

LAB-221



Hedef

Router'larda EIGRP konfigürasyonu gerçekleştirerek farklı networklerin haberleşmesini sağlamak.

PC'lerin IP konfigürasyonları

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

Çalışma-01

Bu çalışmamızda batının en hızlı toparlanma (**convergence time**) süresini elinde bulunduran, en çevik en zeki en güzel routing protokolü olan EIGRP'nin konfigürasyonunu yapcaz. <https://goo.gl/N8w3yk> Tek eksiği uzun yıllar Cisco'nun tescilli ürünü olmak olan EIGRP (aslında bir eksiğide ne yazık ki *database'e sahip olmamasıdır* ve bu nedenle MPLS-TE gibi uygulamalarda kendisine yer bulamamıştır. Öteyandan database'inin olmaması EIGRP'ye en çevik ve en süratli toparlanma sağlayan routing protokolü özelliğini kazandırmaktadır.) 2013 yılında üreticiden bağımsız, open standart statüsüne geçirilsede ilgili RFC 2016 yılının Mayıs ayında yayınlanmıştır. Artık her cihaz üreticisinin çalıştırabileceği bir routing protokolü olan EIGRP'yi henüz Cisco'dan başka bir üreticide görememekteyiz. Merak edenler ve detaylı bir okuma yapmak isteyenler için: <https://tools.ietf.org/html/rfc7868>

EIGRP konfigürasyonu yaparken dikkat edeceğimiz hususlar şunlar olacaktır: **network** komutu ile interfacerleri EIGRP'ye dahil ederken **Wildcard Mask**'ı en fazla örtüşme sağlayacak şekilde yani **0.0.0.0** olarak tanımlayacağız. Cihazların **loopback** interfacerlerini dağıtırken aynı zamanda bu interface IP adreslerini **Router-ID** olarak kullancaz. Stub networkleri **passive-interface** olarak tanımlayarak bu interfacerlerden EIGRP *Hello* paketlerinin gitmesini engelleyeceğiz. Bunun hem gereksiz trafiği engellediğini hemde ilgi networklerden yapılabilecek EIGRP ataklarına karşı bir güvenlik tedbiri olduğunu belirtmek isterim.

EIGRP konfigürasyonu sayesinde üzerlerindeki ve öğrendikleri networklerin bilgilerini, routerlar birbirleriyle paylaşacaklar. Bu paylaşım neticesinde PC'lerin haberleşmesi de sağlanmış olacak.

Cisco IOS Release 15.0(1)M, 12.2(33)SRE, 12.2(33)XNE, Cisco IOS XE Release 2.5, Cisco IOS Release 12.2(33)SX14 ve daha yeni sürümlerinde artık Auto-Summary (classful özetleme/topluca gönderme) yapmamaktadır. Bu sebeble **no auto-summary** komutuna artık ihtiyaç yoktur.

```
R-01#configure terminal
R-01(config)#router eigrp 101
R-01(config-router)#eigrp 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
R-01(config-router)#network 1.1.1.1 0.0.0.0
R-01(config-router)#network 172.16.12.1 0.0.0.0
R-01(config-router)#end
R-01#

R-02#configure terminal
R-02(config)#router eigrp 101
R-02(config-router)#eigrp router-id 2.2.2.2
R-02(config-router)#network 172.16.23.2 0.0.0.0 R-02(config-
router)#network 2.2.2.2 0.0.0.0
R-02(config-router)#network 172.16.12.2 0.0.0.0
R-02(config-router)#end
R-02#

R-03#configure terminal
R-03(config)#router eigrp 101
R-03(config-router)#eigrp router-id 3.3.3.3
R-03(config-router)#network 3.3.3.3 0.0.0.0
R-03(config-router)#network 172.16.34.3 0.0.0.0
R-03(config-router)#network 172.16.23.3 0.0.0.0
R-03(config-router)#end
R-03#

R-04#configure terminal
R-04(config)#router eigrp 101
R-04(config-router)#eigrp router-id 4.4.4.4
R-04(config-router)#network 4.4.4.4 0.0.0.0
R-04(config-router)#passive-interface gigabitEthernet 0/0
R-04(config-router)#passive-interface gigabitEthernet 0/1
R-04(config-router)#network 192.168.20.1 0.0.0.0
```

```
R-04(config-router)#network 192.168.30.1 0.0.0.0 R-04(config-
router)#network 172.16.34.4 0.0.0.0
R-04(config-router)#end
R-04#
```

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
D       1.1.1.1/32 [90/2298112] via 172.16.23.2, 00:04:45, Serial0/0/0
    2.0.0.0/32 is subnetted, 1 subnets
D       2.2.2.2/32 [90/2297856] via 172.16.23.2, 00:04:45, 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
D       4.4.4.4/32 [90/2297856] via 172.16.34.4, 00:02:38, Serial0/0/1
172.16.0.0/16 is variably subnetted, 5 subnets, 2 masks
D       172.16.12.0/24 [90/2170112] via 172.16.23.2, 00:04:45, 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
D       192.168.10.0/24 [90/2170368] via 172.16.23.2, 00:04:45, Serial0/0/0
D       192.168.20.0/24 [90/2170112] via 172.16.34.4, 00:02:38, Serial0/0/1 D
192.168.30.0/24 [90/2170112] via 172.16.34.4, 00:02:38, Serial0/0/1
R-03#
```

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-03 2.2.2.2/32 networküne **2297856** metric uzaklıktaymış. EIGRP bu hesabı yaparken aşağıdaki formülü kullanmaktadır.

$$\text{Metric} = \left[\left(K1 * BW_{\min} + \frac{K2 * BW_{\min}}{256 - \text{load}} + K3 * \text{delay} \right) * \frac{K5}{K4 + \text{reliability}} \right] * 256$$

Görüldüğü gibi EIGRP en iyi yol hesabı için oldukça değişik ve geniş kapsamlı (yada karmaşık/kompleks) bir formül kullanmaktadır. Gerçi default durumda bu formüldeki birçok değer işleme dahil edilmez. Default'da Sadece **Bandwidth** ve **Delay** değerleri üzerinden hesaplama yapılır.

$$\text{Metric} = \left(\left(\frac{10^7}{\text{least-bandwidth}} \right) + \text{cumulative-delay} \right) * 256$$

Bu formülde bahsi geçen **Bandwidth** ve **Delay** değerleri efektif/güncel/anlık değerler değildir. Bilginin gelmiş olduğu ilgili interface'in sabit değerleridir. Tabiki değiştirilebilirler.

R-03#**show interfaces serial 0/0/0**

Serial0/0/0 is up, line protocol is up (connected)

Hardware is HD64570

Internet address is 172.16.23.3/24

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 142 bits/sec, 0 packets/sec

5 minute output rate 140 bits/sec, 0 packets/sec

319 packets input, 20073 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

260 packets output, 16421 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-03#
```

R-04#**show interfaces gigabitEthernet 0/0**

```
GigabitEthernet0/0 is up, line protocol is up (connected)
  Hardware is CN Gigabit Ethernet, address is 00e0.a30d.4c01 (bia
00e0.a30d.4c01)
  Internet address is 192.168.20.1/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00,
  Last input 00:00:08, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: fifo
  Output queue :0/40 (size/max)
  5 minute input rate 17 bits/sec, 0 packets/sec
  5 minute output rate 17 bits/sec, 0 packets/sec
    7 packets input, 896 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
    0 watchdog, 1017 multicast, 0 pause input
    0 input packets with dribble condition detected
    7 packets output, 896 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
```

```
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
R-04#
```

```
R-02#show ip eigrp interfaces
IP-EIGRP interfaces for process 101
```

		Xmit Queue	Mean	Pacing Time	Multicast	
Pending						
Interface	Peers	Un/Reliable	SRTT	Un/Reliable	Flow Timer	Routes
Lo0	0	0/0	1236	0/10	0	0
Se0/0/0	1	0/0	1236	0/10	0	0
Gig0/1	1	0/0	1236	0/10	0	0

```
R-02#
```

show ip eigrp neighbors

IP-EIGRP neighbors for process 101

H	Address	Interface	Hold (sec)	Uptime	SRTT (ms)	RTO	Q Cnt	Seq Num
0	172.16.12.1	Gig0/1	14	00:26:51	40	1000	0	17 1
	172.16.23.3	Se0/0/0	11	00:23:15	40	1000	0	15

R-02#

R-02#show ip eigrp topology

IP-EIGRP Topology Table for AS 101/ID(2.2.2.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

```

P 1.1.1.1/32, 1 successors, FD is 130816
    via 172.16.12.1 (130816/128256), GigabitEthernet0/1
P 2.2.2.2/32, 1 successors, FD is 128256
    via Connected, Loopback0 P 3.3.3.3/32, 1
    successors, FD is 2297856
        via 172.16.23.3 (2297856/128256), Serial0/0/0 P
4.4.4.4/32, 1 successors, FD is 2809856
    via 172.16.23.3 (2809856/2297856), Serial0/0/0
P 172.16.12.0/24, 1 successors, FD is 2816          via
    Connected, GigabitEthernet0/1 P 172.16.23.0/24, 1
    successors, FD is 2169856          via Connected,
    Serial0/0/0
P 172.16.34.0/24, 1 successors, FD is 2681856
    via 172.16.23.3 (2681856/2169856), Serial0/0/0 P
192.168.10.0/24, 1 successors, FD is 3072
    via 172.16.12.1 (3072/2816), GigabitEthernet0/1
P 192.168.20.0/24, 1 successors, FD is 2682112
    via 172.16.23.3 (2682112/2170112), Serial0/0/0 P
192.168.30.0/24, 1 successors, FD is 2682112
    via 172.16.23.3 (2682112/2170112), Serial0/0/0
R-02#

```


show ip eigrp topology all-links

IP-EIGRP Topology Table for AS 101/ID(2.2.2.2)

Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - Reply status

```
P 1.1.1.1/32, 1 successors, FD is 130816
    via 172.16.12.1 (130816/128256), GigabitEthernet0/1
P 2.2.2.2/32, 1 successors, FD is 128256
via Connected, Loopback0 P 3.3.3.3/32, 1
successors, FD is 2297856
    via 172.16.23.3 (2297856/128256), Serial0/0/0 P
4.4.4.4/32, 1 successors, FD is 2809856
    via 172.16.23.3 (2809856/2297856), Serial0/0/0
P 172.16.12.0/24, 1 successors, FD is 2816          via
Connected, GigabitEthernet0/1 P 172.16.23.0/24, 1
successors, FD is 2169856          via Connected,
Serial0/0/0
P 172.16.34.0/24, 1 successors, FD is 2681856
    via 172.16.23.3 (2681856/2169856), Serial0/0/0 P
192.168.10.0/24, 1 successors, FD is 3072
    via 172.16.12.1 (3072/2816), GigabitEthernet0/1
P 192.168.20.0/24, 1 successors, FD is 2682112
via 172.16.23.3 (2682112/2170112), Serial0/0/0 P
192.168.30.0/24, 1 successors, FD is 2682112
via 172.16.23.3 (2682112/2170112), Serial0/0/0 R-02#
```

Bu yapıda yedekli bir yol olmadığı için üstteki tablo ile bir önceki arasında bir fark göremiyoruz. Bu son iki tabloda sürekli gördüğümüz **P** (Passive) sembolü ise, bizlere aslında hiç bir sıkıntının olmadığını ilgili networke dair bir arayış (Active) içinde olmadığını göstermektedir.

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

show ip protocols

```
Routing Protocol is "eigrp 101 "  
  Outgoing update filter list for all interfaces is not set  
  Incoming update filter list for all interfaces is not set  
  Default networks flagged in outgoing updates  
  Default networks accepted from incoming updates  
  Redistributing: eigrp 101  
  EIGRP-IPv4 Protocol for AS(101)  
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0      NSF-  
  aware route hold timer is 240  
  Router-ID:  
  Topology : 0 (base)  
    Active Timer: 3 min  
    Distance: internal 90 external 170  
    Maximum path: 4  
    Maximum hopcount 100  
    Maximum metric variance 1  
  
  Automatic Summarization: disabled  
  Automatic address summarization:  
    Maximum path: 4  
  Routing for Networks:  
    2.0.0.0  
    172.16.23.2/32  
    2.2.2.2/32  
    172.16.12.2/32  
  Routing Information Sources:  
    Gateway      Distance      Last Update  
    172.16.12.1   90            4065557  
    172.16.23.3   90            4282234  
  Distance: internal 90 external 170
```

R-02#

Metric weight K1=1, K2=0, K3=1, K4=0, K5=0

K1 Bandwidth

K2 Load

K3 Delay

K4 Reliability

K5 MTU

R-01#**show ip protocols**

```
Routing Protocol is "eigrp 101 "  
  Outgoing update filter list for all interfaces is not set  
  Incoming update filter list for all interfaces is not set  
  Default networks flagged in outgoing updates  
  Default networks accepted from incoming updates  
  Redistributing: eigrp 101  
  EIGRP-IPv4 Protocol for AS(101)  
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0      NSF-  
aware route hold timer is 240  
  Router-ID:  
  Topology : 0 (base)  
    Active Timer: 3 min  
    Distance: internal 90 external 170  
    Maximum path: 4  
    Maximum hopcount 100  
    Maximum metric variance 1  
  
  Automatic Summarization: disabled  
Automatic address summarization:  
  Maximum path: 4  
  Routing for Networks:  
    172.16.12.1/32  
    1.1.1.1/32  
    192.168.10.1/32  
Passive Interface(s):  
  GigabitEthernet0/0  
  Routing Information Sources:  
    Gateway      Distance      Last Update  
    172.16.12.2   90           4065557  
  Distance: internal 90 external 170
```

R-01#

Bu arada 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=124 Reply  
from 192.168.20.11: bytes=32 time=13ms TTL=124
```

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 = 13ms, Average = 7ms
```

```
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=124 Reply  
from 192.168.30.11: bytes=32 time=11ms TTL=124
```

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 = 11ms, Average = 7ms
```

```
PC>
```

Router'ların son config'leri

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

```
Current configuration : 1058 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 eigrp 101 eigrp router-id
1.1.1.1 passive-interface
GigabitEthernet0/0 network
172.16.12.1 0.0.0.0 network 1.1.1.1
0.0.0.0 network 192.168.10.1 0.0.0.0
!
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#

```
Current configuration : 1035 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
            id 2.2.2.2
            network 2.0.0.0 network 172.16.23.2 0.0.0.0
            network 2.2.2.2 0.0.0.0
            network 172.16.12.2 0.0.0.0
!
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#
```


Current configuration : 998 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  
!  
            id 3.3.3.3  
network 3.3.3.3 0.0.0.0 network 172.16.34.3 0.0.0.0  
network 172.16.23.3 0.0.0.0  
!  
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#
```

Current configuration : 1120 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 192.168.20.1  
255.255.255.0 duplex auto speed auto  
! interface GigabitEthernet0/1 ip address 192.168.30.1  
255.255.255.0 duplex auto speed auto  
! interface Serial0/0/0 ip address 172.16.34.4  
255.255.255.0  
! interface Serial0/0/1 no ip address  
clock rate 2000000 shutdown  
!  
interface Vlan1 no ip address shutdown  
!  
                                id 4.4.4.4  
    passive-interface GigabitEthernet0/0 passive-interface  
GigabitEthernet0/1 network 4.4.4.4 0.0.0.0 network  
192.168.20.1 0.0.0.0 network 192.168.30.1 0.0.0.0 network  
172.16.34.4 0.0.0.0  
!  
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, info@sinanozcelik.com
