

Žilinská univerzita v Žiline
Fakulta riadenia a informatiky

Semestrálna práca z predmetu

Projektovanie sietí 1

ISIS

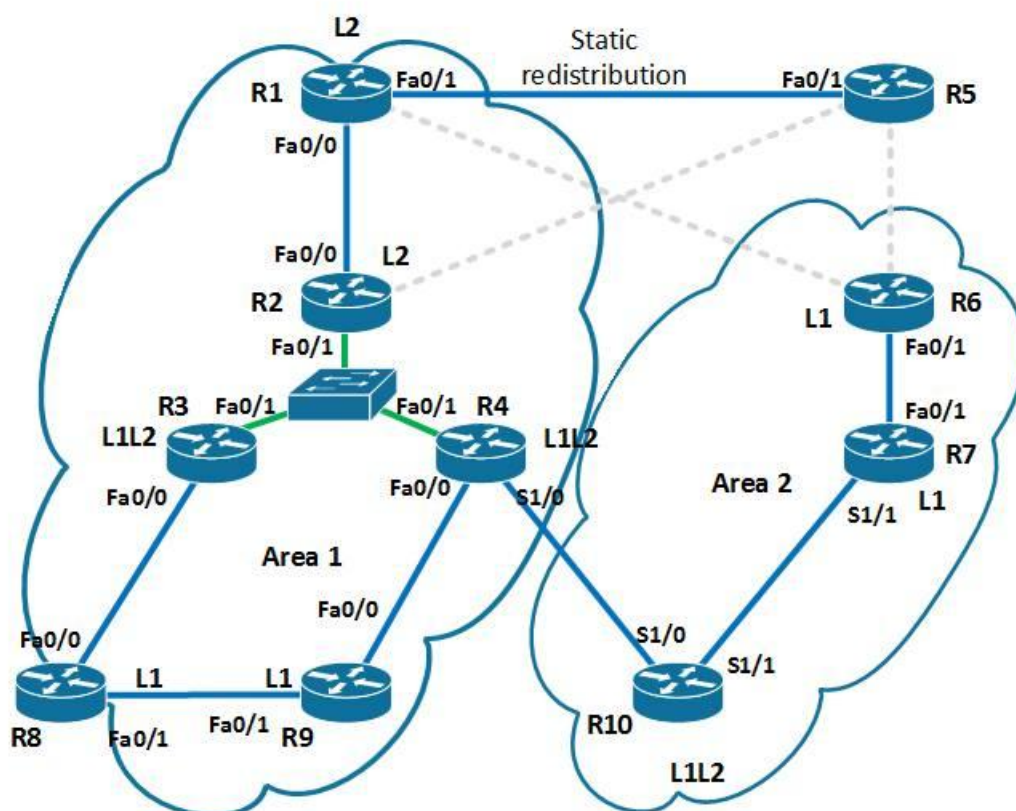
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2. Zadanie

- Nakonfigurovať IS-IS s dvoma oblasťami
- R2, R3, R4 broadcast spojenia prostredníctvom L2 prepínača
- zvyšok spojení P2P
- R3 – R4 P2P, L2 only
- Router id – ISO NSAP formát odvodený z loopback0 rozhrania
- Statická redistribúcia smerovacích záznamov z R5
- Kontrola LAN DIS
- Kontrola IS-IS databáz a smerovacích tabuliek
- Kontrola konektivity
- Area 2 – redistribúcia L2 do L1
- R8, R9 - R3 primárny smerovač pre všetky vnútorné adresy, R4 primárny smerovač len pre R5 smerovacie záznamy
- Skrátenie hello a dead-interval časovačov, zistenie funkčnosti vytrhnutím jednej z liniek smerom ku L2
- Status linky R4 – R10 ? L1L2 ?

3. Topológia



4. Adresovanie

Router	Interface	IP+Maska
R1	Lo0	10.1.255.1/32
	Fa0/0	10.1.12.1/24
	Fa0/1	192.168.15.1/24
R2	Lo0	10.1.255.2/32
	Fa0/0	10.1.12.2/24
	Fa0/1	10.1.20.2/24
R3	Lo0	10.1.255.3/32
	Fa0/0	10.1.38.3/24
	Fa0/1	10.1.20.3/24
R4	Lo0	10.1.255.4/32
	Fa0/0	10.1.49.4/24
	Fa0/1	10.1.20.4/24
	S1/0	10.1.104.4/24
R5	Lo0	10.1.255.5/32
	Fa0/1	192.168.15.5/24
R6	Lo0	10.2.255.6/32
	Fa0/1	10.2.67.6/24
R7	Lo0	10.2.255.7/32
	Fa0/1	10.2.67.7/24
	S1/1	10.2.107.7/24
R8	Lo0	10.1.255.8/32
	Fa0/0	10.1.38.8/24
R9	Lo0	10.1.255.9/32
	Fa0/0	10.1.49.9/24
R10	Lo0	10.2.255.10/32
	S1/0	10.1.104.10/24
	S1/1	10.2.107.10/24

5. Nakonfigurovať ISIS s dvoma oblasťami

```
R4(config-if)#do sh isis top
```

IS-IS paths to level-1 routers

System Id	Metric	Next-Hop	Interface	SNPA
R3	520	R9	Fa0/0	c000.10e0.0000
R4	--			
R8	510	R9	Fa0/0	c000.10e0.0000
R9	500	R9	Fa0/0	c000.10e0.0000

IS-IS paths to level-2 routers

System Id	Metric	Next-Hop	Interface	SNPA
R1	20	R2	Fa0/1	c004.03a4.0001
R2	10	R2	Fa0/1	c004.03a4.0001
R3	10	R3	Fa0/1	c005.03a4.0001
R4	--			
R10	10	R10	Se1/0	*HDLC*

```
R10#sh isis topology
```

IS-IS paths to level-1 routers

System Id	Metric	Next-Hop	Interface	SNPA
R6	20	R7	Se1/1	*HDLC*
R7	10	R7	Se1/1	*HDLC*
R10	--			

IS-IS paths to level-2 routers

System Id	Metric	Next-Hop	Interface	SNPA
R1	30	R4	Se1/0	*HDLC*
R2	20	R4	Se1/0	*HDLC*
R3	20	R4	Se1/0	*HDLC*
R4	10	R4	Se1/0	*HDLC*
R10	--			

6. R2, R3, R4 broadcast spojenia prostredníctvom L2 prepínača zvyšok spojení P2P

Na všetkých fastethernet linkách treba zadať príkaz: `isis network point-to-point`
Okrem spoja R2,R3,R4 ktorý má zostať broadcast(seriové linky sú už nastavené ako point-to-point).

```
R2(config-if)#do sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R1	L1L2	Fa0/0	10.1.12.1	UP	25	00
R4	L1	Fa0/1	10.1.20.4	UP	24	R3.03
R4	L2	Fa0/1	10.1.20.4	UP	24	R3.03
R3	L1	Fa0/1	10.1.20.3	UP	9	R3.03
R3	L2	Fa0/1	10.1.20.3	UP	8	R3.03

```
R3(config-if)#do sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R8	L1L2	Fa0/0	10.1.38.8	UP	25	00
R4	L1	Fa0/1	10.1.20.4	UP	25	R3.03
R4	L2	Fa0/1	10.1.20.4	UP	27	R3.03
R2	L1	Fa0/1	10.1.20.2	UP	27	R3.03
R2	L2	Fa0/1	10.1.20.2	UP	23	R3.03

```
R4(config-if)#do sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R9	L1L2	Fa0/0	10.1.49.9	UP	25	01
R2	L1	Fa0/1	10.1.20.2	UP	24	R3.03
R2	L2	Fa0/1	10.1.20.2	UP	23	R3.03
R3	L1	Fa0/1	10.1.20.3	UP	7	R3.03
R3	L2	Fa0/1	10.1.20.3	UP	7	R3.03
R10	L2	Se1/0	10.1.104.10	UP	21	01

7. R3 – R4 P2P, L2 only

R3-R4 P2P nemá význam, pretože R3,R4 sú spojené spoločnou sieťou z routrom R2.

L2 only sa nastavuje na routroch R3 a R4 na int fa0/1 príkazom:

isis circuit-type level-2-only

```
R3(config-if)#do sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R2	L2	Fa0/1	10.1.20.2	UP	28	R3.03
R4	L2	Fa0/1	10.1.20.4	UP	28	R3.03
R8	L1L2	Fa0/0	10.1.38.8	UP	26	00

```
R4(config-if)#do sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit Id
R2	L2	Fa0/1	10.1.20.2	UP	21	R3.03
R3	L2	Fa0/1	10.1.20.3	UP	9	R3.03
R9	L1L2	Fa0/0	10.1.49.9	UP	23	01
R10	L2	Se1/0	10.1.104.10	UP	29	01

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

Router	IP loopbacku0	NSAP
R1	10.1.255.1	49.0001.0100.0125.5001.00
R2	10.1.255.2	49.0001.0100.0125.5002.00
R3	10.1.255.3	49.0001.0100.0125.5003.00
R4	10.1.255.4	49.0001.0100.0125.5004.00
R6	10.2.255.6	49.0002.0100.0225.5006.00
R7	10.2.255.7	49.0002.0100.0225.5007.00
R8	10.1.255.8	49.0001.0100.0125.5008.00
R9	10.1.255.9	49.0001.0100.0125.5009.00
R10	10.1.255.10	49.0001.0100.0225.5010.00

9. Statická redistribúcia smerovacích záznamov z R5

Na R1 sme zadali príkazy:

ip route 10.1.255.5 255.255.255.255 192.168.15.5

router isis

redistribute static

redistribute connected

Na R5:

ip route 0.0.0.0 0.0.0.0 192.168.15.1

```

R1#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

C    192.168.15.0/24 is directly connected, FastEthernet0/1
    10.0.0.0/8 is variably subnetted, 18 subnets, 2 masks
C    10.1.12.0/24 is directly connected, FastEthernet0/0
i L2  10.1.20.0/24 [115/20] via 10.1.12.2, FastEthernet0/0
i L2  10.1.38.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2  10.1.49.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2  10.2.67.0/24 [115/50] via 10.1.12.2, FastEthernet0/0
i L2  10.1.89.0/24 [115/40] via 10.1.12.2, FastEthernet0/0
i L2  10.2.107.0/24 [115/40] via 10.1.12.2, FastEthernet0/0
i L2  10.1.104.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2  10.2.255.7/32 [115/40] via 10.1.12.2, FastEthernet0/0
i L2  10.1.255.4/32 [115/20] via 10.1.12.2, FastEthernet0/0
i L2  10.2.255.6/32 [115/50] via 10.1.12.2, FastEthernet0/0
S    10.1.255.5/32 [1/0] via 192.168.15.5
C    10.1.255.1/32 is directly connected, Loopback0
i L2  10.1.255.2/32 [115/10] via 10.1.12.2, FastEthernet0/0
i L2  10.1.255.3/32 [115/20] via 10.1.12.2, FastEthernet0/0
i L2  10.1.255.8/32 [115/30] via 10.1.12.2, FastEthernet0/0
i L2  10.2.255.10/32 [115/30] via 10.1.12.2, FastEthernet0/0
i L2  10.1.255.9/32 [115/30] via 10.1.12.2, FastEthernet0/0

```

10. Kontrola LAN DIS

Router R3 je DR na spoločnej sieti medzi R2-R3-R4.

```

R1#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       * 0x000000014  0x1569        661           0/0/0
R2.00-00       0x000000019  0x9E06        659           0/0/0
R3.00-00       0x00000001A  0xB31B        611           0/0/0
R3.03-00       0x00000000A  0xCA04        682           0/0/0
R4.00-00       0x00000001A  0x0F3D        623           0/0/0
R10.00-00      0x00000000F  0x7BA2        541           0/0/0

```

11. Kontrola IS-IS databáz a smerovacích tabuliek

```
R1#sh isis database
```

```
IS-IS Level-1 Link State Database:
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
R1.00-00	* 0x00000006	0x2603	800	1/0/0
R1.02-00	* 0x00000001	0x8CF4	0 (794)	0/0/0

```
IS-IS Level-2 Link State Database:
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
R1.00-00	* 0x00000014	0x1569	795	0/0/0
R2.00-00	0x00000019	0x9E06	793	0/0/0
R3.00-00	0x0000001A	0xB31B	745	0/0/0
R3.03-00	0x0000000A	0xCA04	816	0/0/0
R4.00-00	0x0000001A	0x0F3D	757	0/0/0
R10.00-00	0x0000000F	0x7BA2	675	0/0/0

```
R1#sh ip route isis
```

```
10.0.0.0/8 is variably subnetted, 18 subnets, 2 masks
i L2 10.1.20.0/24 [115/20] via 10.1.12.2, FastEthernet0/0
i L2 10.1.38.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2 10.1.49.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2 10.2.67.0/24 [115/50] via 10.1.12.2, FastEthernet0/0
i L2 10.1.89.0/24 [115/40] via 10.1.12.2, FastEthernet0/0
i L2 10.2.107.0/24 [115/40] via 10.1.12.2, FastEthernet0/0
i L2 10.1.104.0/24 [115/30] via 10.1.12.2, FastEthernet0/0
i L2 10.2.255.7/32 [115/40] via 10.1.12.2, FastEthernet0/0
i L2 10.1.255.4/32 [115/20] via 10.1.12.2, FastEthernet0/0
i L2 10.2.255.6/32 [115/50] via 10.1.12.2, FastEthernet0/0
i L2 10.1.255.2/32 [115/10] via 10.1.12.2, FastEthernet0/0
i L2 10.1.255.3/32 [115/20] via 10.1.12.2, FastEthernet0/0
i L2 10.1.255.8/32 [115/30] via 10.1.12.2, FastEthernet0/0
i L2 10.2.255.10/32 [115/30] via 10.1.12.2, FastEthernet0/0
i L2 10.1.255.9/32 [115/30] via 10.1.12.2, FastEthernet0/0
```

```
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	0x00000009	0xCA74	1136	0/0/0
R7.00-00	0x0000000C	0x1EDB	1147	0/0/0
R10.00-00	* 0x0000000E	0x8AA1	1187	1/0/0

```
IS-IS Level-2 Link State Database:
```

LSPID	LSP Seq Num	LSP Checksum	LSP Holdtime	ATT/P/OL
R1.00-00	0x00000014	0x1569	405	0/0/0
R2.00-00	0x0000001A	0x9C07	1097	0/0/0
R3.00-00	0x0000001A	0xB31B	359	0/0/0
R3.03-00	0x0000000A	0xCA04	431	0/0/0
R4.00-00	0x0000001B	0x0D3E	1036	0/0/0
R10.00-00	* 0x00000010	0x79A3	980	0/0/0


```

R10#sh ip route isis
      10.0.0.0/8 is variably subnetted, 17 subnets, 2 masks
i L2   10.1.12.0/24 [115/30] via 10.1.104.4, Serial1/0
i L2   10.1.20.0/24 [115/20] via 10.1.104.4, Serial1/0
i L2   10.1.38.0/24 [115/30] via 10.1.104.4, Serial1/0
i L2   10.1.49.0/24 [115/20] via 10.1.104.4, Serial1/0
i L1   10.2.67.0/24 [115/20] via 10.2.107.7, Serial1/1
i L2   10.1.89.0/24 [115/30] via 10.1.104.4, Serial1/0
i L1   10.2.255.7/32 [115/10] via 10.2.107.7, Serial1/1
i L2   10.1.255.4/32 [115/10] via 10.1.104.4, Serial1/0
i L1   10.2.255.6/32 [115/20] via 10.2.107.7, Serial1/1
i L2   10.1.255.1/32 [115/40] via 10.1.104.4, Serial1/0
i L2   10.1.255.2/32 [115/20] via 10.1.104.4, Serial1/0
i L2   10.1.255.3/32 [115/20] via 10.1.104.4, Serial1/0
i L2   10.1.255.8/32 [115/30] via 10.1.104.4, Serial1/0
i L2   10.1.255.9/32 [115/20] via 10.1.104.4, Serial1/0

```

12. Kontrola konektivity

Ping z R5 na interface fa0/1 na routeri R6:

```
R5#ping 10.2.107.7
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.2.107.7, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =
1592/1681/1744 ms

Ping z routera R6 na interface fa0/1 na routeri R5:

```
R6#ping 192.168.15.5
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.15.5, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =
1920/1926/1932 ms

Ping z R2 na interface fa0/1 na routeri R6:

```
R2#ping 10.2.67.6
```

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.2.67.6, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =
1052/1550/1904 ms

Ping z R1 na všetky loopbacky:

```
ip host R1 10.1.255.1
```

```
ip host R2 10.1.255.2
```

```
ip host R3 10.1.255.3
```

ip host R4 10.1.255.4
ip host R5 10.1.255.5
ip host R6 10.2.255.6
ip host R7 10.2.255.7
ip host R8 10.1.255.8
ip host R9 10.1.255.9
ip host R10 10.2.255.10

R1#ping R1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.255.1, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/8 ms

R1#ping R2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.255.2, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =

592/993/1272 ms

R1#ping R3

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.255.3, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =

472/636/828 ms

R1#ping R4

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.255.4, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =

772/814/884 ms

R1#ping R5

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.1.255.5, timeout is 2 seconds:

!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max =

324/804/1340 ms

R1#ping R6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 10.2.255.6, timeout is 2 seconds:

!!!!

Success rate is 1000 percent (5/5), round-trip min/avg/max =
1624/1736/1848 ms
R1#ping R7

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.2.255.7, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
1264/1609/1864 ms
R1#ping R8

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.255.8, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
1148/1310/1396 ms
R1#ping R9

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.255.9, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
956/1147/1312 ms
R1#ping R10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.2.255.10, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
1168/1408/1852 ms

13. Area 2 – redistribúcia L2 do L1

Príkazy na routri R10:

access-list 100 permit ip any any
router isis

redistribute isis ip level-2 into level-1 distribute-list 100

```

R7(config-router)#do sh isis database detail

IS-IS Level-1 Link State Database:
LSPID          LSP Seq Num  LSP Checksum  LSP Holdtime  ATT/P/OL
R6.00-00       0x00000009   0xCA74        848           0/0/0
  Area Address: 49.0002
  NLPID:        0xCC
  Hostname: R6
  IP Address:   10.2.255.6
  Metric: 10    IP 10.2.67.0/24
  Metric: 0     IP 10.2.255.6/32
  Metric: 10    IS-Extended R7.00
R7.00-00       * 0x0000000C 0x1EDB        859           0/0/0
  Area Address: 49.0002
  NLPID:        0xCC
  Hostname: R7
  IP Address:   10.2.255.7
  Metric: 10    IP 10.2.67.0/24
  Metric: 10    IP 10.2.107.0/24
  Metric: 0     IP 10.2.255.7/32
  Metric: 10    IS-Extended R6.00
  Metric: 10    IS-Extended R10.00
R10.00-00      0x0000000F 0xA071        1059          1/0/0
  Area Address: 49.0002
  NLPID:        0xCC
  Hostname: R10
  IP Address:   10.2.255.10
  Metric: 10    IP 10.1.104.0/24
  Metric: 10    IP 10.2.107.0/24
  Metric: 0     IP 10.2.255.10/32
  Metric: 10    IS-Extended R7.00
  Metric: 30    IP-Interarea 10.1.12.0/24
  Metric: 20    IP-Interarea 10.1.20.0/24
  Metric: 30    IP-Interarea 10.1.38.0/24
  Metric: 20    IP-Interarea 10.1.49.0/24
  Metric: 30    IP-Interarea 10.1.89.0/24
  Metric: 40    IP-Interarea 10.1.255.1/32
  Metric: 20    IP-Interarea 10.1.255.2/32
  Metric: 20    IP-Interarea 10.1.255.3/32
  Metric: 10    IP-Interarea 10.1.255.4/32
  Metric: 30    IP-Interarea 10.1.255.8/32
  Metric: 20    IP-Interarea 10.1.255.9/32

```

14. R8, R9 - R3 primárny smerovač pre všetky vnútorné adresy, R4 primárny smerovač len pre R5 smerovacie záznamy

Príkazy na routri R9:

```

int e2/0
isis metric 1000

```

Príkazy na routri R4:

```

int e2/0
isis metric 1000
access-list 100 permit ip host 10.1.255.5 host 255.255.255.255
access-list 100 permit ip host 192.168.15.0 host 255.255.255.0

```

```
router isis
```

```
redistribute isis ip level-2 into level-1 distribute-list 100
```

```
R9(config)#do traceroute R1

Type escape sequence to abort.
Tracing the route to R1 (10.1.255.1)

 0 10.1.89.8 772 msec 924 msec 864 msec
 1 10.1.38.3 1140 msec 900 msec 1136 msec
 2 10.1.20.2 1380 msec 1376 msec 1320 msec
 3 10.1.12.1 1824 msec 2012 msec 2548 msec
 4

R1#traceroute R9

Type escape sequence to abort.
Tracing the route to R9 (10.1.255.9)

 0 10.1.12.2 1196 msec 836 msec 880 msec
 1 10.1.20.3 1148 msec 652 msec 916 msec
 2 10.1.38.8 1540 msec 1340 msec 1532 msec
 3 10.1.89.9 1308 msec 1860 msec 1568 msec
 4

R8(config-router)#do traceroute 192.168.15.5

Type escape sequence to abort.
Tracing the route to 192.168.15.5

 0 10.1.89.9 656 msec 596 msec 32 msec
 1 10.1.49.4 744 msec 348 msec 172 msec
 2 10.1.20.2 1324 msec 1752 msec 1752 msec
 3 10.1.12.1 1236 msec 760 msec 1196 msec
 4 192.168.15.5 2608 msec 1636 msec 1236 msec
 5
```

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

Na routeroch R3 a R4 sme na int fa0/0 nastavili:

```
isis hello-interval 1
```

```
isis hello-multiplier 3
```

Overenie cez ping z R9 na R2. Preferovaná cesta bola cez router R3 ale keďže sme chceli overiť nastavené intervaly, tak sme po zahájení pingu odpojili fa0/0 na routri R3. Spojenie sa stratilo a následne hneď obnovilo cez R4.

```
R9#ping
Protocol [ip]:
Target IP address: 10.1.255.2
Repeat count [5]: 50
Datagram size [100]:
Timeout in seconds [2]:
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 50, 100-byte ICMP Echos to 10.1.255.2, timeout is 2 seconds:
!.....!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 88 percent (44/50), round-trip min/avg/max = 256/838/1760 ms
```

16. Status linky R4 - R10 ? L1L2 ?

Medzi routrami R4 a R10 je L2, pretože ležia v iných sieťach.

```
R10#sh isis nei
```

System Id	Type	Interface	IP Address	State	Holdtime	Circuit	Id
R4	L2	Se1/0	10.1.104.4	UP	25	00	
R7	L1	Se1/1	10.2.107.7	UP	29	00	