç farklı çözüm vardır.

Birincisi OSPF konfigurasyonu altında **Referance Bandwidth** değerini değiştirmektir.

```
R(config)#router ospf 1
R(config-router)#auto-cost reference-bandwidth XXX
```

İkincisi Interface konfigurasyonu altında **Bandwidth** değerini değiştirmektir.

```
R(config)#interfaces serial 0/0/0
R(config-if)#bandwidth XXX
```

Üçüncüsü ve en güzel en mantıklı en işe yarar olanı ise Interface konfigurasyonu altında **OSPF Cost** değerini değiştirmektir.

```
R(config)#interfaces serial 0/0/0
R(config-if)# ip ospf cost XXX
```

Şimdi çeşitli çıktılar ile OSPF yapılandırmasının durum bilgilerini inceleyelim.

```
R-02#show ip ospf interface

GigabitEthernet0/1 is up, line protocol is up
  Internet address is 172.16.12.2/24, Area 0
  Process ID 22, Router ID 2.2.2.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 1.1.1.1, Interface address 172.16.12.1
  Backup Designated Router (ID) 2.2.2.2, Interface address 172.16.12.2
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 1.1.1.1  (Designated Router)
  Suppress hello for 0 neighbor(s)
Loopback0 is up, line protocol is up
  Internet address is 2.2.2.2/32, Area 0
  Process ID 22, Router ID 2.2.2.2, Network Type LOOPBACK, Cost: 1
  Loopback interface is treated as a stub Host
```

```
Serial0/0/0 is up, line protocol is up
  Internet address is 172.16.23.2/24, Area 0
  Process ID 22, Router ID 2.2.2.2, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:09
  Index 3/3, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1 , Adjacent neighbor count is 1
    Adjacent with neighbor 3.3.3.3
  Suppress hello for 0 neighbor(s)
R-02#

R-02#show ip ospf neighbor


Neighbor ID     Pri   State           Dead Time   Address         Interface
1.1.1.1           1   FULL/DR         00:00:37    172.16.12.1     GigabitEthernet0/1
3.3.3.3           0   FULL/  -        00:00:32    172.16.23.3     Serial0/0/0
R-02#




R-04#show ip ospf neighbor

Neighbor ID     Pri   State           Dead Time   Address         Interface
5.5.5.5           1   FULL/BDR        00:00:35    172.16.40.5     GigabitEthernet0/0
6.6.6.6           1   FULL/DROTHER    00:00:31    172.16.40.6     GigabitEthernet0/0
3.3.3.3           0   FULL/  -        00:00:38    172.16.34.3     Serial0/0/0
7.7.7.7           0   FULL/  -        00:00:39    172.16.47.7     Serial0/0/1
R-04#

R-01#show ip ospf database
            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
1.1.1.1         1.1.1.1         558         0x80000006 0x005cbe 3
7.7.7.7         7.7.7.7         1343        0x80000005 0x00369f 4
2.2.2.2         2.2.2.2         697         0x80000008 0x00fb40 4
```

```
3.3.3.3         3.3.3.3         691         0x8000000e 0x006cf5 5
4.4.4.4         4.4.4.4         691         0x8000000a 0x007fb6 6
5.5.5.5         5.5.5.5         185         0x80000006 0x001479 3
6.6.6.6         6.6.6.6         105         0x80000006 0x006a2a 3

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
172.16.12.1     1.1.1.1         558         0x80000003 0x00deff 172.16.40.4
4.4.4.4         106         0x80000004 0x00b16e
R-01#
```

```
R-03#show ip ospf database
            OSPF Router with ID (3.3.3.3) (Process ID 3)
                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
7.7.7.7         7.7.7.7         1276        0x80000005 0x00369f 4
2.2.2.2         2.2.2.2         630         0x80000008 0x00fb40 4
3.3.3.3         3.3.3.3         624         0x8000000e 0x006cf5 5
4.4.4.4         4.4.4.4         624         0x8000000a 0x007fb6 6
1.1.1.1         1.1.1.1         491         0x80000006 0x005cbe 3
5.5.5.5         5.5.5.5         118         0x80000006 0x001479 3
6.6.6.6         6.6.6.6         38          0x80000006 0x006a2a 3

                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
172.16.12.1     1.1.1.1         491         0x80000003 0x00deff 172.16.40.4
4.4.4.4         39          0x80000004 0x00b16e
R-03#
```

```
R-06#show ip ospf database
            OSPF Router with ID (6.6.6.6) (Process ID 6)
                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
6.6.6.6         6.6.6.6         77          0x80000006 0x006a2a 3
2.2.2.2         2.2.2.2         2170        0x80000006 0x00ff3e 4
7.7.7.7         7.7.7.7         1316        0x80000005 0x00369f 4
4.4.4.4         4.4.4.4         663         0x8000000a 0x007fb6 6
3.3.3.3         3.3.3.3         663         0x8000000e 0x006cf5 5
1.1.1.1         1.1.1.1         531         0x80000006 0x005cbe 3
5.5.5.5         5.5.5.5         158         0x80000006 0x001479 3
                Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
```

```
172.16.12.1     1.1.1.1         531         0x80000003 0x00deff 172.16.40.4
4.4.4.4         78          0x80000004 0x00b16e
R-06#
```

Dikkatlice bütün router'larda inceleme yapılırsa görülecektirki bu son çıktı hepsinde aynıdır. Tek bir **area** dahilinde olan bütün routerlar aynı **topoloji database**'ine sahiptirler. Zaten bu ifade bir bakıma **area**'nında tarifidir.

Bu ifadenin teyidi için bütün routerlarda OSPF ile öğrenilmiş route bilgilerinede bakabiliriz.

```
R-06#show ip route ospf
     1.0.0.0/32 is subnetted, 1 subnets
O         1.1.1.1 [110/131] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2 [110/130] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
     3.0.0.0/32 is subnetted, 1 subnets
O       3.3.3.3 [110/66] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
     4.0.0.0/32 is subnetted, 1 subnets
O          4.4.4.4 [110/2] via 172.16.40.4, 01:10:54, GigabitEthernet0/0
5.0.0.0/32 is subnetted, 1 subnets
O       5.5.5.5 [110/2] via 172.16.40.5, 01:10:54, GigabitEthernet0/0
     7.0.0.0/32 is subnetted, 1 subnets
O       7.7.7.7 [110/66] via 172.16.40.4, 01:01:19, GigabitEthernet0/0
     172.16.0.0/16 is variably subnetted, 6 subnets, 2 masks
O       172.16.12.0 [110/130] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
O       172.16.23.0 [110/129] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
O       172.16.34.0 [110/65] via 172.16.40.4, 01:10:54, GigabitEthernet0/0
O       172.16.47.0 [110/65] via 172.16.40.4, 01:10:54, GigabitEthernet0/0
O    192.168.10.0 [110/131] via 172.16.40.4, 00:20:27, GigabitEthernet0/0
O    192.168.30.0 [110/66] via 172.16.40.4, 01:01:19, GigabitEthernet0/0 O
192.168.40.0 [110/2] via 172.16.40.5, 01:10:54, GigabitEthernet0/0
R-06#
```

Son olarak sadece cisco router'larda görmekte olduğumuz faydalı bir çıktıyı yine buraya taşıyalım:

```
R-04#show ip protocols
Routing Protocol is "ospf 4"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 4.4.4.4
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
Routing for Networks:
```

```
    172.16.47.4 0.0.0.0 area 0     4.4.4.4 0.0.0.0 area 0
172.16.34.4 0.0.0.0 area 0
    172.16.40.4 0.0.0.0 area 0
Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1              110      00:16:08
2.2.2.2               110      00:43:26     3.3.3.3
110      00:18:21     4.4.4.4              110
00:18:21     5.5.5.5              110
00:09:55     6.6.6.6              110
00:08:35
    7.7.7.7              110      00:29:13
  Distance: (default is 110)
R-04#
R-01#show ip protocols
Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 1.1.1.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
Routing for Networks:
    192.168.10.1 0.0.0.0 area 0     1.1.1.1 0.0.0.0 area 0
172.16.12.1 0.0.0.0 area 0
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway         Distance      Last Update
    1.1.1.1              110      00:17:01
2.2.2.2               110      00:19:20     3.3.3.3
110      00:19:14     4.4.4.4              110
00:19:14     5.5.5.5              110
00:10:48     6.6.6.6              110
00:09:28
    7.7.7.7              110      00:00:05
  Distance: (default is 110)
R-01#
```

PC'lerin haberleşmelerine bir bakalım. PC1'den diğerlerine ping atalım.

```
PC>ping -n 2 192.168.20.11

Pinging 192.168.20.11 with 32 bytes of data:
```

```
Reply from 192.168.20.11: bytes=32 time=2ms TTL=123 Reply
from 192.168.20.11: bytes=32 time=11ms TTL=123

Ping statistics for 192.168.20.11:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 11ms, Average = 6ms
PC>ping -n 2 192.168.30.11

Pinging 192.168.30.11 with 32 bytes of data:

Reply from 192.168.30.11: bytes=32 time=3ms TTL=123 Reply
from 192.168.30.11: bytes=32 time=10ms TTL=123

Ping statistics for 192.168.30.11:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 3ms, Maximum = 10ms, Average = 6ms
PC>ping -n 2 192.168.40.11

Pinging 192.168.40.11 with 32 bytes of data:

Reply from 192.168.40.11: bytes=32 time=2ms TTL=123 Reply
from 192.168.40.11: bytes=32 time=13ms TTL=123

Ping statistics for 192.168.40.11:
    Packets: Sent = 2, Received = 2, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 13ms, Average = 7ms

PC>
```

Router'ların son config`leri

```
R-01#show running-config  Building
configuration...

Current configuration : 1091 bytes
!
version 15.1
```

```
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-01
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524ALVY
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
1.1.1.1 255.255.255.255
! interface GigabitEthernet0/0  ip
address 192.168.10.1 255.255.255.0
duplex auto  speed auto
! interface GigabitEthernet0/1  ip
address 172.16.12.1 255.255.255.0
duplex auto  speed auto
! interface
Serial0/0/0  no ip
address  clock rate
2000000  shutdown
! interface
Serial0/0/1  no ip
address  clock rate
2000000  shutdown
!
```

```
interface Vlan1
no ip address
shutdown
!
router ospf 1
 router-id 1.1.1.1
 log-adjacency-changes  passive-
interface GigabitEthernet0/0  network
192.168.10.1 0.0.0.0 area 0  network
1.1.1.1 0.0.0.0 area 0  network
172.16.12.1 0.0.0.0 area 0
!
ip classless
!
ip flow-export version 9
!
line con 0  exec-
timeout 0 0  logging
synchronous
!
line aux 0
! line vty 0
4  login
!
end
R-
02#
-
conf
ig


Current configuration : 1052 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
```

```
hostname R-02
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX15240R13
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
2.2.2.2 255.255.255.255
! interface
GigabitEthernet0/0  no ip
address  duplex auto  speed
auto  shutdown
! interface GigabitEthernet0/1  ip
address 172.16.12.2 255.255.255.0
duplex auto  speed auto
! interface Serial0/0/0  ip address
172.16.23.2 255.255.255.0  clock rate
2000000
! interface
Serial0/0/1  no ip
address  clock rate
2000000  shutdown
!
interface Vlan1
no ip address
shutdown router
ospf 22  router-id
2.2.2.2  log-
adjacency-changes
network
172.16.12.2
0.0.0.0 area 0
network 2.2.2.2
0.0.0.0 area 0
```

```
network
172.16.23.2
0.0.0.0 area 0
!
ip classless
!
ip flow-export version 9
!
line con 0  exec-
timeout 0 0  logging
synchronous
!
line aux 0
! line vty 0
4  login
!
end
R-
03#
-
conf
ig


Current configuration : 1031 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-03
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524073W
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
3.3.3.3 255.255.255.255
```

```
! interface
GigabitEthernet0/0  no ip
address  duplex auto  speed
auto  shutdown
! interface
GigabitEthernet0/1  no ip
address  duplex auto  speed
auto  shutdown
! interface Serial0/0/0  ip address
172.16.23.3 255.255.255.0
! interface Serial0/0/1  ip address
172.16.34.3 255.255.255.0  clock rate
2000000
!
interface Vlan1
no ip address
shutdown
!
router ospf 3
 router-id 3.3.3.3
 log-adjacency-changes  network
172.16.23.3 0.0.0.0 area 0  network
3.3.3.3 0.0.0.0 area 0  network
172.16.34.3 0.0.0.0 area 0
!
ip classless
!
ip flow-export version 9
!
line con 0  exec-
timeout 0 0  logging
synchronous
!
line aux 0
! line vty 0
4  login
!
end
```

```
     show running-config  Building
configuration...


R-04#


Current configuration : 1080 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-04
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524UDPU
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
4.4.4.4 255.255.255.255
! interface GigabitEthernet0/0  ip
address 172.16.40.4 255.255.255.0
duplex auto  speed auto
! interface
GigabitEthernet0/1  no ip
address  duplex auto  speed
auto  shutdown
! interface Serial0/0/0  ip address
172.16.34.4 255.255.255.0
! interface Serial0/0/1  ip address
172.16.47.4 255.255.255.0  clock rate
2000000
!


!
```

```
interface Vlan1
 no ip address
 shutdown router ospf
 4  router-id 4.4.4.4
  log-adjacency-
 changes  network
 172.16.47.4 0.0.0.0
 area 0  network
 4.4.4.4 0.0.0.0 area
 0  network
 172.16.34.4 0.0.0.0
 area 0  network
 172.16.40.4 0.0.0.0
 area 0
!
ip classless
!
ip flow-export version 9
!
line con 0  exec-
timeout 0 0  logging
synchronous
!
line aux 0
! line vty 0
4  login
!
end
R-
05#


Current configuration : 953 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-05
!
```

```
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524858M
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
5.5.5.5 255.255.255.255
! interface GigabitEthernet0/0  ip
address 172.16.40.5 255.255.255.0
duplex auto  speed auto
! interface GigabitEthernet0/1  ip
address 192.168.40.1 255.255.255.0
duplex auto  speed auto
!
interface Vlan1
no ip address
shutdown
!
router ospf 5  router-id 5.5.5.5
 log-adjacency-changes  passive-
interface GigabitEthernet0/1 network
5.5.5.5 0.0.0.0 area 0 network
192.168.40.1 0.0.0.0 area 0 network
172.16.40.5 0.0.0.0 area 0
ip classless
!
ip flow-export version 9
! line con 0  exec-
timeout 0 0  logging
synchronous
! line aux
0
! line vty 0
4  login
```

```
!
end
R-
06#


Current configuration : 953 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-06
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524SUVT
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
6.6.6.6 255.255.255.255
! interface GigabitEthernet0/0  ip
address 172.16.40.6 255.255.255.0
duplex auto  speed auto
! interface GigabitEthernet0/1  ip
address 192.168.20.1 255.255.255.0
duplex auto  speed auto
!
interface Vlan1
no ip address
shutdown
!
router ospf 6  router-id 6.6.6.6
 log-adjacency-changes  passive-
interface GigabitEthernet0/1 network
6.6.6.6 0.0.0.0 area 0 network
```

```
192.168.20.1 0.0.0.0 area 0 network
172.16.40.6 0.0.0.0 area 0
ip classless
!
ip flow-export version 9
! line con 0  exec-
timeout 0 0  logging
synchronous
! line aux
0
! line vty 0
4  login
!
end
```

```
R-07#


Current configuration : 1072 bytes
!
version 15.1
no service timestamps log datetime msec no
service timestamps debug datetime msec no
service password-encryption
!
hostname R-07
!
no ip cef no
ipv6 cef
!
license udi pid CISCO2901/K9 sn FTX1524XHL7
!
no ip domain-lookup
!
spanning-tree mode pvst
!
interface Loopback0  ip address
7.7.7.7 255.255.255.255
! interface GigabitEthernet0/0  ip
address 192.168.30.1 255.255.255.0
duplex auto  speed auto
! interface
GigabitEthernet0/1  no ip
address  duplex auto  speed
auto  shutdown
! interface
Serial0/0/0  no ip
address  clock rate
2000000  shutdown
! interface Serial0/0/1  ip address
172.16.47.7 255.255.255.0
!
interface Vlan1
no ip address
shutdown
!
router ospf 77  router-id 7.7.7.7
log-adjacency-changes  passive-
interface GigabitEthernet0/0  network
```

```
7.7.7.7 0.0.0.0 area 0  network
192.168.30.1 0.0.0.0 area 0  network
172.16.47.7 0.0.0.0 area 0
!
ip classless
!
ip flow-export version 9
!
line con 0  exec-
timeout 0 0  logging
synchronous
!
line aux 0
! line vty 0
4  login
! end
```

Umarım faydalı bir LAB çalışması olmuştur.
Soru ve yorumlarınız için,

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