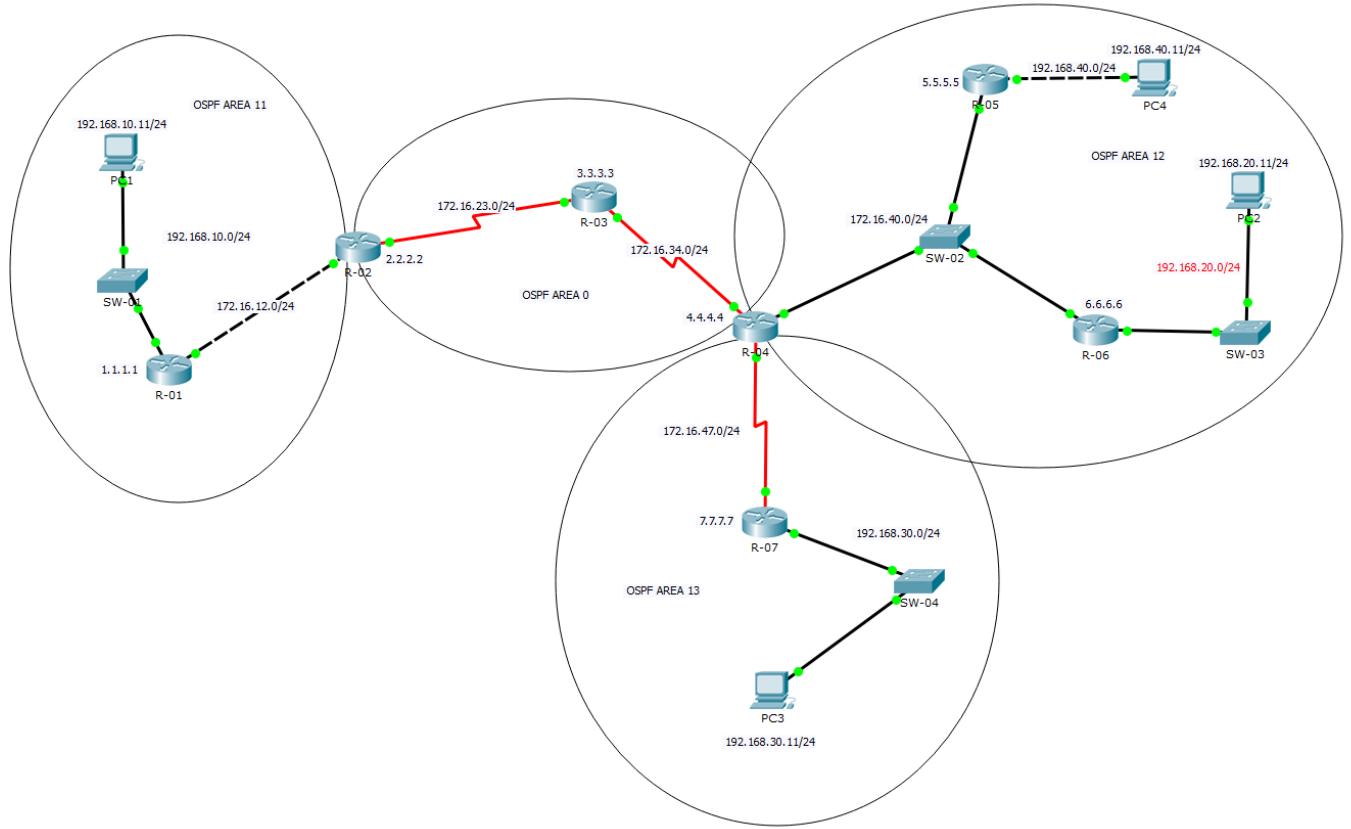# LAB-232

Hedef

Router'larda Multi 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 **çoklu area** 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 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 11
R-01(config-router)#network 1.1.1.1 0.0.0.0 area 11
R-01(config-router)#network 172.16.12.1 0.0.0.0 area 11
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 11
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 13
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 12
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 12
R-05(config-router)#network 192.168.40.1 0.0.0.0 area 12
R-05(config-router)#network 172.16.40.5 0.0.0.0 area 12
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 12
R-06(config-router)#network 192.168.20.1 0.0.0.0 area 12
R-06(config-router)#network 172.16.40.6 0.0.0.0 area 12
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 13
R-07(config-router)#network 192.168.30.1 0.0.0.0 area 13
R-07(config-router)#network 172.16.47.7 0.0.0.0 area 13
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 IA    1.1.1.1/32 [110/130] via 172.16.34.3, 00:00:58, 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, 00:01:08, 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, 00:01:08, 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, 00:00:13, GigabitEthernet0/0
     6.0.0.0/32 is subnetted, 1 subnets
O       6.6.6.6/32 [110/2] via 172.16.40.6, 00:00:13, GigabitEthernet0/0
     7.0.0.0/32 is subnetted, 1 subnets
O       7.7.7.7/32 [110/65] via 172.16.47.7, 00:00:38, Serial0/0/1
     172.16.0.0/16 is variably subnetted, 8 subnets, 2 masks
O IA    172.16.12.0/24 [110/129] via 172.16.34.3, 00:01:08, Serial0/0/0
O       172.16.23.0/24 [110/128] via 172.16.34.3, 00:01:08, 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 IA 192.168.10.0/24 [110/130] via 172.16.34.3, 00:00:58, Serial0/0/0
O    192.168.20.0/24 [110/2] via 172.16.40.6, 00:00:13, GigabitEthernet0/0
O    192.168.30.0/24 [110/65] via 172.16.47.7, 00:00:38, Serial0/0/1
O    192.168.40.0/24 [110/2] via 172.16.40.5, 00:00:13, 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

Lower Cost — High — Bandwidth — Low — Higher Cost

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
```

Birde router R-03'de IP Routing tablosuna bakalım.

```
R-03#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 IA    1.1.1.1/32 [110/66] via 172.16.23.2, 00:02:48, Serial0/0/0
      2.0.0.0/32 is subnetted, 1 subnets
O       2.2.2.2/32 [110/65] via 172.16.23.2, 00:03:16, Serial0/0/0
      3.0.0.0/32 is subnetted, 1 subnets
C       3.3.3.3/32 is directly connected, Loopback0
      4.0.0.0/32 is subnetted, 1 subnets
O       4.4.4.4/32 [110/65] via 172.16.34.4, 00:02:58, Serial0/0/1
      5.0.0.0/32 is subnetted, 1 subnets
O IA    5.5.5.5/32 [110/66] via 172.16.34.4, 00:01:57, Serial0/0/1
      6.0.0.0/32 is subnetted, 1 subnets
O IA    6.6.6.6/32 [110/66] via 172.16.34.4, 00:01:57, Serial0/0/1
      7.0.0.0/32 is subnetted, 1 subnets
O IA    7.7.7.7/32 [110/129] via 172.16.34.4, 00:01:57, Serial0/0/1
      172.16.0.0/16 is variably subnetted, 7 subnets, 2 masks
O IA    172.16.12.0/24 [110/65] via 172.16.23.2, 00:03:16, Serial0/0/0
C       172.16.23.0/24 is directly connected, Serial0/0/0
L       172.16.23.3/32 is directly connected, Serial0/0/0
C       172.16.34.0/24 is directly connected, Serial0/0/1
L       172.16.34.3/32 is directly connected, Serial0/0/1
O IA    172.16.40.0/24 [110/65] via 172.16.34.4, 00:02:58, Serial0/0/1
O IA    172.16.47.0/24 [110/128] via 172.16.34.4, 00:02:58, Serial0/0/1
O IA 192.168.10.0/24 [110/66] via 172.16.23.2, 00:02:48, Serial0/0/0
O IA 192.168.20.0/24 [110/66] via 172.16.34.4, 00:01:57, Serial0/0/1
O IA 192.168.30.0/24 [110/129] via 172.16.34.4, 00:01:57, Serial0/0/1
O IA 192.168.40.0/24 [110/66] via 172.16.34.4, 00:01:57, Serial0/0/1

R-03#
```

Şimdi çeşitli çıktılar ile OSPF yapılandırmasının durum bilgilerini inceleyelim.

```
R-04#show ip ospf interface

Serial0/0/1 is up, line protocol is up
  Internet address is 172.16.47.4/24, Area 13
  Process ID 4, Router ID 4.4.4.4, 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 00:00:06
  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 7.7.7.7
  Suppress hello for 0 neighbor(s)
Loopback0 is up, line protocol is up
  Internet address is 4.4.4.4/32, Area 0
  Process ID 4, Router ID 4.4.4.4, 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 172.16.34.4/24, Area 0
  Process ID 4, Router ID 4.4.4.4, 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 00:00:06
  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)
GigabitEthernet0/0 is up, line protocol is up
  Internet address is 172.16.40.4/24, Area 12
  Process ID 4, Router ID 4.4.4.4, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DROTHER, Priority 1
  Designated Router (ID) 6.6.6.6, Interface address 172.16.40.6
  Backup Designated Router (ID) 5.5.5.5, Interface address 172.16.40.5
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:06
  Index 4/4, 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 2, Adjacent neighbor count is 2
```

```
      Adjacent with neighbor 6.6.6.6  (Designated Router)
      Adjacent with neighbor 5.5.5.5  (Backup Designated Router)
    Suppress hello for 0 neighbor(s)

R-04#

R-02#show ip ospf interface

GigabitEthernet0/1 is up, line protocol is up
  Internet address is 172.16.12.2/24, Area 11
  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-02#show ip ospf

 Routing Process "ospf 22" with ID 2.2.2.2
 Supports only single TOS(TOS0) routes
 Supports opaque LSA
 It is an area border router
 SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
 Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
 Number of external LSA 0. Checksum Sum 0x000000
 Number of opaque AS LSA 0. Checksum Sum 0x000000
 Number of DCbitless external and opaque AS LSA 0
 Number of DoNotAge external and opaque AS LSA 0
 Number of areas in this router is 2. 2 normal 0 stub 0 nssa
 External flood list length 0
    Area 11
        Number of interfaces in this area is 1
        Area has no authentication
        SPF algorithm executed 6 times
        Area ranges are
        Number of LSA 16. Checksum Sum 0x0888fb
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
    Area BACKBONE(0)
        Number of interfaces in this area is 2
        Area has no authentication
        SPF algorithm executed 5 times
        Area ranges are
        Number of LSA 14. Checksum Sum 0x05950b
        Number of opaque link LSA 0. Checksum Sum 0x000000
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 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 11)

Link ID          ADV Router       Age          Seq#        Checksum Link count
1.1.1.1          1.1.1.1          1055         0x80000004 0x008299 3
2.2.2.2          2.2.2.2          1055         0x80000003 0x00f0bb 1


             Net Link States (Area 11)
Link ID          ADV Router       Age          Seq#        Checksum
172.16.12.2      2.2.2.2          1055         0x80000001 0x00ca11


             Summary Net Link States (Area 11)
Link ID          ADV Router       Age          Seq#        Checksum
2.2.2.2          2.2.2.2          1052         0x80000001 0x00fa53
172.16.23.0      2.2.2.2          1052         0x80000002 0x004af7
3.3.3.3          2.2.2.2          1052         0x80000003 0x004bbc
172.16.34.0      2.2.2.2          1052         0x80000004 0x004fa5
4.4.4.4          2.2.2.2          1042         0x80000005 0x009b26
172.16.47.0      2.2.2.2          1042         0x80000006 0x003e67
172.16.40.0      2.2.2.2          1042         0x80000007 0x0011d9
7.7.7.7          2.2.2.2          992          0x80000008 0x008de4
192.168.30.0     2.2.2.2          992          0x80000009 0x00d134
5.5.5.5          2.2.2.2          992          0x8000000a 0x006d4a
192.168.40.0     2.2.2.2          992          0x8000000b 0x00e652
6.6.6.6          2.2.2.2          992          0x8000000c 0x003b76
192.168.20.0     2.2.2.2          992          0x8000000d 0x00bf8b


R-01#
```

R-02#**show ip ospf database**

OSPF Router with ID (2.2.2.2) (Process ID 22)

Router Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
2.2.2.2	2.2.2.2	1249	0x80000003	0x00da0a	3
3.3.3.3	3.3.3.3	1234	0x80000005	0x007eec	5
4.4.4.4	4.4.4.4	1231	0x80000003	0x003b79	3

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.12.0	2.2.2.2	1264	0x80000001	0x004d40
172.16.47.0	4.4.4.4	1237	0x80000001	0x00071c
172.16.40.0	4.4.4.4	1231	0x80000002	0x00d98e
192.168.10.0	2.2.2.2	1224	0x80000002	0x003fa1
1.1.1.1	2.2.2.2	1224	0x80000003	0x002f20
7.7.7.7	4.4.4.4	1171	0x80000003	0x005699
192.168.30.0	4.4.4.4	1171	0x80000004	0x009ae8
5.5.5.5	4.4.4.4	1171	0x80000005	0x0036fe
192.168.40.0	4.4.4.4	1171	0x80000006	0x00af07
6.6.6.6	4.4.4.4	1171	0x80000007	0x00042b
192.168.20.0	4.4.4.4	1171	0x80000008	0x008840

Router Link States (Area 11)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
2.2.2.2	2.2.2.2	1229	0x80000003	0x00f0bb	1
1.1.1.1	1.1.1.1	1229	0x80000004	0x008299	3

Net Link States (Area 11)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.12.2	2.2.2.2	1229	0x80000001	0x00ca11

Summary Net Link States (Area 11)

Link ID	ADV Router	Age	Seq#	Checksum
2.2.2.2	2.2.2.2	1226	0x80000001	0x00fa53
172.16.23.0	2.2.2.2	1226	0x80000002	0x004af7
3.3.3.3	2.2.2.2	1226	0x80000003	0x004bbc
172.16.34.0	2.2.2.2	1226	0x80000004	0x004fa5
4.4.4.4	2.2.2.2	1216	0x80000005	0x009b26
172.16.47.0	2.2.2.2	1216	0x80000006	0x003e67
172.16.40.0	2.2.2.2	1216	0x80000007	0x0011d9
7.7.7.7	2.2.2.2	1166	0x80000008	0x008de4
192.168.30.0	2.2.2.2	1166	0x80000009	0x00d134
5.5.5.5	2.2.2.2	1166	0x8000000a	0x006d4a
192.168.40.0	2.2.2.2	1166	0x8000000b	0x00e652
6.6.6.6	2.2.2.2	1166	0x8000000c	0x003b76
192.168.20.0	2.2.2.2	1166	0x8000000d	0x00bf8b

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
2.2.2.2         2.2.2.2         1360        0x80000003 0x00da0a 3
3.3.3.3         3.3.3.3         1345        0x80000005 0x007eec 5
4.4.4.4         4.4.4.4         1345        0x80000003 0x003b79 3
```

```
            Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#        Checksum
172.16.12.0     2.2.2.2         1375        0x80000001 0x004d40
172.16.47.0     4.4.4.4         1348        0x80000001 0x00071c
172.16.40.0     4.4.4.4         1342        0x80000002 0x00d98e
192.168.10.0    2.2.2.2         1335        0x80000002 0x003fa1
1.1.1.1         2.2.2.2         1335        0x80000003 0x002f20
7.7.7.7         4.4.4.4         1282        0x80000003 0x005699
192.168.30.0    4.4.4.4         1282        0x80000004 0x009ae8
5.5.5.5         4.4.4.4         1282        0x80000005 0x0036fe
192.168.40.0    4.4.4.4         1282        0x80000006 0x00af07
6.6.6.6         4.4.4.4         1282        0x80000007 0x00042b
192.168.20.0    4.4.4.4         1282        0x80000008 0x008840
R-03#
```

R-04#**show ip ospf database**

```
        OSPF Router with ID (4.4.4.4) (Process ID 4)
```

```
            Router Link States (Area 0)
```

```
Link ID         ADV Router      Age         Seq#        Checksum Link count
2.2.2.2         2.2.2.2         1493        0x80000003 0x00da0a 3
4.4.4.4         4.4.4.4         1478        0x80000003 0x003b79 3
3.3.3.3         3.3.3.3         1478        0x80000005 0x007eec 5
```

```
            Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#        Checksum
172.16.47.0     4.4.4.4         1481        0x80000001 0x00071c
172.16.12.0     2.2.2.2         1508        0x80000001 0x004d40
172.16.40.0     4.4.4.4         1476        0x80000002 0x00d98e
192.168.10.0    2.2.2.2         1468        0x80000002 0x003fa1
1.1.1.1         2.2.2.2         1468        0x80000003 0x002f20
7.7.7.7         4.4.4.4         1415        0x80000003 0x005699
192.168.30.0    4.4.4.4         1415        0x80000004 0x009ae8
5.5.5.5         4.4.4.4         1415        0x80000005 0x0036fe
192.168.40.0    4.4.4.4         1415        0x80000006 0x00af07
6.6.6.6         4.4.4.4         1415        0x80000007 0x00042b
192.168.20.0    4.4.4.4         1415        0x80000008 0x008840
```

Router Link States (Area 12)

```
Link ID          ADV Router       Age            Seq#        Checksum Link count
4.4.4.4          4.4.4.4          1425           0x80000002 0x000956 1
6.6.6.6          6.6.6.6          1425           0x80000004 0x00b2e1 3
5.5.5.5          5.5.5.5          1425           0x80000004 0x005c31 3
```

Net Link States (Area 12)

```
Link ID          ADV Router       Age            Seq#        Checksum
172.16.40.6      6.6.6.6          1425           0x80000002 0x0067a1
```

Summary Net Link States (Area 12)

```
Link ID          ADV Router       Age            Seq#        Checksum
172.16.47.0      4.4.4.4          1481           0x80000001 0x00071c
7.7.7.7          4.4.4.4          1415           0x80000002 0x005898
192.168.30.0     4.4.4.4          1415           0x80000003 0x009ce7
4.4.4.4          4.4.4.4          1415           0x80000004 0x005cde
172.16.34.0      4.4.4.4          1415           0x80000005 0x008e9d
172.16.23.0      4.4.4.4          1415           0x80000006 0x00896c
3.3.3.3          4.4.4.4          1415           0x80000007 0x0007f4
2.2.2.2          4.4.4.4          1415           0x80000008 0x00b509
172.16.12.0      4.4.4.4          1415           0x80000009 0x0006f6
192.168.10.0     4.4.4.4          1415           0x8000000a 0x00f758
1.1.1.1          4.4.4.4          1415           0x8000000b 0x00e7d6
```

Router Link States (Area 13)

```
Link ID          ADV Router       Age            Seq#        Checksum Link count
4.4.4.4          4.4.4.4          1446           0x80000003 0x00bded 2
7.7.7.7          7.7.7.7          1446           0x80000004 0x00389e 4
```

Summary Net Link States (Area 13)

```
Link ID          ADV Router       Age            Seq#        Checksum
172.16.40.0      4.4.4.4          1476           0x80000001 0x00db8d
4.4.4.4          4.4.4.4          1415           0x80000002 0x0060dc
172.16.34.0      4.4.4.4          1415           0x80000003 0x00929b
172.16.23.0      4.4.4.4          1415           0x80000004 0x008d6a
3.3.3.3          4.4.4.4          1415           0x80000005 0x000bf2
2.2.2.2          4.4.4.4          1415           0x80000006 0x00b907
172.16.12.0      4.4.4.4          1415           0x80000007 0x000af4
192.168.10.0     4.4.4.4          1415           0x80000008 0x00fb56
1.1.1.1          4.4.4.4          1415           0x80000009 0x00ebd4
5.5.5.5          4.4.4.4          1415           0x8000000a 0x002c04
192.168.40.0     4.4.4.4          1415           0x8000000b 0x00a50c
6.6.6.6          4.4.4.4          1415           0x8000000c 0x00f930
192.168.20.0     4.4.4.4          1415           0x8000000d 0x007e45
R-04#
```

R-05#**show ip ospf database**

```
           OSPF Router with ID (5.5.5.5) (Process ID 5)

               Router Link States (Area 12)

Link ID         ADV Router      Age         Seq#       Checksum Link count
6.6.6.6         6.6.6.6         1522        0x80000004 0x00b2e1 3
5.5.5.5         5.5.5.5         1522        0x80000004 0x005c31 3
4.4.4.4         4.4.4.4         1522        0x80000002 0x000956 1

               Net Link States (Area 12)
Link ID         ADV Router      Age         Seq#       Checksum
172.16.40.6     6.6.6.6         1522        0x80000002 0x0067a1

               Summary Net Link States (Area 12)
Link ID         ADV Router      Age         Seq#       Checksum
172.16.47.0     4.4.4.4         1578        0x80000001 0x00071c
7.7.7.7         4.4.4.4         1512        0x80000002 0x005898
192.168.30.0    4.4.4.4         1512        0x80000003 0x009ce7
4.4.4.4         4.4.4.4         1512        0x80000004 0x005cde
172.16.34.0     4.4.4.4         1512        0x80000005 0x008e9d
172.16.23.0     4.4.4.4         1512        0x80000006 0x00896c
3.3.3.3         4.4.4.4         1512        0x80000007 0x0007f4
2.2.2.2         4.4.4.4         1512        0x80000008 0x00b509
172.16.12.0     4.4.4.4         1512        0x80000009 0x0006f6
192.168.10.0    4.4.4.4         1512        0x8000000a 0x00f758
1.1.1.1         4.4.4.4         1512        0x8000000b 0x00e7d6

R-05#
https://goo.gl/hKPtQd
```

R-06#**show ip ospf database**

OSPF Router with ID (6.6.6.6) (Process ID 6)

Router Link States (Area 12)

Link ID	ADV Router	Age	Seq#	Checksum	Link count
6.6.6.6	6.6.6.6	1381	0x80000004	0x00b2e1	3
4.4.4.4	4.4.4.4	1381	0x80000002	0x000956	1
5.5.5.5	5.5.5.5	1381	0x80000004	0x005c31	3

Net Link States (Area 12)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.40.6	6.6.6.6	1381	0x80000002	0x0067a1

Summary Net Link States (Area 12)

Link ID	ADV Router	Age	Seq#	Checksum
172.16.47.0	4.4.4.4	1437	0x80000001	0x00071c
7.7.7.7	4.4.4.4	1371	0x80000002	0x005898
192.168.30.0	4.4.4.4	1371	0x80000003	0x009ce7
4.4.4.4	4.4.4.4	1371	0x80000004	0x005cde
172.16.34.0	4.4.4.4	1371	0x80000005	0x008e9d
172.16.23.0	4.4.4.4	1371	0x80000006	0x00896c
3.3.3.3	4.4.4.4	1371	0x80000007	0x0007f4
2.2.2.2	4.4.4.4	1371	0x80000008	0x00b509
172.16.12.0	4.4.4.4	1371	0x80000009	0x0006f6
192.168.10.0	4.4.4.4	1371	0x8000000a	0x00f758
1.1.1.1	4.4.4.4	1371	0x8000000b	0x00e7d6

R-06#

```
R-07#show ip ospf database

              OSPF Router with ID (7.7.7.7) (Process ID 77)

                Router Link States (Area 13)

Link ID           ADV Router        Age           Seq#          Checksum Link count
7.7.7.7           7.7.7.7           1636          0x80000004 0x00389e 4
4.4.4.4           4.4.4.4           1636          0x80000003 0x00bded 2

                Summary Net Link States (Area 13)
Link ID           ADV Router        Age           Seq#          Checksum
172.16.40.0       4.4.4.4           1666          0x80000001 0x00db8d
4.4.4.4           4.4.4.4           1605          0x80000002 0x0060dc
172.16.34.0       4.4.4.4           1605          0x80000003 0x00929b
172.16.23.0       4.4.4.4           1605          0x80000004 0x008d6a
3.3.3.3           4.4.4.4           1605          0x80000005 0x000bf2
2.2.2.2           4.4.4.4           1605          0x80000006 0x00b907
172.16.12.0       4.4.4.4           1605          0x80000007 0x000af4
192.168.10.0      4.4.4.4           1605          0x80000008 0x00fb56
1.1.1.1           4.4.4.4           1605          0x80000009 0x00ebd4
5.5.5.5           4.4.4.4           1605          0x8000000a 0x002c04
192.168.40.0      4.4.4.4           1605          0x8000000b 0x00a50c
6.6.6.6           4.4.4.4           1605          0x8000000c 0x00f930
192.168.20.0      4.4.4.4           1605          0x8000000d 0x007e45
R-07#
```

Dikkatlice bütün router'larda database incelemesi yapılırsa görülecektirki bu son çıktılarda sadece R-05 ve R-06 aynı database'e sahiptir (onlarda aynı area'da oldukları için). Çoklu **area** yapılanmasında olan bütün routerlar farklı **topoloji database**'lerine sahiptirler. Bu noktada en az bir interface'i area 0 da olup diğer interface'leri farklı area/area'larda olan router'lara **Area Border Router (ABR)** denmektedir. ABR'lar çoklu database'lere sahip oldukları için diğerlerine kıyasla daha iyi bir CPU'ya ihtiyaç duyabilirler. Günümüzdeki cihazların CPU yapılanmarında ciddi bir iyileşme olduğu gözlenmekte olsa da topolojinin büyüklüğüne göre bu durumun göz ardı edilmemesi gerekmektedir. Gerçi CPU'lardaki bu iyileşme bizlere **area** yapılanmasını da gereksiz kılmaktadır. Günümüzde çok sayıda cihazın tek bir area'da çalışacağı öngürülmektedir. Bu noktada net bir sayı mevcut değildir. Bu sayı için CPU ve yapının kendisine has değişkenler göz önünde bulundurulmalıdır.

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 3. 3 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    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 12
    172.16.47.4 0.0.0.0 area 13
  Routing Information Sources:
    Gateway           Distance      Last Update
    2.2.2.2              110        00:06:51
    3.3.3.3              110        00:06:35
    4.4.4.4              110        00:06:03
    5.5.5.5              110        00:05:43
    6.6.6.6              110        00:05:44
    7.7.7.7              110        00:06:04
  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 11
    1.1.1.1 0.0.0.0 area 11
    172.16.12.1 0.0.0.0 area 11
  Passive Interface(s):
    GigabitEthernet0/0
  Routing Information Sources:
    Gateway           Distance      Last Update
    1.1.1.1              110        00:07:28
    2.2.2.2              110        00:07:29
  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=3ms 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 = 3ms, Average = 3ms

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=12ms 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 = 12ms, Average = 7ms

PC>
```

```
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 11
 network 1.1.1.1 0.0.0.0 area 11
 network 172.16.12.1 0.0.0.0 area 11
!
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#show running-config
Building configuration...

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 11
 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#show running-config
Building configuration...

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
```

```
R-04#show running-config
Building configuration...

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 13
 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 12
!
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#show running-config
Building configuration...

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 12
 network 192.168.40.1 0.0.0.0 area 12
 network 172.16.40.5 0.0.0.0 area 12
!
```

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

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 12
 network 192.168.20.1 0.0.0.0 area 12
 network 172.16.40.6 0.0.0.0 area 12
!
```

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

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 13
 network 192.168.30.1 0.0.0.0 area 13
 network 172.16.47.7 0.0.0.0 area 13
!
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
```

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Umarım faydalı bir LAB çalışması olmuştur.
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