ŽILINSKÁ UNIVERZITA V ŽILINE
Fakulta riadenia a informatiky

Projektovanie sietí 1

Zadanie č. 2: IS-IS

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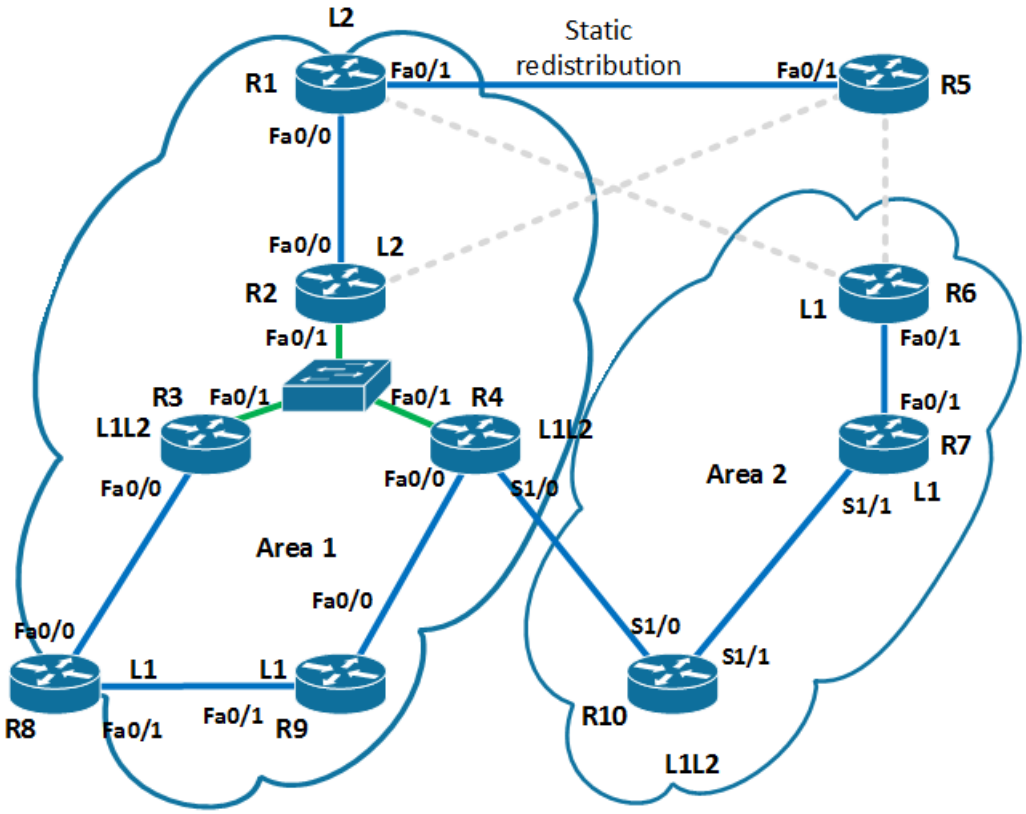
Zadanie

Úlohou bolo na smerovačoch v už vytvorenej topológii nakonfigurovať správne fungujúci smerovací protokol IS-IS a overiť jeho funkčnosť a splnenie jednotlivých bodov zadania.

Topológia



Adresovanie

Smerovač	Interface	IP Adresa	Maska siete
R1	l0	10.255.255.1	255.255.255.255
	fa0/0	10.0.12.1	255.255.255.0
	fa0/1	10.0.15.1	255.255.255.0
R2	l0	10.255.255.2	255.255.255.255
	fa0/0	10.1.12.2	255.255.255.0
	fa0/1	10.1.234.1	255.255.255.0
R3	l0	10.255.255.3	255.255.255.255
	fa0/0	10.1.38.1	255.255.255.0
	fa0/1	10.1.234.2	255.255.255.0
R4	l0	10.255.255.4	255.255.255.255
	fa0/0	10.1.49.1	255.255.255.0
	fa0/1	10.1.234.3	255.255.255.0
	s1/0	10.10.40.1	255.255.255.0

R5	l0	10.255.255.5	255.255.255.255
	fa0/1	10.10.15.2	255.255.255.0
R6	l0	10.255.255.6	255.255.255.255
	fa0/1	10.2.67.1	255.255.255.0
R7	l0	10.255.255.7	255.255.255.255
	fa0/1	10.2.67.2	255.255.255.0
	s1/1	10.2.70.1	255.255.255.0
R8	l0	10.255.255.8	255.255.255.255
	fa0/0	10.1.38.2	255.255.255.0
	fa0/1	10.1.89.1	255.255.255.0
R9	l0	10.255.255.9	255.255.255.255
	fa0/0	10.1.49.2	255.255.255.0
	fa0/1	10.1.89.2	255.255.255.0
R10	l0	10.255.255.10	255.255.255.255
	s1/0	10.10.40.2	255.255.255.0
	s1/1	10.2.70.2	255.255.255.0

Úlohy

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Pozn.: Pre lepšiu prehľadnosť výpisov na smerovačoch sme z nich nepodstatné časti vymazali a dôležité časti zvýraznili hrubým písmom.

1. Nakonfigurovať IS-IS s dvomi oblasťami

Podľa zadania sme smerovače R1 – R4, R8 a R9 nakonfigurovali tak, aby ležali v IS-IS oblasti Area 1 a R6, R7 a R10 v oblasti Area 2.

```
R10#show clns neighbors detail

System Id      Interface   SNPA            State Holdtime Type Protocol
R4             Se1/0       *HDLC*          Up    31       L2   IS-IS
  Area Address(es): 49.0001
R7             Se1/1       *HDLC*          Up    25       L1   IS-IS
  Area Address(es): 49.0002

R4#show clns neighbors detail

System Id      Interface   SNPA            State Holdtime Type Protocol
R10             Se1/0      *HDLC*          Up    17       L2   IS-IS
  Area Address(es): 49.0002
R2              Fa0/1      c015.6127.0001  Up    29       L2   IS-IS
  Area Address(es): 49.0001
R9              Fa0/0      c01c.6127.0000  Up    22       L1   IS-IS
  Area Address(es): 49.0001
```

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

Na nasledujúcom výpise vidíme, že na sieti medzi R2, R3, R4 je zvolený DIS router, v našom prípade je to R2 – v stĺpci LSPID vidíme pri R2 hodnotu 02-00. Z toho vyplýva, že rozhrania sú nastavené ako broadcast.

```
R2#sh isis database l2
IS-IS Level-2 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00              0x000000D6   0x2E67        632               0/0/0
R2.00-00            * 0x000000D6   0x3AD6        888               0/0/0
R2.02-00            * 0x000000B1   0xFFCF        915               0/0/0
R3.00-00              0x000000E2   0x906C        888               0/0/0
R4.00-00              0x000000E2   0xC59B        949               0/0/0
R10.00-00             0x000000D9   0x37D4        1026              0/0/0

R3#sh isis database l2
IS-IS Level-2 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00              0x000000D6   0x2E67        609               0/0/0
R2.00-00              0x000000D6   0x3AD6        866               0/0/0
R2.02-00              0x000000B1   0xFFCF        893               0/0/0
R3.00-00            * 0x000000E2   0x906C        869               0/0/0
R4.00-00              0x000000E2   0xC59B        929               0/0/0
R10.00-00             0x000000D9   0x37D4        1005              0/0/0

R4#sh isis database l2
IS-IS Level-2 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
```

```
R1.00-00              0x000000D6   0x2E67        598               0/0/0
R2.00-00              0x000000D6   0x3AD6        854               0/0/0
R2.02-00              0x000000B1   0xFFCF        881               0/0/0
R3.00-00              0x000000E2   0x906C        856               0/0/0
R4.00-00            * 0x000000E2   0xC59B        919               0/0/0
R10.00-00             0x000000D9   0x37D4        996               0/0/0
```

3. Zvyšok spojení P2P

Podobne ako v predchádzajúcom prípade. Ak na sieti nie je zvolený DIS router – v LSPID je všade 00-00, znamená to, že spojenie je typu P2P (nastavili sme ho príkazom *isis network point-to-point* na príslušných rozhraniach). Uvádzame len výpis z R6 a R7.

```
R6#sh isis database
IS-IS Level-1 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R6.00-00            * 0x000000D6   0xBC0E        803               0/0/0
R7.00-00              0x000000D7   0xBA9C        850               0/0/0
R10.00-00             0x000000D6   0x4B21        368               1/0/0

R7#sh isis database
IS-IS Level-1 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R6.00-00              0x000000D6   0xBC0E        761               0/0/0
R7.00-00            * 0x000000D7   0xBA9C        811               0/0/0
R10.00-00             0x000000D7   0x4922        1158              1/0/0
```

4. R3 – R4 L2 only

Aby sme okruh linky medzi smerovačmi R3 a R4 nastavili na level-2 only, použijeme na daných rozhraniach medzi nimi príkaz *isis circuit-type level-2-only*. Správnosť overíme výpisom *show clns interface* na týchto rozhraniach.

```
R3#show clns interface fa0/1
FastEthernet0/1 is up, line protocol is up
  Checksums enabled, MTU 1497, Encapsulation SAP
  ...
  Routing Protocol: IS-IS
    Circuit Type: level-2
    Interface number 0x1, local circuit ID 0x2
    Level-2 Metric: 10, Priority: 64, Circuit ID: R2.02
    DR ID: R2.02
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 2
    Next IS-IS LAN Level-2 Hello in 4 seconds

R4#sh clns interface fa0/1
FastEthernet0/1 is up, line protocol is up
  Checksums enabled, MTU 1497, Encapsulation SAP
  ...
```

```
  Routing Protocol: IS-IS
    Circuit Type: level-2
    Interface number 0x1, local circuit ID 0x2
    Level-2 Metric: 10, Priority: 64, Circuit ID: R2.02
    DR ID: R2.02
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 2
    Next IS-IS LAN Level-2 Hello in 2 seconds
```

5. Router id – ISO NSAP formát odvodený z loopback0 rozhrania

Loopback0 na každom smerovači má nakonfigurovanú IP adresu v tvare 10.255.255.X, kde X je číslo smerovača. Na základe tejto adresy sme všetkým smerovačom priradili Router ID pomocou nasledovného algoritmu:

$$10.255.255.X \rightarrow 010.255.255.00X \rightarrow 0102.5525.500X$$

Väčšinu Router ID smerovačov sme nechali vypísať príkazom *show isis hostname* na R4.

```
R4#show isis hostname
Level  System ID      Dynamic Hostname  (notag)
 1     0102.5525.5003 R3
 2     0102.5525.5002 R2
 2     0102.5525.5001 R1
     * 0102.5525.5004 R4
 1     0101.5525.5009 R9
 1     0102.5525.5008 R8
 2     0102.5525.5010 R10
```

6. Statická redistribúcia smerovacích záznamov z R5

Smerovač R5 má jediný prepoj s R1 a nepatrí do žiadnej oblasti v rámci IS-IS ani nemá nakonfigurovaný žiadny iný smerovací protokol. Preto bolo potrebné zo smerovača R1 nastaviť statickú cestu na loopoback R5, zo smerovača R5 default route na R1 a na R1 použiť príkaz *redistribute static ip*, aby danú statickú cestu preposielal do celej siete a tým zabezpečil konektivitu so smerovačom R5 aj ostatným smerovačom v topológii. Statický smerovací záznam vidíme na výpise *show ip route static* na R1.

```
R1#sh ip route static
     10.0.0.0/8 is variably subnetted, 19 subnets, 2 masks
S       10.255.255.5/32 [1/0] via 10.10.15.2, FastEthernet0/1
```

7. Kontrola LAN DIS

Ako LAN DIS sme zvolili R2 tak, že sme mu nastavili prioritu na príslušnom rozhraní na 100, keďže ostatné majú prednastavené 64, R2 vyhrá voľbu. Na nasledujúcom výpise vidno, že predchádzajúcim DIS smerovačom bol R4, ktorý bol určený na základe najvyššej adresy,

po zmene priority sa ním stal R2, ale časovač R4 ešte nevypršal - preto je tam ešte zobrazený aj on.

```
R4#sh isis database l2
IS-IS Level-2 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00              0x00000026   0x8FB6        515               0/0/0
R2.00-00              0x00000027   0x9927        1178              0/0/0
R2.02-00              0x00000001   0x611F        1179              0/0/0
R3.00-00              0x00000034   0xEDBD        1178              0/0/0
R4.00-00            * 0x00000034   0x23EC        1180              0/0/0
R4.02-00            * 0x00000017   0x9081        0 (1180)          0/0/0
R10.00-00             0x00000029   0x9824        456               0/0/0
```

8. Kontrola IS-IS databáz a smerovacích tabuliek

Výpismi show ip route a show isis database na R4 a R10 overíme, či majú smerovače všetky potrebné informácie o smerovačoch a sieťach v topológii.

```
R4#sh ip route
     10.0.0.0/8 is variably subnetted, 19 subnets, 2 masks
i L2    10.255.255.10/32 [115/10] via 10.10.40.2, Serial1/0
i L1    10.255.255.8/32 [115/510] via 10.1.49.2, FastEthernet0/0
i L1    10.255.255.9/32 [115/500] via 10.1.49.2, FastEthernet0/0
i L2    10.1.12.0/24 [115/20] via 10.1.234.1, FastEthernet0/1
i L2    10.255.255.2/32 [115/10] via 10.1.234.1, FastEthernet0/1
i L1    10.255.255.3/32 [115/520] via 10.1.49.2, FastEthernet0/0
i L2    10.255.255.1/32 [115/20] via 10.1.234.1, FastEthernet0/1
i L2    10.255.255.6/32 [115/30] via 10.10.40.2, Serial1/0
i L2    10.255.255.7/32 [115/20] via 10.10.40.2, Serial1/0
C       10.255.255.4/32 is directly connected, Loopback0
i L2    10.255.255.5/32 [115/20] via 10.1.234.1, FastEthernet0/1
i L2    10.10.15.0/24 [115/30] via 10.1.234.1, FastEthernet0/1
C       10.10.40.0/24 is directly connected, Serial1/0
i L1    10.1.38.0/24 [115/520] via 10.1.49.2, FastEthernet0/0
C       10.1.49.0/24 is directly connected, FastEthernet0/0
i L2    10.2.67.0/24 [115/30] via 10.10.40.2, Serial1/0
i L2    10.2.70.0/24 [115/20] via 10.10.40.2, Serial1/0
i L1    10.1.89.0/24 [115/510] via 10.1.49.2, FastEthernet0/0
C       10.1.234.0/24 is directly connected, FastEthernet0/1

R4#sh isis database

IS-IS Level-1 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R9.00-00              0x00000095   0x8343        653               0/0/0
R3.00-00              0x00000095   0x2705        659               1/0/0
R4.00-00            * 0x00000098   0x6423        772               1/0/0
R8.00-00              0x00000097   0x2A81        1050              0/0/0
IS-IS Level-2 Link State Database:
```

```
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00              0x00000095   0xB026        583               0/0/0
R2.00-00              0x00000094   0xBE94        411               0/0/0
R2.02-00              0x0000006F   0x848D        1065              0/0/0
R3.00-00              0x000000A1   0x132B        1013              0/0/0
R4.00-00            * 0x000000A1   0x485A        451               0/0/0
R10.00-00             0x00000097   0xBB92        974               0/0/0

R10#sh ip route
     10.0.0.0/8 is variably subnetted, 19 subnets, 2 masks
C       10.255.255.10/32 is directly connected, Loopback0
i L2    10.255.255.8/32 [115/30] via 10.10.40.1, Serial1/0
i L2    10.255.255.9/32 [115/40] via 10.10.40.1, Serial1/0
i L2    10.1.12.0/24 [115/30] via 10.10.40.1, Serial1/0
i L2    10.255.255.2/32 [115/20] via 10.10.40.1, Serial1/0
i L2    10.255.255.3/32 [115/20] via 10.10.40.1, Serial1/0
i L2    10.255.255.1/32 [115/30] via 10.10.40.1, Serial1/0
i L1    10.255.255.6/32 [115/20] via 10.2.70.1, Serial1/1
i L1    10.255.255.7/32 [115/10] via 10.2.70.1, Serial1/1
i L2    10.255.255.4/32 [115/10] via 10.10.40.1, Serial1/0
i L2    10.255.255.5/32 [115/30] via 10.10.40.1, Serial1/0
i L2    10.10.15.0/24 [115/40] via 10.10.40.1, Serial1/0
C       10.10.40.0/24 is directly connected, Serial1/0
i L2    10.1.38.0/24 [115/30] via 10.10.40.1, Serial1/0
i L2    10.1.49.0/24 [115/510] via 10.10.40.1, Serial1/0
i L1    10.2.67.0/24 [115/20] via 10.2.70.1, Serial1/1
C       10.2.70.0/24 is directly connected, Serial1/1
i L2    10.1.89.0/24 [115/40] via 10.10.40.1, Serial1/0
i L2    10.1.234.0/24 [115/20] via 10.10.40.1, Serial1/0

R10#sh isis database

IS-IS Level-1 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R6.00-00              0x00000095   0x3FCC        877               0/0/0
R7.00-00              0x00000095   0x3F5A        793               0/0/0
R10.00-00           * 0x00000096   0xCBE0        843               1/0/0
IS-IS Level-2 Link State Database:
LSPID                 LSP Seq Num  LSP Checksum  LSP Holdtime      ATT/P/OL
R1.00-00              0x00000095   0xB026        543               0/0/0
R2.00-00              0x00000094   0xBE94        370               0/0/0
R2.02-00              0x0000006F   0x848D        1025              0/0/0
R3.00-00              0x000000A1   0x132B        972               0/0/0
R4.00-00              0x000000A2   0x465B        1185              0/0/0
R10.00-00           * 0x00000097   0xBB92        937               0/0/0
```

9. Kontrola konektivity

Pomocou tcl skriptu sme spustili príkaz ping zo smerovača R6 na všetky známe IP adresy - všetky rozhrania všetkých smerovačov. Príkaz samotný a jeho výstup sú uvedené nižšie.

```
R6#tclsh
```

```
R6(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
10.10.15.1
10.10.15.2
10.10.40.1
10.10.40.2
10.1.12.1
10.1.12.2
10.1.234.1
10.1.234.2
10.1.234.3
10.1.38.1
10.1.38.2
10.1.49.1
10.1.49.2
10.1.89.1
10.1.89.2
10.2.70.1
10.2.70.2
10.2.67.1
10.2.67.2
} {
ping $address }

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 = 88/98/104 ms
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 = 64/76/84 ms
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 = 84/98/112 ms
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 = 44/57/72 ms
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 = 100/119/136 ms
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 = 1/1/4 ms
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 = 8/17/24 ms
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 = 84/96/100 ms
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 = 80/96/104 ms
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 = 20/36/40 ms
Sending 5, 100-byte ICMP Echos to 10.10.15.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/100/116 ms
Sending 5, 100-byte ICMP Echos to 10.10.15.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/120/132 ms
Sending 5, 100-byte ICMP Echos to 10.10.40.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 44/58/72 ms
Sending 5, 100-byte ICMP Echos to 10.10.40.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/35/40 ms
Sending 5, 100-byte ICMP Echos to 10.1.12.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/98/116 ms
Sending 5, 100-byte ICMP Echos to 10.1.12.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/73/80 ms
Sending 5, 100-byte ICMP Echos to 10.1.234.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/74/80 ms
Sending 5, 100-byte ICMP Echos to 10.1.234.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/73/84 ms
Sending 5, 100-byte ICMP Echos to 10.1.234.3, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 44/59/68 ms
Sending 5, 100-byte ICMP Echos to 10.1.38.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/96/112 ms
Sending 5, 100-byte ICMP Echos to 10.1.38.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/97/112 ms
Sending 5, 100-byte ICMP Echos to 10.1.49.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 44/57/68 ms
Sending 5, 100-byte ICMP Echos to 10.1.49.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/96/116 ms
Sending 5, 100-byte ICMP Echos to 10.1.89.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 80/96/112 ms
Sending 5, 100-byte ICMP Echos to 10.1.89.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/98/112 ms
Sending 5, 100-byte ICMP Echos to 10.2.70.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/16/20 ms
Sending 5, 100-byte ICMP Echos to 10.2.70.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/36/40 ms
Sending 5, 100-byte ICMP Echos to 10.2.67.1, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms
Sending 5, 100-byte ICMP Echos to 10.2.67.2, timeout is 2 seconds:!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/17/24 ms
```

10. Area 2 – redistribúcia L2 do L1

V rámci jednej oblasti si smerovače vymieňajú informácie úrovne Level1, medzi oblasťami je to smerovanie Level2. Na smerovači R10 sme nastavili, aby preposielal informácie z oblasti Area 1 do Area 2 – redistribuoval L2 do L1. V smerovacích záznamoch na R6 vidíme, že má vďaka tomu informácie aj o sieťach z Area 1.

```
R6#sh ip route
     10.0.0.0/8 is variably subnetted, 19 subnets, 2 masks
i L1    10.255.255.10/32 [115/20] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.8/32 [115/50] via 10.2.67.2, FastEthernet0/1
```

```
i ia    10.255.255.9/32 [115/60] via 10.2.67.2, FastEthernet0/1
i ia    10.1.12.0/24 [115/50] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.2/32 [115/40] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.3/32 [115/40] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.1/32 [115/50] via 10.2.67.2, FastEthernet0/1
C       10.255.255.6/32 is directly connected, Loopback0
i L1    10.255.255.7/32 [115/10] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.4/32 [115/30] via 10.2.67.2, FastEthernet0/1
i ia    10.255.255.5/32 [115/50] via 10.2.67.2, FastEthernet0/1
i ia    10.10.15.0/24 [115/60] via 10.2.67.2, FastEthernet0/1
i L1    10.10.40.0/24 [115/30] via 10.2.67.2, FastEthernet0/1
i ia    10.1.38.0/24 [115/50] via 10.2.67.2, FastEthernet0/1
i ia    10.1.49.0/24 [115/530] via 10.2.67.2, FastEthernet0/1
C       10.2.67.0/24 is directly connected, FastEthernet0/1
i L1    10.2.70.0/24 [115/20] via 10.2.67.2, FastEthernet0/1
i ia    10.1.89.0/24 [115/60] via 10.2.67.2, FastEthernet0/1
i ia    10.1.234.0/24 [115/40] via 10.2.67.2, FastEthernet0/1
i*L1 0.0.0.0/0 [115/20] via 10.2.67.2, FastEthernet0/1
```

11. R8, R9 - R3 primárny smerovač pre všetky vnútorné adresy

To sme docielili tým, že sme znehodnotili cestu medzi R9 a R4, jej hodnotu sme nastavili na 500. Aby nevznikali slučky, nastavili sme ju obojstranne na R4 aj R9. Overenie funkčnosti sme urobili pomocou príkazu tracertoute na loopback smerovača R2.

```
R4#sh isis topology l1
IS-IS paths to level-1 routers
System Id            Metric     Next-Hop       Interface   SNPA
R9                   500        R9             Fa0/0       c026.612d.0000
R3                   520        R9             Fa0/0       c026.612d.0000
R4                   --
R8                   510        R9             Fa0/0       c026.612d.0000

R9#traceroute 10.255.255.2
Tracing the route to 10.255.255.2
  1 10.1.89.1 20 msec 16 msec 12 msec - preferovaná linka R8-R9
  2 10.1.38.1 36 msec 36 msec 40 msec
  3 10.1.234.1 48 msec *  76 msec
```

R8, R9 - R4 primárny smerovač len pre R5 smerovacie záznamy

Na R4 sme vytvorili ACL, ktorý povolí iba IP 10.255.255.5 a následne redistribuovali L2 záznamy do L1 pomocou tohoto ACL. Overenie funkčnosti pomocou traceroute na R5 a R1 z routra R9.

```
R9#traceroute 10.255.255.5
Tracing the route to 10.255.255.5
  1 10.1.49.1 24 msec 16 msec 16 msec - preferovaná linka R4-R9
  2 10.1.234.1 28 msec 36 msec 36 msec
  3 10.1.12.1 68 msec 48 msec 68 msec
```

```
  4 10.10.15.2 56 msec *  80 msec

R9#traceroute 10.255.255.1
Tracing the route to 10.255.255.1
  1 10.1.89.1 12 msec 16 msec 16 msec - preferovaná linka R8-R9
  2 10.1.38.1 28 msec 40 msec 40 msec
  3 10.1.234.1 68 msec 40 msec 72 msec
  4 10.1.12.1 56 msec *  52 msec
```

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

Hello-interval sme skrátili na 5 sekúnd, čo vidno na časoch príchodov hello paketov.

```
R2#debug isis adj-packets
IS-IS Adjacency related packets debugging is on
...
*Mar    2 01:03:31.485: ISIS-Adj: Rec serial IIH from c01e.612d.0000
(FastEthernet0/0), cir type L2, cir id 01, length 1496
...
*Mar    2 01:03:35.957: ISIS-Adj: Rec serial IIH from c01e.612d.0000
(FastEthernet0/0), cir type L2, cir id 01, length 1496
...
*Mar    2 01:03:40.481: ISIS-Adj: Rec serial IIH from c01e.612d.0000
(FastEthernet0/0), cir type L2, cir id 01, length 1496
...
*Mar    2 01:03:44.965: ISIS-Adj: Rec serial IIH from c01e.612d.0000
(FastEthernet0/0), cir type L2, cir id 01, length 1496
*...
```

13. Status linky R4 – R10 ? L1L2 ?

Status tejto linky (typ okruhu) overíme príkazom *show clns interface s1/0* na smerovačoch R4 a R10.

```
R4#sh clns interface s1/0
Serial1/0 is up, line protocol is up
  ...
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x2, local circuit ID 0x100
    Neighbor System-ID: R10
    Level-1 Metric: 10, Priority: 64, Circuit ID: R10.00
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 0
    Level-2 Metric: 10, Priority: 64, Circuit ID: R4.00
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 1
    Next IS-IS Hello in 672 milliseconds
    if state UP
```

```
R10#sh clns interface s1/0
Serial1/0 is up, line protocol is up
  ...
  Routing Protocol: IS-IS
    Circuit Type: level-1-2
    Interface number 0x0, local circuit ID 0x100
    Neighbor System-ID: R4
    Level-1 Metric: 10, Priority: 64, Circuit ID: R10.00
    Level-1 IPv6 Metric: 10
    Number of active level-1 adjacencies: 0
    Level-2 Metric: 10, Priority: 64, Circuit ID: R10.00
    Level-2 IPv6 Metric: 10
    Number of active level-2 adjacencies: 1
    Next IS-IS Hello in 2 seconds
    if state UP
```