ŽILINSKÁ UNIVERZITA V ŽILINE

FAKULTA RIADENIA A INFORMATIKY

Dokumentácia k zadaniu OSPF z predmetu Projektovanie sietí 1

Tomáš Pikna, 5ZKS11

Stanislav Rusnák, 5ZKS11

Akad.rok 2016/2017

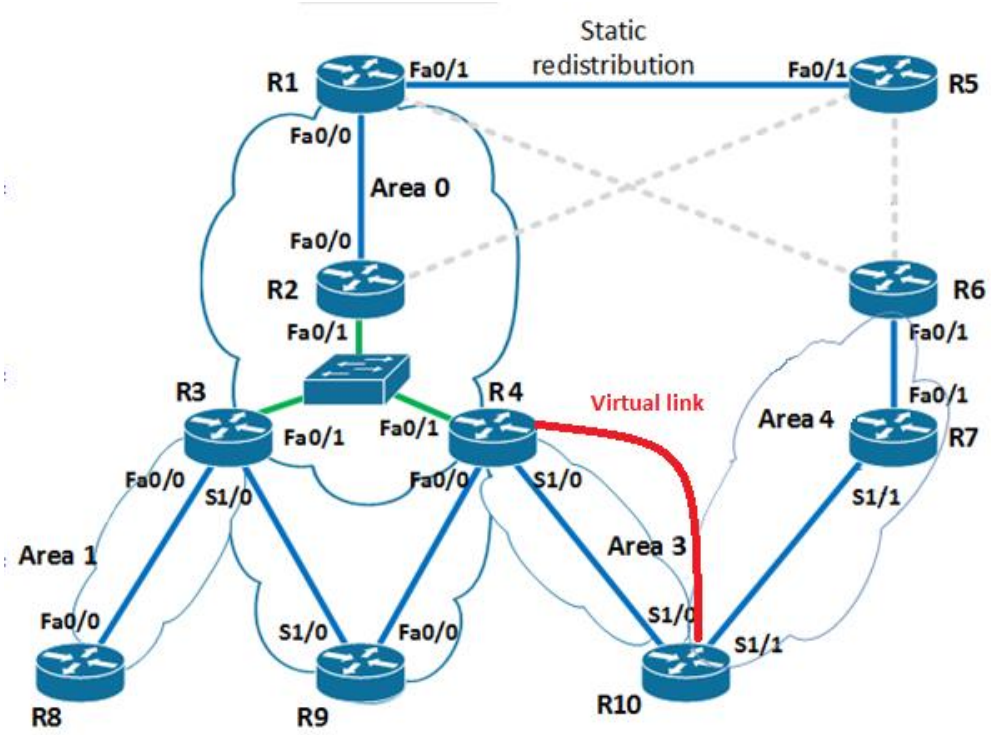
Obsah

1. Cvičenie OSPF

Na tomto cvičení bolo potrebné nakonfigurovať zadanie so smerovacím protokolom OSPF, splnenie úloh a ich overenie.

1.1. Topológia

V topológii bolo použitých 10 smerovačov, ktoré boli označené 1R1-1R10. Tieto boli prepojené sériovými alebo FastEthernet rozhraniami. Smerovače boli rozdelené do oblastí 0-4. 1R1, 1R2, 1R3 boli prepojené prepínačom.



1.2. Adresovanie

IP adresy na jednotlivých interfacoch boli prideľované podľa šablóny : 10.OBLASŤ.SPOJ ROUTER1 ROUTER2.ČÍSLO ROUTRA KTORÉMU PATRÍ INTERFACE. Ako príklad : interface fa0/0 na R8 v area1 má IP adresu : 10.1.38.8. IP adresy loopbackov na jednotlivých smerovačoch boli podľa šablóny : 10.255.255.ČÍSLO ROUTRA.

Router	Interface	IP Adresa	Maska
1R1	loopback	10.255.255.1	255.255.255.255
	fa0/0	10.0.12.1	255.255.255.0
	fa0/1	10.255.15.1	255.255.255.0
1R2	loopback	10.255.255.2	255.255.255.255
	fa0/0	10.0.12.2	255.255.255.0
	fa0/1	10.0.234.2	255.255.255.0
1R3	loopback	10.255.255.3	255.255.255.255
	fa0/0	10.1.38.3	255.255.255.0
	fa0/1	10.0.234.3	255.255.255.0
	s1/0	10.2.39.3	255.255.255.0
1R4	loopback	10.255.255.4	255.255.255.255
	fa0/0	10.2.49.4	255.255.255.0
	fa0/1	10.0.234.4	255.255.255.0
	s1/0	10.3.104.4	255.255.255.0
1R5	loopback	10.255.255.5	255.255.255.255
	fa0/1	10.255.15.5	255.255.255.0
1R6	loopback	10.255.255.6	255.255.255.255
	fa0/1	10.4.67.6	255.255.255.0
1R7	loopback	10.255.255.7	255.255.255.255
	fa0/1	10.4.67.7	255.255.255.0
	s1/1	10.4.107.7	255.255.255.0
1R8	loopback	10.255.255.8	255.255.255.255
	fa0/0	10.1.38.8	255.255.255.0
1R9	loopback	10.255.255.9	255.255.255.255
	fa0/0	10.2.49.9	255.255.255.0
	s1/0	10.2.39.9	255.255.255.0
1R10	loopback	10.255.255.255	255.255.255.255
	s1/0	10.3.104.10	255.255.255.0
	s1/1	10.4.104.10	255.255.255.0

1.3. Zadania úloh

- Nakonfigurovať OSPF s viacerými oblasťami
- R2, R3, R4 broadcast spojenia prostredníctvom L2 prepínača
- zvyšok spojení P2P
- Router-id - loopback0, passive-interface
- Area 1 – Totally Stubby
- Area 3 – Stub
- Area 4 – pripojenie pomocou virtuálnej linky
- Statická redistribúcia smerovacích záznamov z R5
- Kontrola DR prostredníctvom "ip ospf priority"
- Kontrola OSPF databáz a smerovacích tabuliek
- Kontrola konektivity
- Area 2 – R3 primárny smerovač, R4 sekundárny smerovač so sumarizovanými internými smerovacími záznamami do jedného sumarizačného
- Skrátenie hello a dead-interval časovačov, zistenie funkčnosti vytrhnutím jednej z liniek smerom ku L2 prepínaču
- Zdokumentovať (topo, adresácia, dizajn, úlohy)

1.4. Konfigurácia OSPF s viacerými oblasťami

Kontrolu správnej konfigurácie sme vykonali na smerovačoch R3 a R10, ktoré sú vo všetkých oblastiach.

```
1R3#sh 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 10.255.255.3
  It is an area border router
  Number of areas in this router is 3. 2 normal 1 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.234.0 0.0.0.255 area 0
    10.1.38.0 0.0.0.255 area 1
    10.2.39.0 0.0.0.255 area 2
 Reference bandwidth unit is 100 mbps
```

```
1R10#sh 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 10.255.255.10
  Number of areas in this router is 2. 1 normal 1 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.3.104.0 0.0.0.255 area 3
    10.4.107.0 0.0.0.255 area 4
 Reference bandwidth unit is 100 mbps
```

1.5. R2, R3, R4 broadcast spojenia prostredníctvom L2 prepínača

Ak sa medzi zariadeniami rozhoduje o DR a BDR smerovačoch, považujeme to za dôkaz existencie broadcast spojenia.

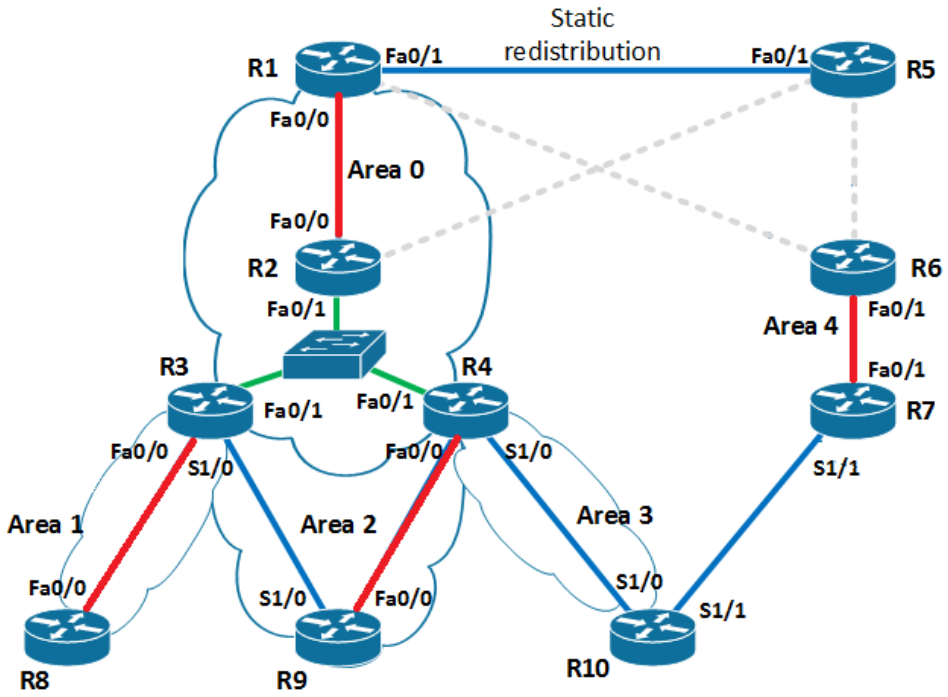
```
1R4#sh ip ospf neigh

Neighbor ID     Pri   State           Dead Time   Address         Interface
10.255.255.2    100   FULL/DR         00:00:36    10.0.234.2      FastEthernet0/
1
10.255.255.3      1   FULL/DROTHER    00:00:32    10.0.234.3      FastEthernet0/
1
10.255.255.9      0   FULL/  -        00:00:35    10.2.49.9       FastEthernet0/
0
10.255.255.10     0   FULL/  -        00:00:32    10.3.104.10     Serial1/0
```

1.6. Zvyšok spojení P2P

Medzi spojeniami zvýraznenými na obrázku bolo potrebné nastaviť p2p spojenie, pretože boli zapojené cez FastEthernet porty, čo spôsobovalo duplicitné záznamy v tabuľkách a vytváranie DR smerovačov v každom takomto spojení. Použili sme príkaz

ip ospf network point-to-point

na jednotlivých rozhraniach. Tento príkaz sme použili v oboch smeroch a tým sme sprehľadnili tabuľky OSPF databázy. Nepoužívali sme tento príkaz na sériových rozhraniach, pretože tie sú p2p defaultne.



P2P rozhranie medzi 1R1 a 1R2

```
1R1#sh ip ospf int brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/0        1     0               10.0.12.1/24       10    P2P   1/1
```

P2P rozhranie medzi 1R3 a 1R8

```
1R3#sh ip ospf int brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/1        1     0               10.0.234.3/24      10    DROTH 2/2
Fa0/0        1     1               10.1.38.3/24       10    P2P   1/1
Se1/0        1     2               10.2.39.3/24       64    P2P   1/1
```

P2P rozhranie medzi 1R4 a 1R9

```
1R4#sh ip ospf int brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/1        1     0               10.0.234.4/24      10    BDR   2/2
Fa0/0        1     2               10.2.49.4/24       10    P2P   1/1
Se1/0        1     3               10.3.104.4/24      64    P2P   1/1
```

P2P rozhranie medzi 1R6 a 1R7

```
1R6#sh ip ospf int brief
Interface    PID   Area            IP Address/Mask    Cost  State Nbrs F/C
Fa0/1        1     4               10.4.67.6/24       10    P2P   1/1
```

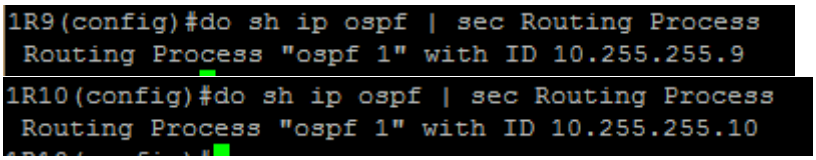
1.7.Router-id - loopback0, passive-interface

Passive interfaces postupne pre routre 1R1 – 1R10

```
1R1(config)#do sh ip proto | section Passive
  Passive Interface(s):
    Loopback0
1R2(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R3(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R4(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R5(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R6(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R7(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R8(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R9(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
1R10(config)#do sh ip proto | sec Passive
  Passive Interface(s):
    Loopback0
```

Router-ID ako IP loopbackov pre routre 1R1 – 1R10

```
1R1(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.1
1R2(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.2
1R3(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.3
1R4(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.4
1R5(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.5
1R6(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.6
1R7(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.7
1R8(config)#do sh ip ospf | sec Routing Process
 Routing Process "ospf 1" with ID 10.255.255.8
```


1R9(config)#do sh ip ospf | sec Routing Process
Routing Process "ospf 1" with ID 10.255.255.9
1R10(config)#do sh ip ospf | sec Routing Process
Routing Process "ospf 1" with ID 10.255.255.10

1.8. Area 1 – Totally Stubby

Totally Stubby area je oblasť, do ktorej sa nepreposielajú LSA3, LSA4 a LSA5 a ktorá neakceptuje LSA4 a LSA5

- Nemá info o ASBR, externých sieťach, ani o sieťach z iných oblastí
- Nemôže obsahovať ASBR
- Má info len o intra area cestách
- Funkcionalita totally stubby oblasti spočíva v dodatočnej činnosti ABR

Na R3 sme použili príkaz *area 1 stub no-summary.* R3 generuje len default route.

```
1R8(config)#do sh ip ospf data

            OSPF Router with ID (10.255.255.8) (Process ID 1)

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    98          0x8000001F 0x00134F 2
10.255.255.8    10.255.255.8    1201        0x80000015 0x00E77B 2

                Summary Net Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.3    98          0x8000000C 0x002FF6
```

1.9. Area 3 – Stub

1R10 smerovač je v Area 3. Príkazom *show ip ospf | begin Area 3* zistíme podrobnejšie informácie o oblasti Area 3.

```
1R10(config)#do sh ip ospf | begin Area 3
    Area 3
        Number of interfaces in this area is 1
        It is a stub area
```

```
1R10(config)#do sh ip ospf data

           OSPF Router with ID (10.255.255.10) (Process ID 1)

               Router Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.4    10.255.255.4    1262        0x8000001A 0x006607 2
10.255.255.10   10.255.255.10   1463        0x80000018 0x001F45 2

               Summary Net Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.4    1262        0x80000003 0x003BF2
10.0.12.0       10.255.255.4    1262        0x8000000E 0x00DC1D
10.0.234.0      10.255.255.4    1262        0x80000011 0x00DE43
10.2.0.0        10.255.255.4    1262        0x8000000B 0x00EA26
10.255.255.9    10.255.255.4    1262        0x8000000D 0x00AE58

               Router Link States (Area 4)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.6    10.255.255.6    723         0x80000015 0x0034EE 2
10.255.255.7    10.255.255.7    247         0x80000016 0x008BE7 4
10.255.255.10   10.255.255.10   692         0x80000016 0x00A9AF 2
```

1.10. Area 4 – pripojenie pomocou virtuálnej linky

Pripojenie Area 4 pomocou virtuálnej linky nieje možné, pretože Area 3 je Stubby oblasť. Ak by nebola Stubby oblasťou, pripojili by sme ju takýmito príkazmi:

```
1R4(config)# router ospf 1

1R4 (config-router)# area 3 virtual-link 10.3.104.10
```

```
1R10(config)# router ospf 1

1R10 (config-router)# area 3 virtual-link 10.3.104.4
```

1.11. Statická redistribúcia smerovacích záznamov z R5

Overovanie je na smerovači 1R1, pretože na ňom bola nastavená redistribúcia. Na overenie použijeme RID 1R5.

```
1R1(config)#do sh ip route 10.255.255.5
Routing entry for 10.255.255.5/32
  Known via "static", distance 1, metric 0
  Redistributing via ospf 1
  Advertised by ospf 1 subnets
```

1.12. Kontrola DR prostredníctvom „ip ospf priority“

```
1R3(config)#do sh ip ospf neigh

Neighbor ID     Pri   State           Dead Time   Address         Interface
10.255.255.2    100   FULL/DR         00:00:37    10.0.234.2      FastEthernet0/
1
10.255.255.4      1   FULL/BDR        00:00:34    10.0.234.4      FastEthernet0/
1
10.255.255.8      0   FULL/  -        00:00:38    10.1.38.8       FastEthernet0/
0
10.255.255.9      0   FULL/  -        00:00:37    10.2.39.9       Serial1/0
```

```
1R2(config)#do sh run | begin interface FastEthernet0/1
interface FastEthernet0/1
 ip address 10.0.234.2 255.255.255.0
 ip ospf priority 100
 duplex auto
 speed auto
!
```

1.13. Kontrola OSPF a smerovacích tabuliek

1R1 OSPF DB + route

```
1R1#sh ip ospf database

            OSPF Router with ID (10.255.255.1) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.1    10.255.255.1    1853        0x8000001C 0x002E76 2
10.255.255.2    10.255.255.2    824         0x80000027 0x00DBB6 3
10.255.255.3    10.255.255.3    564         0x8000002F 0x004BA6 1
10.255.255.4    10.255.255.4    824         0x80000014 0x007F8A 1

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.234.2      10.255.255.2    568         0x80000023 0x0020C9

                Summary Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.1.38.0       10.255.255.3    564         0x8000001C 0x0019C0
10.2.0.0        10.255.255.4    797         0x8000000B 0x00CC42
10.2.39.0       10.255.255.3    564         0x8000001F 0x00C910
10.2.49.0       10.255.255.3    564         0x8000001B 0x00C702
10.3.104.0      10.255.255.4    1052        0x80000011 0x005613
10.255.255.9    10.255.255.3    566         0x80000013 0x0058AC
10.255.255.9    10.255.255.4    1313        0x8000000D 0x009074

                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
10.255.255.5    10.255.255.1    844         0x80000013 0x00AEC5 0
```

```
1R1#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 11 subnets, 3 masks
O IA    10.255.255.9/32 [110/26] via 10.0.12.2, 00:10:48, FastEthernet0/0
C       10.0.12.0/24 is directly connected, FastEthernet0/0
O IA    10.2.0.0/16 [110/30] via 10.0.12.2, 00:14:55, FastEthernet0/0
C       10.255.255.1/32 is directly connected, Loopback0
S       10.255.255.5/32 [1/0] via 10.255.15.5, FastEthernet0/1
O IA    10.1.38.0/24 [110/30] via 10.0.12.2, 00:10:48, FastEthernet0/0
O IA    10.2.39.0/24 [110/25] via 10.0.12.2, 00:10:48, FastEthernet0/0
O IA    10.2.49.0/24 [110/35] via 10.0.12.2, 00:10:50, FastEthernet0/0
O IA    10.3.104.0/24 [110/84] via 10.0.12.2, 00:14:57, FastEthernet0/0
O       10.0.234.0/24 [110/20] via 10.0.12.2, 04:58:11, FastEthernet0/0
C       10.255.15.0/24 is directly connected, FastEthernet0/1
```

1R2 OSPF DB + route

```
1R2(config)#do sh ip ospf data

            OSPF Router with ID (10.255.255.2) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.1    10.255.255.1    1991        0x8000001C 0x002E76 2
10.255.255.2    10.255.255.2    961         0x80000027 0x00DBB6 3
10.255.255.3    10.255.255.3    701         0x8000002F 0x004BA6 1
10.255.255.4    10.255.255.4    962         0x80000014 0x007F8A 1

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.234.2      10.255.255.2    704         0x80000023 0x0020C9

                Summary Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.1.38.0       10.255.255.3    701         0x8000001C 0x0019C0
10.2.0.0        10.255.255.4    933         0x8000000B 0x00CC42
10.2.39.0       10.255.255.3    701         0x8000001F 0x00C910
10.2.49.0       10.255.255.3    701         0x8000001B 0x00C702
10.3.104.0      10.255.255.4    1188        0x80000011 0x005613
10.255.255.9    10.255.255.3    703         0x80000013 0x0058AC
10.255.255.9    10.255.255.4    1450        0x8000000D 0x009074

                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
10.255.255.5    10.255.255.1    984         0x80000013 0x00AEC5 0
```

```
1R2(config)#do sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 10 subnets, 3 masks
O IA    10.255.255.9/32 [110/16] via 10.0.234.3, 00:12:22, FastEthernet0/1
C       10.0.12.0/24 is directly connected, FastEthernet0/0
C       10.255.255.2/32 is directly connected, Loopback0
O IA    10.2.0.0/16 [110/20] via 10.0.234.4, 00:16:29, FastEthernet0/1
O E2    10.255.255.5/32 [110/20] via 10.0.12.1, 04:59:43, FastEthernet0/0
O IA    10.1.38.0/24 [110/20] via 10.0.234.3, 00:12:22, FastEthernet0/1
O IA    10.2.39.0/24 [110/15] via 10.0.234.3, 00:12:23, FastEthernet0/1
O IA    10.2.49.0/24 [110/25] via 10.0.234.3, 00:12:23, FastEthernet0/1
O IA    10.3.104.0/24 [110/74] via 10.0.234.4, 00:16:30, FastEthernet0/1
C       10.0.234.0/24 is directly connected, FastEthernet0/1
```

1R3 OSPF DB + route

```
1R3#sh ip ospf data

            OSPF Router with ID (10.255.255.3) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.1    10.255.255.1    39          0x8000001D 0x002C77 2
10.255.255.2    10.255.255.2    1038        0x80000027 0x00DBB6 3
10.255.255.3    10.255.255.3    776         0x8000002F 0x004BA6 1
10.255.255.4    10.255.255.4    1039        0x80000014 0x007F8A 1

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.234.2      10.255.255.2    782         0x80000023 0x0020C9

                Summary Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.1.38.0       10.255.255.3    776         0x8000001C 0x0019C0
10.2.0.0        10.255.255.4    1010        0x8000000B 0x00CC42
10.2.39.0       10.255.255.3    776         0x8000001F 0x00C910
10.2.49.0       10.255.255.3    776         0x8000001B 0x00C702
10.3.104.0      10.255.255.4    1265        0x80000011 0x005613
10.255.255.9    10.255.255.3    778         0x80000013 0x0058AC
10.255.255.9    10.255.255.4    1526        0x8000000D 0x009074

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    787         0x8000002B 0x00FA5B 2
10.255.255.8    10.255.255.8    771         0x80000017 0x00E37D 2

                Summary Net Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.3    788         0x80000001 0x0045EB
```

```
                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    787         0x8000002E 0x003224 2
10.255.255.4    10.255.255.4    1267        0x8000001A 0x009EAA 2
10.255.255.9    10.255.255.9    1896        0x8000001D 0x00D79C 5

                Summary Net Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.12.0       10.255.255.3    773         0x80000001 0x00DE27
10.0.12.0       10.255.255.4    1039        0x80000001 0x00D82C
10.0.234.0      10.255.255.3    785         0x80000001 0x00E64A
10.0.234.0      10.255.255.4    1270        0x80000016 0x00B664
10.1.38.0       10.255.255.3    790         0x80000001 0x004FA5
10.1.38.0       10.255.255.4    787         0x80000001 0x00AD3C
10.2.0.0        10.255.255.3    775         0x80000001 0x004BC4
10.3.104.0      10.255.255.3    775         0x80000001 0x00E08F
10.3.104.0      10.255.255.4    1270        0x80000016 0x004C18

                Summary ASB Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.255.255.1    10.255.255.3    775         0x80000001 0x004BC4
10.255.255.1    10.255.255.4    1039        0x80000001 0x0045C9

                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
10.255.255.5    10.255.255.1    1064        0x80000013 0x00AEC5 0
```

```
1R3#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 10 subnets, 3 masks
O       10.255.255.9/32 [110/6] via 10.2.39.9, 00:14:34, Serial1/0
O       10.0.12.0/24 [110/20] via 10.0.234.2, 00:14:19, FastEthernet0/1
O IA    10.2.0.0/16 [110/20] via 10.0.234.4, 00:14:19, FastEthernet0/1
C       10.255.255.3/32 is directly connected, Loopback0
O E2    10.255.255.5/32 [110/20] via 10.0.234.2, 00:14:19, FastEthernet0/1
C       10.1.38.0/24 is directly connected, FastEthernet0/0
C       10.2.39.0/24 is directly connected, Serial1/0
O       10.2.49.0/24 [110/15] via 10.2.39.9, 00:14:35, Serial1/0
O IA    10.3.104.0/24 [110/74] via 10.0.234.4, 00:14:20, FastEthernet0/1
C       10.0.234.0/24 is directly connected, FastEthernet0/1
1R3#
```

1R4 OSPF DB + route

```
1R4#sh ip ospf data

            OSPF Router with ID (10.255.255.4) (Process ID 1)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.1    10.255.255.1    160         0x8000001D 0x002C77 2
10.255.255.2    10.255.255.2    1159        0x80000027 0x00DBB6 3
10.255.255.3    10.255.255.3    898         0x8000002F 0x004BA6 1
10.255.255.4    10.255.255.4    1158        0x80000014 0x007F8A 1

                Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.234.2      10.255.255.2    902         0x80000023 0x0020C9

                Summary Net Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum
10.1.38.0       10.255.255.3    898         0x8000001C 0x0019C0
10.2.0.0        10.255.255.4    1129        0x8000000B 0x00CC42
10.2.39.0       10.255.255.3    898         0x8000001F 0x00C910
10.2.49.0       10.255.255.3    898         0x8000001B 0x00C702
10.3.104.0      10.255.255.4    1384        0x80000011 0x005613
10.255.255.9    10.255.255.3    899         0x80000013 0x0058AC
10.255.255.9    10.255.255.4    1645        0x8000000D 0x009074

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    910         0x8000002E 0x003224 2
10.255.255.4    10.255.255.4    1386        0x8000001A 0x009EAA 2
10.255.255.9    10.255.255.9    2017        0x8000001D 0x00D79C 5
```

```
                Summary Net Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.12.0       10.255.255.3    895         0x80000001 0x00DE27
10.0.12.0       10.255.255.4    1155        0x80000001 0x00D82C
10.0.234.0      10.255.255.3    905         0x80000001 0x00E64A
10.0.234.0      10.255.255.4    1386        0x80000016 0x00B664
10.1.38.0       10.255.255.3    910         0x80000001 0x004FA5
10.1.38.0       10.255.255.4    903         0x80000001 0x00AD3C
10.2.0.0        10.255.255.3    896         0x80000001 0x004BC4
10.3.104.0      10.255.255.3    896         0x80000001 0x00E08F
10.3.104.0      10.255.255.4    1387        0x80000016 0x004C18

                Summary ASB Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.255.255.1    10.255.255.3    896         0x80000001 0x004BC4
10.255.255.1    10.255.255.4    1158        0x80000001 0x0045C9

                Router Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.4    10.255.255.4    1389        0x8000001B 0x006408 2
10.255.255.10   10.255.255.10   1541        0x80000019 0x001D46 2

                Summary Net Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.4    1389        0x80000004 0x0039F3
10.0.12.0       10.255.255.4    1158        0x80000001 0x00F610
10.0.234.0      10.255.255.4    1389        0x80000012 0x00DC44
10.1.38.0       10.255.255.4    906         0x80000001 0x00CB20
10.2.0.0        10.255.255.4    1389        0x8000000C 0x00E827
10.255.255.9    10.255.255.4    1389        0x8000000E 0x00AC59

                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
10.255.255.5    10.255.255.1    1183        0x80000013 0x00AEC5 0
```

```
1R4#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 10 subnets, 3 masks
O       10.255.255.9/32 [110/11] via 10.2.49.9, 02:04:56, FastEthernet0/0
O       10.0.12.0/24 [110/20] via 10.0.234.2, 00:20:27, FastEthernet0/1
O       10.2.0.0/16 is a summary, 02:04:56, Null0
C       10.255.255.4/32 is directly connected, Loopback0
O E2    10.255.255.5/32 [110/20] via 10.0.234.2, 00:20:27, FastEthernet0/1
O IA    10.1.38.0/24 [110/20] via 10.0.234.3, 00:16:15, FastEthernet0/1
O       10.2.39.0/24 [110/15] via 10.2.49.9, 01:04:49, FastEthernet0/0
C       10.2.49.0/24 is directly connected, FastEthernet0/0
C       10.3.104.0/24 is directly connected, Serial1/0
C       10.0.234.0/24 is directly connected, FastEthernet0/1
```

1R5 OSPF DB + route

```
1R5#sh ip ospf data

            OSPF Router with ID (10.255.255.5) (Process ID 1)
1R5#sh ip route
Codes: 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

Gateway of last resort is 10.255.15.1 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.255.255.5/32 is directly connected, Loopback0
C       10.255.15.0/24 is directly connected, FastEthernet0/1
S*   0.0.0.0/0 [1/0] via 10.255.15.1, FastEthernet0/1
```

1R6 OSPF DB + route

```
1R6#sh ip ospf data

            OSPF Router with ID (10.255.255.6) (Process ID 1)

                Router Link States (Area 4)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.6    10.255.255.6    995         0x80000016 0x0032EF 2
10.255.255.7    10.255.255.7    534         0x80000017 0x0089E8 4
10.255.255.10   10.255.255.10   938         0x80000017 0x00A7B0 2
```

```
1R6#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.255.255.6/32 is directly connected, Loopback0
C       10.4.67.0/24 is directly connected, FastEthernet0/1
O       10.4.107.0/24 [110/74] via 10.4.67.7, 10:11:44, FastEthernet0/1
```

1R7 OSPF DB + route

```
1R7#sh ip ospf data

            OSPF Router with ID (10.255.255.7) (Process ID 1)

                Router Link States (Area 4)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.6    10.255.255.6    1074        0x80000016 0x0032EF 2
10.255.255.7    10.255.255.7    610         0x80000017 0x0089E8 4
10.255.255.10   10.255.255.10   1015        0x80000017 0x00A7B0 2
```

```
1R7#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.255.255.7/32 is directly connected, Loopback0
C       10.4.67.0/24 is directly connected, FastEthernet0/1
C       10.4.107.0/24 is directly connected, Serial1/1
```

1R8 OSPF DB + route

```
1R8#sh ip ospf data

            OSPF Router with ID (10.255.255.8) (Process ID 1)

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    1211        0x8000002B 0x00FA5B 2
10.255.255.8    10.255.255.8    1192        0x80000017 0x00E37D 2

                Summary Net Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.3    1212        0x80000001 0x0045EB
```

```
1R8#sh ip route
Codes: 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

Gateway of last resort is 10.1.38.3 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.255.255.8/32 is directly connected, Loopback0
C       10.1.38.0/24 is directly connected, FastEthernet0/0
O*IA 0.0.0.0/0 [110/11] via 10.1.38.3, 00:20:37, FastEthernet0/0
```

1R9 OSPF DB + route

```
1R9#sh ip ospf data

            OSPF Router with ID (10.255.255.9) (Process ID 1)

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.3    10.255.255.3    1298        0x8000002E 0x003224 2
10.255.255.4    10.255.255.4    1777        0x8000001A 0x009EAA 2
10.255.255.9    10.255.255.9    350         0x8000001E 0x00D59D 5

                Summary Net Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.0.12.0       10.255.255.3    1284        0x80000001 0x00DE27
10.0.12.0       10.255.255.4    1545        0x80000001 0x00D82C
10.0.234.0      10.255.255.3    1294        0x80000001 0x00E64A
10.0.234.0      10.255.255.4    1776        0x80000016 0x00B664
10.1.38.0       10.255.255.3    1299        0x80000001 0x004FA5
10.1.38.0       10.255.255.4    1293        0x80000001 0x00AD3C
10.2.0.0        10.255.255.3    1284        0x80000001 0x004BC4
10.3.104.0      10.255.255.3    1284        0x80000001 0x00E08F
10.3.104.0      10.255.255.4    1778        0x80000016 0x004C18

                Summary ASB Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum
10.255.255.1    10.255.255.3    1285        0x80000001 0x004BC4
10.255.255.1    10.255.255.4    1548        0x80000001 0x0045C9

                Type-5 AS External Link States

Link ID         ADV Router      Age         Seq#       Checksum Tag
10.255.255.5    10.255.255.1    1573        0x80000013 0x00AEC5 0
```

```
1R9#sh ip route
Codes: 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

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 9 subnets, 3 masks
C       10.255.255.9/32 is directly connected, Loopback0
O IA    10.0.12.0/24 [110/25] via 10.2.39.3, 00:21:55, Serial1/0
O IA    10.2.0.0/16 [110/25] via 10.2.39.3, 00:21:55, Serial1/0
O E2    10.255.255.5/32 [110/20] via 10.2.39.3, 00:21:54, Serial1/0
O IA    10.1.38.0/24 [110/15] via 10.2.39.3, 00:22:04, Serial1/0
C       10.2.39.0/24 is directly connected, Serial1/0
C       10.2.49.0/24 is directly connected, FastEthernet0/0
O IA    10.3.104.0/24 [110/74] via 10.2.49.4, 01:39:15, FastEthernet0/0
O IA    10.0.234.0/24 [110/15] via 10.2.39.3, 00:22:06, Serial1/0
1R9#
```

1R10 OSPF DB + route

```
1R10#sh ip ospf data

            OSPF Router with ID (10.255.255.10) (Process ID 1)

                Router Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.4    10.255.255.4    1845        0x8000001B 0x006408 2
10.255.255.10   10.255.255.10   1994        0x80000019 0x001D46 2

                Summary Net Link States (Area 3)

Link ID         ADV Router      Age         Seq#       Checksum
0.0.0.0         10.255.255.4    1845        0x80000004 0x0039F3
10.0.12.0       10.255.255.4    1614        0x80000001 0x00F610
10.0.234.0      10.255.255.4    1845        0x80000012 0x00DC44
10.1.38.0       10.255.255.4    1361        0x80000001 0x00CB20
10.2.0.0        10.255.255.4    1845        0x8000000C 0x00E827
10.255.255.9    10.255.255.4    1845        0x8000000E 0x00AC59

                Router Link States (Area 4)

Link ID         ADV Router      Age         Seq#       Checksum Link count
10.255.255.6    10.255.255.6    1292        0x80000016 0x0032EF 2
10.255.255.7    10.255.255.7    829         0x80000017 0x0089E8 4
10.255.255.10   10.255.255.10   1233        0x80000017 0x00A7B0 2
1R10#
```

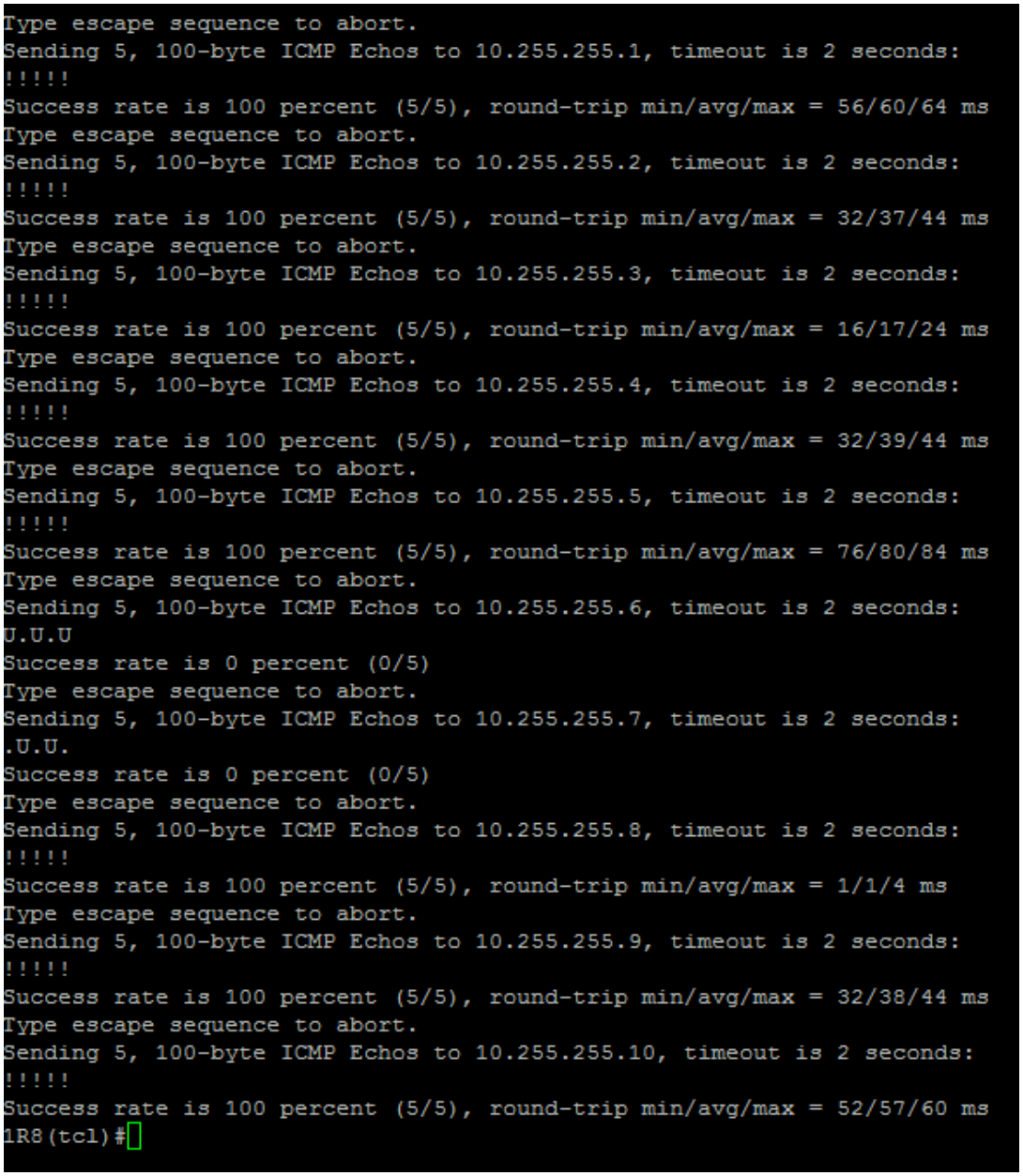
```
1R10#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, 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

Gateway of last resort is 10.3.104.4 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 9 subnets, 3 masks
C       10.255.255.10/32 is directly connected, Loopback0
O IA    10.255.255.9/32 [110/75] via 10.3.104.4, 02:11:14, Serial1/0
O IA    10.0.12.0/24 [110/84] via 10.3.104.4, 00:27:16, Serial1/0
O IA    10.2.0.0/16 [110/74] via 10.3.104.4, 02:11:14, Serial1/0
O IA    10.1.38.0/24 [110/84] via 10.3.104.4, 00:23:04, Serial1/0
O       10.4.67.0/24 [110/74] via 10.4.107.7, 02:11:29, Serial1/1
C       10.3.104.0/24 is directly connected, Serial1/0
C       10.4.107.0/24 is directly connected, Serial1/1
O IA    10.0.234.0/24 [110/74] via 10.3.104.4, 02:11:16, Serial1/0
O*IA 0.0.0.0/0 [110/65] via 10.3.104.4, 02:11:16, Serial1/0
```

1.14. Kontrola konektivity

Na kontrolu konektivity sme použili skript, ktorý postupne použil príkaz ping nad všetkými loopback rozhraniami všetkých smerovačov.

```
1R8(tcl)#foreach address {
+>10.255.255.1
+>10.255.255.2
+>10.255.255.3
+>10.255.255.4
+>10.255.255.5
+>10.255.255.6
+>10.255.255.7
+>10.255.255.8
+>10.255.255.9
+>10.255.255.10
+>} {ping $address}
```

Nasledujúci obrázok ukazuje použitie skriptu na smerovači 1R8. Konektivitu na smerovače 1R6 a 1R7, ktoré patria do Area 4 nemáme z dôvodu chýbajúcej virtuálnej linky.



Z tohto dôvodu sme spustili skript aj na smerovači 1R10, ktorý má jednu sieť aj v Area 4, z tohto dôvodu má konektivitu na všetky smerovače.

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/60/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/37/44 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/39/44 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/17/20 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.5, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/79/84 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.6, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/39/44 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.7, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/16/24 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.8, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/59/64 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.9, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/37/40 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.255.255.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/4 ms
```

1.15. Area 2 – R3 primárny smerovač, R4 sekundárny smerovač so sumarizovanými internými smerovacími záznamami do jedného sumarizačného

Primárnu cestu pre Area 2 cez R3 smerovač sme nastavili cenou (cost) cesty medzi R3 a R9. Ako dôkaz je použitý príkaz traceroute pred úpravou costou, kedy cesta vedie cez R4 a po úprave costov, kedy cesta vedie cez R3. Zároveň sme príkazmi uvedenými nižšie sumarizovali interné smerovacie záznamy.

Pôvodné:

```
1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

  1 10.0.12.2 16 msec 16 msec 16 msec
  2 10.0.234.4 28 msec 36 msec 36 msec
  3 10.2.49.9 68 msec *  52 msec
```

1R9#sh ip ospf int s1/0
Serial1/0 is up, line protocol is up
 Internet Address 10.2.39.9/24, Area 2
 Process ID 1, Router ID 10.255.255.9, Network Type POINT_TO_POINT, **Cost: 64**

1R2#show ip ospf data
Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.2.39.0	**10.255.255.3**	**352**	**0x80000010**	**0x00E701**
10.2.39.0	**10.255.255.4**	**23**	**0x80000001**	**0x006488**
10.2.49.0	**10.255.255.3**	**352**	**0x8000000C**	**0x00E5F2**
10.2.49.0	**10.255.255.4**	**23**	**0x80000001**	**0x00C324**

Príkazy:

1R4(config)#router ospf 1
1R4(config-router)#area 2 range 10.2.0.0 255.255.0.0

1R3(config)#int s1/0
1R3(config-if)#ip ospf cost 5

1R9(config)#int s1/0
1R9(config-if)#ip ospf cost 5

Zmena:

```
1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

  1 10.0.12.2 16 msec 16 msec 16 msec
  2 10.0.234.3 36 msec 28 msec 36 msec
  3 10.2.39.9 72 msec *  72 msec
```

Summary Net Link States (Area 0)

Link ID	ADV Router	Age	Seq#	Checksum
10.2.0.0	**10.255.255.4**	**25**	**0x80000001**	**0x00E038**
10.2.39.0	**10.255.255.3**	**553**	**0x80000010**	**0x00E701**
10.2.49.0	**10.255.255.3**	**553**	**0x8000000C**	**0x00E5F2**

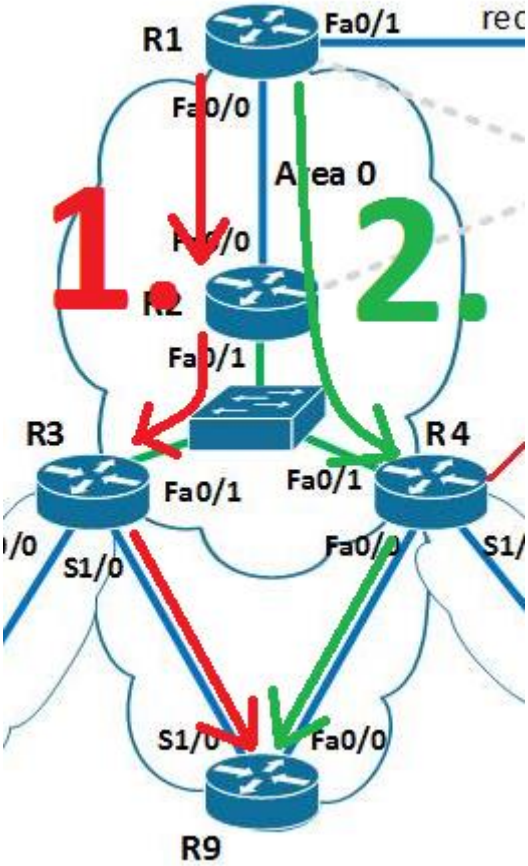
1R9#sh ip osp int s1/0
Serial1/0 is up, line protocol is up

Internet Address 10.2.39.9/24, Area 2
Process ID 1, Router ID 10.255.255.9, Network Type POINT_TO_POINT, **Cost: 5**

1.16. Skrátenie hello a dead-interval časovačov, zistenie funkčnosti vytrhnutím jednej z liniek smerom ku L2 prepínaču

Postup:

Na overenie skráteného hello a dead-intervalu sme si vybrali trasu z R1 na loopback R9, ktorý sme už kvôli testovaniu oceňovania trasy medzi R3 a R9 už oznamovali do OSPF. Trasa je nastavená tak, aby využívala R3 na prechod z R2 do R9, no možná cesta je aj cez R4, no kvoli cene nie je výhodná.



Spustili sme príkaz ping s 200 opakovaniami z 1R1 na 1R9 loopback, zmenili sme čas po ktorom nastane time-out na 1 sekundu, aby bolo vidno, koľko sekúnd v priemere trvalo protokolu zaregistrovať chybu a prehodiť trasu. Príkazom traceroute pred a po odosielaní ICMP paketov sme overovali trasu, či ju protokol zmenil. Počas odosielania ICMP paketov sme vypli interface fa0/1 na 1R3 aby sme zaznamenali čas, koľko trvalo protokolu zaznamenať zmenu.

Stav pred:

1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

1 10.0.12.2 8 msec 20 msec 12 msec
2 10.0.234.3 32 msec 36 msec 36 msec
3 10.2.39.9 68 msec * 60 msec

1R1#ping
Protocol [ip]:
Target IP address: 10.255.255.9
Repeat count [5]: 200
Datagram size [100]:
Timeout in seconds [2]: 1
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 200, 100-byte ICMP Echos to 10.255.255.9, timeout is 1 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!.....!!!!!
!!
!!
Success rate is 79 percent (159/200), round-trip min/avg/max = 40/60/72 ms

Približne 41 sekúnd

1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

1 10.0.12.2 16 msec 16 msec 20 msec
2 10.0.234.4 24 msec 36 msec 40 msec
3 10.2.49.9 64 msec * 64 msec

Na int fa0/1 prepínača R2,R3,R4 sme nakonfigurovali „ip ospf hello-interval 5“ (namiesto pôvodných 10 sec), čo dvojnásobne zrýchlilo prehodenie packetov na náhradnú trasu.

Stav po:

1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

1 10.0.12.2 8 msec 20 msec 12 msec
2 10.0.234.3 32 msec 36 msec 36 msec
3 10.2.39.9 68 msec * 60 msec

1R1#ping
Protocol [ip]:
Target IP address: 10.255.255.9
Repeat count [5]: 200

Datagram size [100]:
Timeout in seconds [2]: 1
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 200, 100-byte ICMP Echos to 10.255.255.9, timeout is 1 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!.....!!!!!!!!!!!!!!!!!!!!!!
!!
!!
Success rate is 88 percent (177/200), round-trip min/avg/max = 40/60/84 ms

Približne 23 sekúnd

1R1#traceroute 10.255.255.9

Type escape sequence to abort.
Tracing the route to 10.255.255.9

1 10.0.12.2 16 msec 16 msec 20 msec
2 10.0.234.4 24 msec 36 msec 40 msec
3 10.2.49.9 64 msec * 64 msec