# Distribúcia multicastovej prevádzky
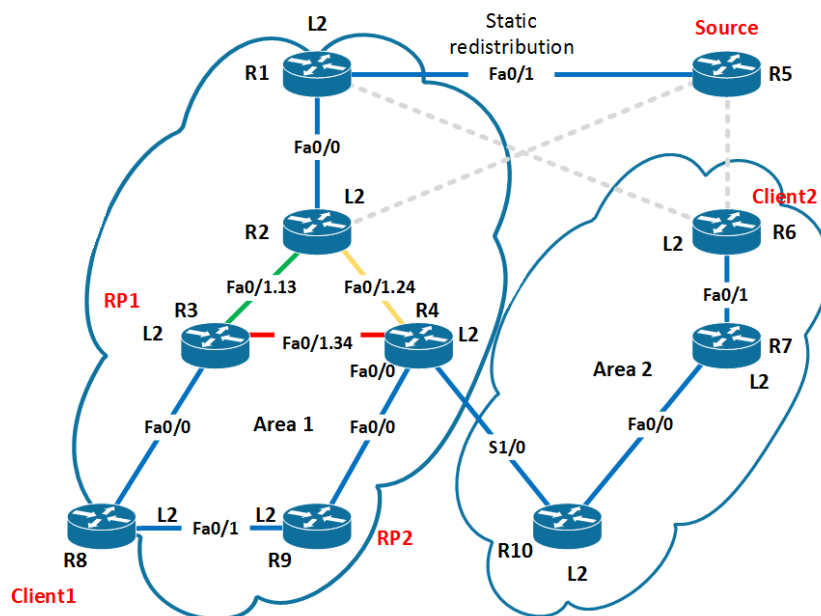
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# Obsah

## 1.1 Topológia

Budeme konfigurovať distribúciu multicastovej prevádzky so smerovacím protokolom IS-IS na topológií, ktorá je znázornená na obrázku 1. IP adresácia je uvedená v tabuľke 1 a dopĺňa grafické znázornenie topológie na obrázku 1.



Obr. 1: Topológia IS-IS

Tabuľka 1: IP adresácia

| Smerovač | Funkcia | Rozhranie | IP adresa | Maska |
|---|---|---|---|---|
| R1 | L2 | Fa0/0 | 10.0.12.1 | 255.255.255.0 |
| | | Fa0/1 | 10.100.15.1 | 255.255.255.0 |
| | | Lo0 | 10.255.255.1 | 255.255.255.255 |
| R2 | L2 | Fa0/0 | 10.0.12.2 | 255.255.255.0 |
| | | Fa0/1 | 10.100.234.2 | 255.255.255.0 |
| | | Lo0 | 10.255.255.2 | 255.255.255.255 |
| R3 | L1/L2 | 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 | 255.255.255.252 |
| | | Lo0 | 10.255.255.3 | 255.255.255.255 |
| R4 | L1/L2 | 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 | 255.255.255.252 |
| | | Lo0 | 10.255.255.4 | 255.255.255.255 |
| R5 | Smerovač iného systému | Fa0/1 | 10.100.15.5 | 255.255.255.0 |
| | | Lo0 | 10.255.255.5 | 255.255.255.255 |
| R6 | L1 | Fa0/0 | 10.4.67.6 | 255.255.255.0 |
| | | Lo0 | 10.255.255.6 | 255.255.255.255 |
| R7 | L1 | Fa0/1 | 10.4.67.7 | 255.255.255.0 |
| | | S1/1 | 10.4.107.7 | 255.255.255.0 |
| | | Lo0 | 10.255.255.7 | 255.255.255.255 |
| R8 | L1 | Fa0/0 | 10.1.38.8 | 255.255.255.0 |
| | | Lo0 | 10.255.255.8 | 255.255.255.255 |
| R9 | L1 | Fa0/0 | 10.2.49.9 | 255.255.255.0 |
| | | S1/0 | 10.2.39.9 | 255.255.255.0 |
| | | Lo0 | 10.255.255.9 | 255.255.255.255 |
| R10 | L1/L2 | S1/0 | 10.3.104.10 | 255.255.255.0 |
| | | S1/1 | 10.4.107.10 | 255.255.255.0 |
| | | Lo0 | 10.255.255.10 | 255.255.255.255 |

## 1.2 Úlohy

### 1.2.1 Použiť IS–IS (L2 only) single area dizajn, priame p2p prepojenia medzi R2, R3, R4

### 1.2.2 Nakonfigurovať PIM–SM s jedným statickým RP

**Popis**

Dohodli sme sa, že budeme používať iba smerovací protokol IS-IS. Subrozhranie ".13" a VLAN 13 sme premenovali na ".23" a VLAN 23, lebo sieť je medzi smerovačmi R2 a R3 (23), a nie medzi R1 a R3 (13).

**Konfigurácia**

```
=======================================================
DENSE MODE
=======================================================
R1
ena
conf t
hostname R1
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.12.1 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.1 255.255.255.255
  ip router isis
  no shut
int f0/1
  ip addr 10.100.15.1 255.255.255.0
  no shut
router isis
  net 49.0001.0102.5525.5001.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  redistribute static
  redistribute connected
  exit
ip route 10.255.255.5 255.255.255.255 f0/1 10.100.15.5

!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim dense-mode
int lo0
  ip pim dense-mode
  exit

R2
ena
conf t
hostname R2
no ip domain-lookup
```

```
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.12.2 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.2 255.255.255.255
  ip router isis
  no shut
int f0/1
  no ip add
  isis network point-to-point
  no sh
int f0/1.23
  encap dot1q 23
  ip addr 10.1.23.2 255.255.255.0
  ip router isis
int f0/1.24
  encap dot1q 24
  ip addr 10.1.24.2 255.255.255.0
  ip router isis
router isis
  net 49.0001.0102.5525.5002.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim dense-mode
int f0/1.23
  ip pim dense-mode
int f0/1.24
  ip pim dense-mode
int lo0
  ip pim dense-mode
  exit


R3
```

```
ena
conf t
hostname R3
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.38.3 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.3 255.255.255.255
  ip router isis
  no shut
int f0/1
  no ip addr
  isis network point-to-point
  no shut
int f0/1.23
  encap dot1q 23
  ip addr 10.1.23.3 255.255.255.0
  ip router isis
int f0/1.34
  encap dot1q 34
  ip addr 10.1.34.3 255.255.255.0
  ip router isis
router isis
  net 49.0001.0102.5525.5003.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim dense-mode
int f0/1.23
  ip pim dense-mode
int f0/1.34
  ip pim dense-mode
int lo0
  ip pim dense-mode
  exit
```

```
R4
ena
conf t
hostname R4
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.49.4 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.4 255.255.255.255
  ip router isis
  no shut
int f0/1
  no ip addr
  isis network point-to-point
  no sh
int f0/1.24
  encap dot1q 24
  ip addr 10.1.24.4 255.255.255.0
  ip router isis
int f0/1.34
  encap dot1q 34
  ip addr 10.1.34.4 255.255.255.0
  ip router isis
int s1/0
  ip addr 10.1.104.4 255.255.255.0
  ip router isis
  no shut
router isis
  net 49.0001.0102.5525.5004.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim dense-mode
```

```
int f0/1.24
  ip pim dense-mode
int f0/1.34
  ip pim dense-mode
int s1/0
  ip pim dense-mode
int lo0
  ip pim dense-mode
  exit


R5
ena
conf t
hostname R5
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int lo0
  ip addr 10.255.255.5 255.255.255.255
  no shut
int f0/1
  ip addr 10.100.15.5 255.255.255.0
  no shut
ip route 0.0.0.0 0.0.0.0 f0/1 10.100.15.1



R6
ena
conf t
hostname R6
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/1
  ip addr 10.2.67.6 255.255.255.0
  ip router isis
```

```
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.6 255.255.255.255
  ip router isis
  no shut
int lo1
  ip add 10.255.255.66 255.255.255.255
  ip router isis
  ip igmp join-group 239.0.0.1
router isis
  net 49.0002.0102.5525.5006.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/1
  ip pim dense-mode
  exit
int lo0
  ip pim dense-mode
  exit
int lo1
  ip pim dense-mode
  exit


R7
ena
conf t
hostname R7
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/1
  ip addr 10.2.67.7 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.7 255.255.255.255
  ip router isis
```

```
  no shut
int f0/0
  ip addr 10.2.107.7 255.255.255.0
  Ip router isis
  isis network point-to-point
  no shut
router isis
  net 49.0002.0102.5525.5007.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim dense-mode
  exit
int lo0
  ip pim dense-mode
  exit




R8
ena
conf t
hostname R8
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.38.8 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.8 255.255.255.255
  ip router isis
  no shut
int lo1
  ip add 10.255.255.88 255.255.255.255
  ip router isis
  ip igmp join-group 239.0.0.1
```

```
int f0/1
  ip addr 10.1.89.8 255.255.255.0
  Ip router isis
  isis network point-to-point
  no shut
router isis
  net 49.0001.0102.5525.5008.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim dense-mode
  exit
int lo0
  ip pim dense-mode
  exit
int lo1
  ip pim dense-mode
  exit




R9
ena
conf t
hostname R9
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int f0/0
  ip addr 10.1.49.9 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
int lo0
  ip addr 10.255.255.9 255.255.255.255
  ip router isis
  no shut
int f0/1
```

```
  ip addr 10.1.89.9 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
router isis
  net 49.0001.0102.5525.5009.00
  passive-interface lo0
  is-type level-2
  metric-style wide
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim dense-mode
  exit
int lo0
  ip pim dense-mode


R10
ena
conf t
hostname R10
no ip domain-lookup
username admin privil 15 secret admin
line con 0
  login local
  logging syn
  exec-time 120
line vty 0 15
  privilege level 15
  no login
int s1/0
  ip addr 10.1.104.10 255.255.255.0
  ip router isis
  no shut
int lo0
  ip addr 10.255.255.10 255.255.255.255
  ip router isis
  no shut
int f0/0
  ip addr 10.2.107.10 255.255.255.0
  ip router isis
  isis network point-to-point
  no shut
router isis
  net 49.0002.0102.5525.5010.00
  passive-interface lo0
  is-type level-2
  metric-style wide
```

```
  exit

!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim dense-mode
  exit
int s1/0
  ip pim dense-mode
  exit
int lo0
  ip pim dense-mode
  exit
```

**Overenie**

```
R5#ping 239.0.0.1

Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 239.0.0.1, timeout is 2 seconds:

Reply to request 0 from 10.1.38.8, 68 ms
Reply to request 0 from 10.2.67.6, 132 ms
----------------------------------------------------------------
R8#sh ip pim interface
```

| Address | Interface | Ver/ Mode | Nbr Count | Query Intvl | DR Prior | DR |
|---|---|---|---|---|---|---|
| 10.255.255.88 | Loopback1 | v2/D | 0 | 30 | 1 | 10.255.255.88 |
| 10.1.38.8 | FastEthernet0/0 | v2/D | 1 | 30 | 1 | 10.1.38.8 |
| 10.1.89.8 | FastEthernet0/1 | v2/D | 1 | 30 | 1 | 10.1.89.9 |
| 10.255.255.8 | Loopback0 | v2/D | 0 | 30 | 1 | 10.255.255.8 |

### 1.2.3   Nakonfigurovať SPARSE mód

**Popis**

Konfigurujeme "SPARSE" mód bez záložného RP.

```
========================================================
SPARSE MODE
========================================================
R1
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-mode
int lo0
  ip pim sparse-mode
```

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```
  exit
ip pim rp-addr 10.255.255.3


R2
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-mode
int f0/1.23
  ip pim sparse-mode
int f0/1.24
  ip pim sparse-mode
int lo0
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3



R3
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-mode
int f0/1.23
  ip pim sparse-mode
int f0/1.34
  ip pim sparse-mode
int lo0
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3



R4
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-mode
int f0/1.24
  ip pim sparse-mode
int f0/1.34
  ip pim sparse-mode
int s1/0
  ip pim sparse-mode
int lo0
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3
R6
!aktivujeme multicast smerovanie
ip multicast-routing
```

```
int range f0/1
  ip pim sparse-mode
  exit
int lo0
  ip pim sparse-mode
  exit
int lo1
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3


R7
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-mode
  exit
int lo0
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3


R8
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-mode
  exit
int lo0
  ip pim sparse-mode
  exit
int lo1
  ip pim sparse-mode
 exit
ip pim rp-addr 10.255.255.3



R9
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-mode
  exit
int lo0
  ip pim sparse-mode
ip pim rp-addr 10.255.255.3
```

```
R10
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-mode
  exit
int s1/0
  ip pim sparse-mode
  exit
int lo0
  ip pim sparse-mode
  exit
ip pim rp-addr 10.255.255.3
```

**Overenie**

```
R5#ping 239.0.0.1

Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 239.0.0.1, timeout is 2 seconds:

Reply to request 0 from 10.1.38.8, 60 ms
Reply to request 0 from 10.2.67.6, 124 ms
```

Odpovede prichádzali od klientov 10.1.38.8 (R8) a 10.2.67.6 (R6).

```
R3#sh ip pim int

Address         Interface           Ver/   Nbr    Query   DR      DR
                                    Mode   Count  Intvl   Prior
10.1.38.3       FastEthernet0/0     v2/S   1      30      1       10.1.38.8
10.1.23.3       FastEthernet0/1.23  v2/S   1      30      1       10.1.23.3
10.1.34.3       FastEthernet0/1.34  v2/S   1      30      1       10.1.34.4
10.255.255.3    Loopback0           v2/S   0      30      1       10.255.255.3

R1#sh ip pim rp
Group: 239.0.0.1, RP: 10.255.255.3, v2, uptime 00:06:22, expires never
Group: 224.0.1.40, RP: 10.255.255.3, v2, uptime 00:07:07, expires never


R1#sh ip igmp groups
IGMP Connected Group Membership
Group Address   Interface           Uptime    Expires   Last Reporter   Group
                                                                        Accounted
224.0.1.40      FastEthernet0/0     00:35:38  00:02:21  10.1.12.2
```

## 1.2.4  Zabezpečiť RP redundanciu

**Popis**

V "SPARSE-DENSE" móde môžeme nastaviť záložný RP, ktorý bude vyberaný pomocou BSR.

**Konfigurácia**

```
====================================================
SPARSE-DENSE MODE
====================================================
R1
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-dense-mode
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3


R2
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-dense-mode
int f0/1.23
  ip pim sparse-dense-mode
int f0/1.24
  ip pim sparse-dense-mode
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3


R3
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-dense-mode
int f0/1.23
  ip pim sparse-dense-mode
int f0/1.34
  ip pim sparse-dense-mode
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3
```

```
ip pim rp-candidate lo0

R4
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-dense-mode
int f0/1.24
  ip pim sparse-dense-mode
int f0/1.34
  ip pim sparse-dense-mode
int s1/0
  ip pim sparse-dense-mode
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3


R6
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/1
  ip pim sparse-dense-mode
  exit
int lo0
  ip pim sparse-dense-mode
  exit
int lo1
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3


R7
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-dense-mode
  exit
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3


R8
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-dense-mode
```

```
  exit
int lo0
  ip pim sparse-dense-mode
  exit
int lo1
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3



R9
!aktivujeme multicast smerovanie
ip multicast-routing
int range f0/0 - 1
  ip pim sparse-dense-mode
  exit
int lo0
  ip pim sparse-dense-mode
no ip pim rp-addr 10.255.255.3
ip pim bsr-candidate lo0



R10
!aktivujeme multicast smerovanie
ip multicast-routing
int f0/0
  ip pim sparse-dense-mode
  exit
int s1/0
  ip pim sparse-dense-mode
  exit
int lo0
  ip pim sparse-dense-mode
  exit
no ip pim rp-addr 10.255.255.3
```

**Overenie**

```
R5#ping 239.0.0.1

Type escape sequence to abort.
Sending 1, 100-byte ICMP Echos to 239.0.0.1, timeout is 2 seconds:

Reply to request 0 from 10.1.89.8, 76 ms
Reply to request 0 from 10.2.67.6, 136 ms

R4#sh ip pim rp
Group: 239.0.0.1, RP: 10.255.255.3, v2, uptime 00:04:27, expires 00:02:19

R4#sh ip pim int
```

```
Address            Interface          Ver/   Nbr    Query  DR      DR
                                      Mode   Count  Intvl  Prior
10.1.49.4          FastEthernet0/0    v2/SD  1      30     1       10.1.49.9
10.1.24.4          FastEthernet0/1.24 v2/SD  1      30     1       10.1.24.4
10.1.34.4          FastEthernet0/1.34 v2/SD  1      30     1       10.1.34.4
10.1.104.4         Serial1/0          v2/SD  1      30     1       0.0.0.0
10.255.255.4       Loopback0          v2/SD  0      30     1       10.255.255.4

R9#sh ip igmp groups
IGMP Connected Group Membership
Group Address   Interface        Uptime     Expires    Last Reporter   Group
                                                                        Accounted
224.0.1.39      FastEthernet0/0  00:11:57   00:01:57   10.1.49.4
224.0.1.40      FastEthernet0/0  01:03:32   00:02:59   10.1.49.4
```

Z výpisov vyplýva, že záložný RP je aktívny.

```
R4#show ip pim autorp
AutoRP Information:
  AutoRP is enabled.

PIM AutoRP Statistics: Sent/Received
  RP Announce: 0/184, RP Discovery: 188/160
```

```
Power Tools

R6#mstat 10.100.15.5 224.0.1.40
Type escape sequence to abort.
Mtrace from 10.100.15.5 to 10.2.67.6 via group 224.0.1.40
From source (?) to destination (?)
Waiting to accumulate statistics......
Results after 10 seconds:

  Source          Response Dest   Packet Statistics For      Only For Traffic
10.100.15.5       10.2.67.6       All Multicast Traffic      From 10.100.15.5
    |       __/ rtt 87    ms      Lost/Sent = Pct  Rate      To 224.0.1.40
    v      /     hop 87   ms      --------------------       --------------------
10.100.15.1
10.1.12.1         ?
    |     ^       ttl   0
    v     |       hop -8    s      0/0 = --%      0 pps    0/0 = --%  0 pps
10.1.12.2
10.1.24.2         ?
    |     ^       ttl   1
```

```
    v     |        hop 2576 ms     0/0 = --%       0 pps    0/0 = --%  0 pps
10.1.24.4
10.1.104.4      ?
    |     ^        ttl   2
    v     |        hop 15   s      0/0 = --%       0 pps    0/0 = --%  0 pps
10.1.104.10
10.2.107.10     ?
    |     ^        ttl   3
    v     |        hop -8   s      0/0 = --%       0 pps    0/0 = --%  0 pps
10.2.107.7
10.2.67.7       ?
    |     ^        ttl   4
    v     |        hop -1   s      0/0 = --%       0 pps    0/0 = --%  0 pps
10.2.67.6       ?
    |     _      ttl   5
    v            hop 0    ms        0            0 pps          0    0 pps
10.2.67.6       10.2.67.6
  Receiver      Query Source
```

### 1.2.5  Zmerať konvergenciu v prípade výpadku

**Popis**

Vypli sme linku medzi R2 a R3 zmenou IP adresy na chybnú (z 10.1.23.3 na
10.2.23.3).

**Konfigurácia**

```
R3(config)#int f0/1
R3(config-if)#int f0/1.23
R3(config-subif)#ip address 10.2.23.3 255.255.255.248
*Mar  2 23:53:39.844: %PIM-5-DRCHG: DR change from neighbor 10.1.23.3 to
10.2.23.3 on interface FastEthernet0/1.23
```

Kontrola konvergencie zo smerovača R5:

```
R5#ping
Protocol [ip]:
Target IP address: 10.255.255.8
Repeat count [5]: 10000000
Datagram size [100]:
Timeout in seconds [2]: 1
Extended commands [n]:
Sweep range of sizes [n]:
Type escape sequence to abort.
Sending 10000000, 100-byte ICMP Echos to 10.255.255.8, timeout is 1 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
!!!!!!!!!!!!!!!!.............!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!.
Success rate is 98 percent (770/785), round-trip min/avg/max = 56/81/112 ms
```

Nakoniec sme merali konvergenciu pri celkovom výpadku RP (R3).

```
*Mar  5 23:01:28.230: %PIM-5-NBRCHG: neighbor 10.1.23.3 UP on interface
FastEthernet0/1.23
*Mar  5 23:01:28.282: %PIM-5-DRCHG: DR change from neighbor 0.0.0.0 to
10.1.23.3 on interface FastEthernet0/1.23


R1#show ip pim rp mapping
PIM Group-to-RP Mappings

Group(s) 224.0.0.0/4
  RP 10.255.255.3 (?), v2
    Info source: 10.255.255.9 (?), via bootstrap, priority 0, holdtime 150
         Uptime: 4d20h, expires: 00:02:13
```