ŽILINSKÁ UNIVERZITA V ŽILINE

FAKULTA RIADENIA A INFORMATIKY

Dokumentácia k zadaniu BGP z predmetu Projektovanie sietí 1

Tomáš Pikna, 5ZKS11

Stanislav Rusnák, 5ZKS11

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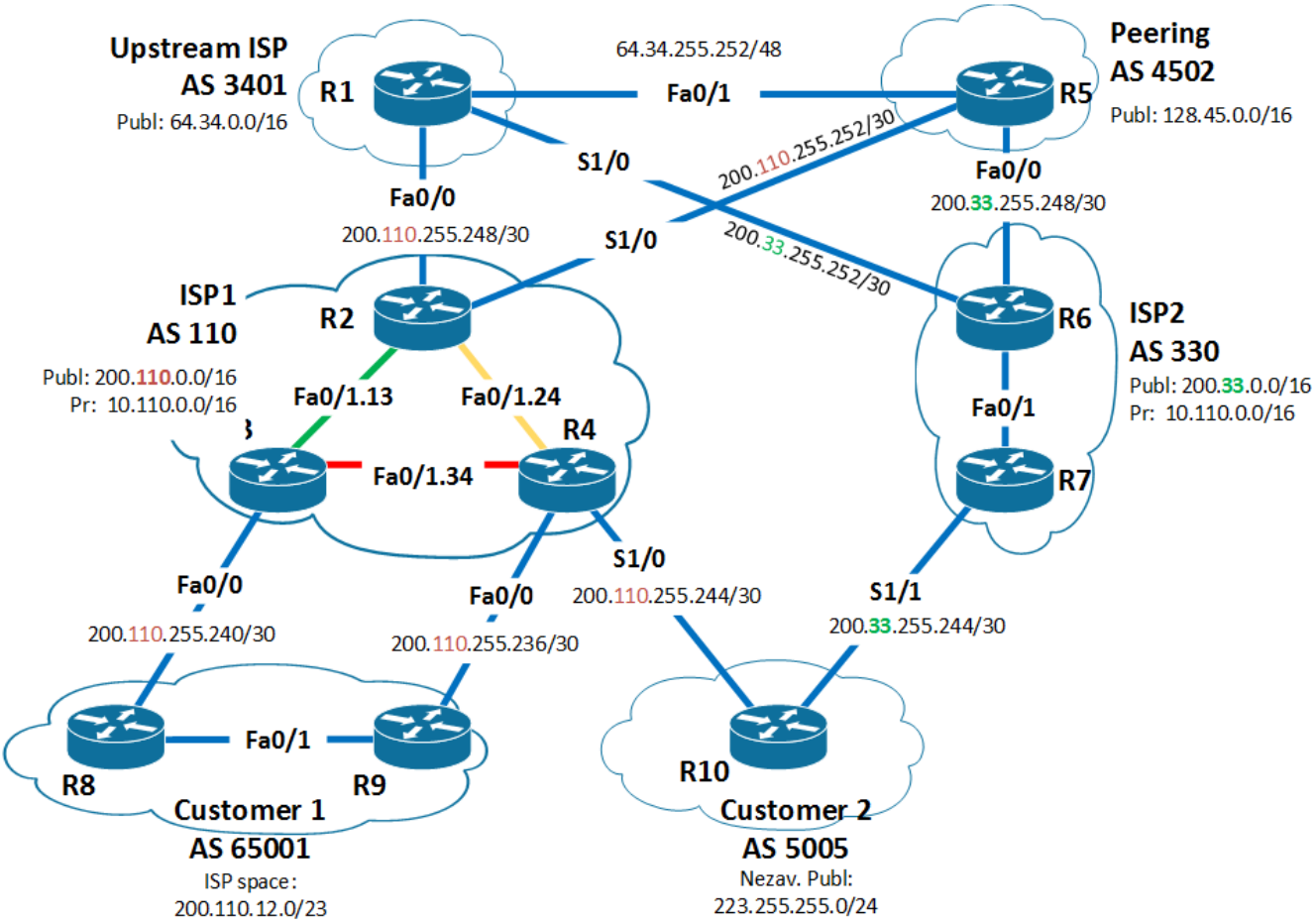
1. BGP

V tomto cvičení sme precvičovali nadobudnuté vedomosti o protokole BGP jeho konfiguráciou podľa zadania spolu s protokolmi OSPF alebo IS-IS.

2. Topológia

V topológii sa nachádza 10 smerovačov rozdelených do 6 oblastí, resp. autonómnych systémov. Smerovače R2,R3 a R4 sú prepojené prepínačom. V AS 110,330 a 65001 sme pre interné smerovanie použili protokol IS-IS.



3. Adresácia

Loopback0 rozhrania sú rozhrania zariadenia v tvare 10.255.255.ČÍSLOROUTRA, Loopback1 predstavujú siete za týmito smerovačmi. Pre smerovače v AS 110,330,65001 bolo potrebné určiť taktiež NET adresy kvôli protokolu IS-IS, ktoré boli určené z loopback0 rozhrania.

R1

FastEthernet0/0 : 200.110.255.249 **FastEthernet0/1** : 64.34.255.253 **Serial1/0** : 200.33.255.253

Loopback0 : 10.255.255.1
Loopback1 : 64.34.0.1

R2

FastEthernet0/0 : 200.110.255.250
FastEthernet0/1.23 : 10.110.23.2
FastEthernet0/1.24 : 10.110.24.2
Serial1/0 : 200.110.255.253
Loopback0 : 10.255.255.2
Loopback1 : 200.110.2.1
NET : 49.0001.0102.5525.5002.00

R3

FastEthernet0/0 : 200.110.255.241
FastEthernet0/1.23 : 10.110.23.3
FastEthernet0/1.34 : 10.110.34.3
Loopback0 : 10.255.255.3
Loopback1 : 200.110.3.1
NET : 49.0001.0102.5525.5003.00

R4

FastEthernet0/0 : 200.110.255.237
FastEthernet0/1.24 : 10.110.24.4
FastEthernet0/1.34 : 10.110.34.4
Serial1/0 : 200.110.255.245
Loopback0 : 10.255.255.4
Loopback1 : 200.110.4.1
NET : 49.0001.0102.5525.5004.00

R5

FastEthernet0/0 : 200.33.255.249
FastEthernet0/1 : 64.34.255.254
Serial1/0 : 200.110.255.254
Loopback0 : 10.255.255.5
Loopback1 : 128.45.0.1

R6

FastEthernet0/0 : 200.33.255.250
FastEthernet0/1 : 10.110.67.6
Serial1/0 : 200.33.255.254
Loopback0 : 10.255.255.6
Loopback1 : 200.33.6.1

NET : 49.0001.0102.5525.5006.00

R7

FastEthernet0/1 : 10.110.67.7
Serial1/1 : 200.33.255.245
Loopback0 : 10.255.255.7
Loopback1 : 200.33.7.1
NET : 49.0001.0102.5525.5007.00

R8

FastEthernet0/0 : 200.110.255.242
FastEthernet0/1 : 10.110.89.8
Loopback0 : 10.255.255.8
Loopback1 : 200.110.12.1
NET : 49.0001.0102.5525.5008.00

R9

FastEthernet0/0 : 200.110.255.238
FastEthernet0/1 : 10.110.89.9
Loopback0 : 10.255.255.9
Loopback1 : 200.110.13.1
NET : 49.0001.0102.5525.5009.00

R10

Serial1/0 : 200.110.255.246
Serial1/1 : 200.33.255.246
Loopback0 : 10.255.255.10
Loopback1 : 223.255.255.1

4. Úlohy

4.1. Použiť IGP OSPF alebo IS-IS (L2 only) single area dizajn, priame p2p prepojenia, ISP1, ISP2

Použili sme smerovací protokol IS-IS v AS 110,330,65001.

KONFIGURÁCIA (* je číslo smerovača a X príslušný interface smerovača)

```
R*#router isis
R*# 49.0002.0102.5525.500*.00
```

```
R*#is-type level-2-only
R*#int X
R*#ip router isis
```

R2

```
R2#sh clns neigh
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R4             Fa0/1.24    c003.41ea.0001  Up     7         L2   IS-IS
R3             Fa0/1.23    c002.41ea.0001  Up     8         L2   IS-IS
R2#sh ip proto | sec Routing
Routing Protocol is "isis"
…
```

R3

```
R3#sh clns neigh
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R2             Fa0/1.23    c001.41ea.0001  Up     21        L2   IS-IS
R4             Fa0/1.34    c003.41ea.0001  Up     8         L2   IS-IS
R3#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

R4

```
R4#sh clns neigh
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R2             Fa0/1.24    c001.41ea.0001  Up     28        L2   IS-IS
R3             Fa0/1.34    c002.41ea.0001  Up     25        L2   IS-IS
R4#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

R6

```
R6#sh clns neigh
System Id      Interface   SNPA            State  Holdtime  Type Protocol
R7             Fa0/1       c006.41ea.0001  Up     9         L2   IS-IS
R6#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

R7

```
R7#sh clns neigh
System Id      Interface   SNPA            State  Holdtime  Type Protocol
```

```
R6          Fa0/1      c005.41ea.0001     Up    23       L2   IS-IS
R7#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

R8

```
R8#sh clns neigh
System Id     Interface   SNPA            State  Holdtime  Type Protocol
R9          Fa0/1      c008.41ea.0001     Up    8        L2   IS-IS
R8#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

R9

```
R9#sh clns neigh
System Id     Interface   SNPA            State  Holdtime  Type Protocol
R8          Fa0/1      c007.41ea.0001     Up    25       L2   IS-IS
R9#sh ip proto | sec Routing
Routing Protocol is "isis"
...
```

P2P prepojenia

R3

```
R3#sh run | sec interface FastEthernet0/1.23
interface FastEthernet0/1.23
encapsulation dot1Q 23
ip address 10.110.23.3 255.255.255.0
ip router isis
isis network point-to-point
R3#sh run | sec interface FastEthernet0/1.34
interface FastEthernet0/1.34
encapsulation dot1Q 34
ip address 10.110.34.3 255.255.255.0
ip router isis
isis network point-to-point
```

R7

```
R7#sh run | sec interface FastEthernet0/1
interface FastEthernet0/1
ip address 10.110.67.7 255.255.255.0
ip router isis
```

```
isis network point-to-point
```

4.2. Distribúcia internetových statických smerovacích záznamov z AS3401, AS4502 a zákaznických smerovacích záznamov z AS65001, AS5005, AS330

Redistribúcia statických záznamov sa konfiguruje príkazom *redistribute static*, avšak v našom prípade sme žiadne statické záznamy nemali, preto sa tento bod zadania nedal splniť.

4.3. Zabezpečiť plnú konektivitu prostredníctvom iBGP alebo eBGP protokolov pre zákaznícke a internetové smer. záznamy

V AS 110,330,65001 bol použitý smerovací protokol IS-IS. Na konektivitu medzi autonómnymi systémami bol použitý protokol BGP.

KONFIGURÁCIA (ako príklad smerovač R4)

```
R4(config)#router bgp 110
R4(config-router)#network 200.110.4.0
R4(config-router)#neighbor 10.255.255.2 remote-as 110
R4(config-router)# neighbor 10.255.255.3 remote-as 110
R4(config-router)#neighbor 200.110.255.238 remote-as 65001
R4(config-router)# neighbor 200.110.255.246 remote-as 5005
```

Príkazom *router bgp XYZ* zapneme smerovací protokol BGP pre daný smerovač v danom AS (XYZ). Príkazom *network* začneme v BGP ohlasovať siete, ktoré oznamovať chceme (v našom prípade adresy z loopbackov 1). Príkazom *neighbor IP remote-as XYZ* nadväzujeme susedské vzťahy s ostatnými smerovačmi v rovnakých alebo iných AS.

R4

```
R4#sh ip proto
...
Routing Protocol is "bgp 110"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  IGP synchronization is disabled
  Automatic route summarization is disabled
  Unicast Aggregate Generation:
    200.110.0.0/21     summary-only
  Neighbor(s):
    Address          FiltIn FiltOut DistIn DistOut Weight RouteMap
    10.255.255.2
    10.255.255.3
    200.110.255.238
```

```
  200.110.255.246                         NO_tran
 Maximum path: 1
 Routing Information Sources:
  Gateway         Distance      Last Update
  (this router)       200       1w6d
  10.255.255.2        200       6d03h
  10.255.255.3        200       6d05h
  200.110.255.246      20       6d04h
  200.110.255.238      20       6d06h
 Distance: external 20 internal 200 local 200
```

Smerovač R4 má 4 susedov : R2,R3,R9,R10

```
R4#sh bgp summ
BGP router identifier 200.110.4.1, local AS number 110
BGP table version is 45, main routing table version 45
8 network entries using 960 bytes of memory
11 path entries using 572 bytes of memory
12/8 BGP path/bestpath attribute entries using 1488 bytes of memory
5 BGP AS-PATH entries using 120 bytes of memory
4 BGP community entries using 96 bytes of memory
0 BGP route-map cache entries using 0 bytes of memory
0 BGP filter-list cache entries using 0 bytes of memory
Bitfield cache entries: current 2 (at peak 5) using 64 bytes of memory
BGP using 3300 total bytes of memory
BGP activity 13/5 prefixes, 31/20 paths, scan interval 60 secs

Neighbor        V    AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
10.255.255.2    4   110   19168   19153       45    0    0 6d05h         6
10.255.255.3    4   110   19121   19141       45    0    0 6d05h         2
200.110.255.238 4 65001   19166   19178       45    0    0 1w6d          1
200.110.255.246 4  5005   10264   10295        0    0    0 6d04h    Idle
```

```
R4#sh ip bgp
BGP table version is 45, local router ID is 200.110.4.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*>i0.0.0.0          10.255.255.2             0    100      0 i
*>i64.34.0.0/24     200.110.255.249          0    100      0 3401 i
*>i128.45.0.0/24    200.110.255.254          0    100      0 4502 i
*>i200.33.0.0/21    200.110.255.249          0    100      0 3401 330 i
* i200.110.0.0/21   10.255.255.2             0    100      0 i
```

```
* i               10.255.255.3           0    100      0 i
*>                0.0.0.0                  32768 i
s> 200.110.4.0     0.0.0.0                  0        32768 i
*>i200.110.8.0/21   200.110.255.242         0    150      0 65001 i
*                 200.110.255.238         0           0 65001 i
*>i223.255.255.0    200.110.255.254         0    100      0 4502 330 5005 i
```

4.3.1.Kontrola, či interné ISP adresy nie sú propagované

Kontrola prebehla na smerovačoch R4,R5. Ani na jednom niesú privátne adresy propagované

R4

```
R4#sh bgp
BGP table version is 56, local router ID is 200.110.4.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*>i0.0.0.0          10.255.255.2             0    100      0 i
*>i64.34.0.0/24     200.110.255.249          0    100      0 3401 i
*>i128.45.0.0/24    200.110.255.254          0    100      0 4502 i
*>i200.33.0.0/21    200.110.255.249          0    100      0 3401 330 i
* i200.110.0.0/21   10.255.255.2             0    100      0 i
* i                 10.255.255.3             0    100      0 i
*>                  0.0.0.0                  32768 i
s> 200.110.4.0      0.0.0.0                  0        32768 i
*>i200.110.8.0/21   200.110.255.242          0    150      0 65001 i
*                   200.110.255.238          0           0 65001 i
*> 223.255.255.0    200.110.255.246          0           0 5005 i
```

R5

```
R5#sh ip bgp
BGP table version is 44, local router ID is 128.45.0.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 64.34.0.0/24     64.34.255.253            0           0 3401 i
*> 128.45.0.0/24    0.0.0.0                  0        32768 i
*> 200.33.0.0/21    200.33.255.250           0           0 330 i
*                   64.34.255.253                     0 3401 330 i
*  200.110.0.0/21   64.34.255.253                     0 3401 110 i
*>                  200.110.255.253          0           0 110 i
```

```
*  200.110.8.0/21   64.34.255.253                0 3401 110 i
*>               200.110.255.253                0 110 i
*> 223.255.255.0    200.110.255.253                0 110 5005 i
*                64.34.255.253                0 3401 110 5005 i
```

4.3.2.Prepísať privátne AS65001

na R4 a R2 sa aplikovali nasledujúce príkazy:

```
R4(config-router)#neighbor 200.110.255.246 remove-private-as
R2(config-router)#neighbor 200.110.255.249 remove-private-as
R2(config-router)#neighbor 200.110.255.254 remove-private-as
```

Pred aplikáciou príkazov :

```
R5#sh ip bgp
BGP table version is 12, local router ID is 10.255.255.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.33.255.250                 0 330 3401 i
*>               200.110.255.253                0 110 3401 i
*> 128.45.0.0/24    0.0.0.0                  0         32768 i
*  200.33.6.0       200.110.255.253                0 110 3401 330 i
*>               200.33.255.250           0         0 330 i
*  200.33.7.0       200.110.255.253                0 110 3401 330 i
*>               200.33.255.250                 0 330 i
*> 200.110.2.0      200.110.255.253          0         0 110 i
*  200.110.3.0      200.33.255.250                 0 330 3401 110 i
*>               200.110.255.253                0 110 i
*  200.110.4.0      200.33.255.250                 0 330 3401 110 i
*>               200.110.255.253                0 110 i
*> 200.110.12.0     200.110.255.253                  0 110 65001 i
*> 200.110.13.0     200.110.255.253                  0 110 65001 i
*                200.33.255.250                 0 330 3401 110 65001 i
*  223.255.255.0    200.110.255.253                0 110 5005 i
*>               200.33.255.250                 0 330 5005 i
```

Po aplikácii príkazov :

```
R5#sh ip bgp
BGP table version is 14, local router ID is 10.255.255.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
```

```
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.33.255.250                 0 330 3401 i
*>                  200.110.255.253                0 110 3401 i
*> 128.45.0.0/24    0.0.0.0                  0     32768 i
*  200.33.6.0       200.110.255.253                0 110 3401 330 i
*>                  200.33.255.250           0     0 330 i
*  200.33.7.0       200.110.255.253                0 110 3401 330 i
*>                  200.33.255.250                 0 330 i
*> 200.110.2.0      200.110.255.253          0     0 110 i
*  200.110.3.0      200.33.255.250                 0 330 3401 110 i
*>                  200.110.255.253                0 110 i
*  200.110.4.0      200.33.255.250                 0 330 3401 110 i
*>                  200.110.255.253                0 110 i
*> 200.110.12.0     200.110.255.253                0 110 i
*> 200.110.13.0     200.110.255.253                0 110 i
*  223.255.255.0    200.110.255.253                0 110 5005 i
*>                  200.33.255.250                 0 330 5005 i
```

4.3.3.Sumarizácia

Sumarizáciu sietí sme previedli v AS 110,330,65001

AS 110

Na routroch R2,R3,R4 v konfigurácii BGP sme použili príkazy :

```
router bgp 110
aggregate-address 200.110.0.0 255.255.248.0 summary-only
```

AS 330

Na routroch R6,R7 v konfigurácii BGP sme použili príkazy :

```
router bgp 330
aggregate-address 200.33.0.0 255.255.248.0 summary-only
```

AS 65001

Na routroch R8,R9 v konfigurácii BGP sme použili príkazy :

```
router bgp 65001
aggregate-address 200.110.8.0 255.255.248.0 summary-only
```

Kontrola

Pred aplikáciou príkazov :

```
R5#sh ip bgp
BGP table version is 14, local router ID is 10.255.255.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.33.255.250                         0 330 3401 i
*>                  200.110.255.253                        0 110 3401 i
*> 128.45.0.0/24    0.0.0.0                  0         32768 i
*  200.33.6.0       200.110.255.253                        0 110 3401 330 i
*>                  200.33.255.250           0             0 330 i
*  200.33.7.0       200.110.255.253                        0 110 3401 330 i
*>                  200.33.255.250                         0 330 i
*> 200.110.2.0      200.110.255.253          0             0 110 i
*  200.110.3.0      200.33.255.250                         0 330 3401 110 i
*>                  200.110.255.253                        0 110 i
*  200.110.4.0      200.33.255.250                         0 330 3401 110 i
*>                  200.110.255.253                        0 110 i
*> 200.110.12.0     200.110.255.253                        0 110 i
*> 200.110.13.0     200.110.255.253                        0 110 i
*  223.255.255.0    200.110.255.253                        0 110 5005 i
*>                  200.33.255.250                         0 330 5005 i
```

Po aplikácii príkazov :

```
R5#sh ip bgp
BGP table version is 37, local router ID is 10.255.255.5
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.33.255.250                         0 330 3401 i
*>                  200.110.255.253                        0 110 3401 i
*> 128.45.0.0/24    0.0.0.0                  0         32768 i
*  200.33.0.0/21    200.110.255.253                        0 110 3401 330 i
*>                  200.33.255.250           0             0 330 i
*  200.110.0.0/21   200.33.255.250                        0 330 3401 110 i
*>                  200.110.255.253          0             0 110 i
*> 200.110.8.0/21   200.110.255.253                        0 110 i
*                   200.33.255.250                         0 330 3401 110 i
*  223.255.255.0    200.110.255.253                        0 110 5005 i
*>                  200.33.255.250                         0 330 5005 i
```

4.4. Kontrola konektivity medzi zákazníckymi a internetovými smerovacími záznamami

Použili sme tcl skript na smerovačoch R1,R5,R8 a R10 (cieľové a zdrojová adresa sa menili v závislosti na tom, na ktorom smerovači bol skript pustený, v ukážke je to smerovač R8):

R8

```
foreach address {
64.34.0.1
200.110.2.1
200.110.3.1
200.110.4.1
128.45.0.1
200.33.6.1
200.33.7.1
223.255.255.1
200.110.13.1
} {
ping $address source 200.110.12.1}
```

VÝSLEDKY

R1

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 223.255.255.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/79/100 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.2.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/31/48 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.3.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/55/72 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.4.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/46/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 128.45.0.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 16/24/40 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.6.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/24/32 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.7.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 36/60/88 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.12.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/83/96 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.13.1, timeout is 2 seconds:
Packet sent with a source address of 64.34.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/144/176 ms
```

R5

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 64.34.0.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/35/76 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.2.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/27/44 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.3.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/51/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.4.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/70/152 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 223.255.255.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/76/92 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.6.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/32/40 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.7.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 48/50/56 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.12.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/87/120 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.13.1, timeout is 2 seconds:
Packet sent with a source address of 128.45.0.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 92/125/148 ms
```

R8

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 64.34.0.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/76/92 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.2.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/60/80 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.3.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/25/28 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.4.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/48/68 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 128.45.0.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/71/84 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.6.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/108/148 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.7.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/137/160 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 223.255.255.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 120/142/168 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.13.1, timeout is 2 seconds:
Packet sent with a source address of 200.110.12.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/24/36 ms
```

R10

```
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 64.34.0.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/70/104 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.2.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/101/140 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.3.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 100/136/168 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.4.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/120/152 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 128.45.0.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/68/88 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.6.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/47/60 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.33.7.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/24/52 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.12.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 132/147/176 ms
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 200.110.13.1, timeout is 2 seconds:
Packet sent with a source address of 223.255.255.1
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 140/154/184 ms
```

4.5. Primárne linky R3-R8, R4-R10

Úlohou bolo aby z AS 65001 išla všetka komunikácia cez linku R3-R8. To bolo potrebné nastaviť na smerovačoch R3 a R8 pomocou atribútov a komunít v smere von aj dnu.

R8 v smere von z 65001

```
R8(config)# route-map R8-R3 permit 10 // vytvorenie route mapy (RM)
R8(config-route-map)# set local-preference 150 // zvýhodnenie linky (def. 100 – vyššia je lepšia)
R8(config)# router bgp 65001
R8(config-router)# neighbor 200.110.255.241 route-map R8-R3 in // aplikovanie RM voči R3
```

R8 v smere do 65001

```
R8(config)#access-list 101 permit ip any any
R8(config)# route-map R8-R3-out permit 10
R8(config-route-map)# set community 65001:1100 additive //značkovanie prevádzky z AS 65001
R8(config-route-map)# match ip address 101
```

```
R8(config)# router bgp 65001
R8(config-router)# neighbor 200.110.255.241 route-map R8-R3-out out // aplikácia com. voči R3
R8(config-router)# neighbor 200.110.255.241 send-community
```

R3 v smere do 65001

```
R3(config)# ip community-list 110 permit 65001:1100
R3(config)# route-map R3-R8-in permit 10
R3(config-route-map)# match community 110 // zachytávanie prevádzky z AS 65001
R3(config-route-map)# set local-preference 150 // zvýhodnenie linky
R3(config)# router bgp 110
R3(config-router)# neighbor 200.110.255.242 route-map R3-R8-in in
```

Aby sa zmeny prejavili, bolo potrebné použiť príkaz *clear ip bgp **.

Smer R9 na R2

```
R9#sh ip bgp
BGP table version is 58, local router ID is 200.110.13.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  0.0.0.0          200.110.255.237                        0 110 i
*>i                 200.110.255.241          0    150      0 110 i
*  64.34.0.0/24     200.110.255.237                        0 110 3401 i
*>i                 200.110.255.241          0    150      0 110 3401 i
*>i128.45.0.0/24    200.110.255.241          0    150      0 110 4502 i
*                   200.110.255.237                        0 110 4502 i
*>i200.33.0.0/21    200.110.255.241          0    150      0 110 3401 330 i
*                   200.110.255.237                        0 110 3401 330 i
*>i200.110.0.0/21   200.110.255.241          0    150      0 110 i
*                   200.110.255.237          0             0 110 i
* i200.110.8.0/21   10.255.255.8             0    100      0 i
*>                  0.0.0.0                             32768 i
s> 200.110.13.0     0.0.0.0                  0         32768 i
i223.255.255.0      200.110.255.241          0    150      0 110 5005 i
*                   200.110.255.237                        0 110 4502 330 5005

R9#traceroute 200.110.2.1 source 200.110.13.1
Type escape sequence to abort.
Tracing the route to 200.110.2.1
  1 10.110.89.8 [AS 110] 28 msec 20 msec 28 msec
  2 200.110.255.241 [AS 110] 64 msec 60 msec 44 msec
  3 10.110.23.2 [AS 110] 68 msec *  68 msec
```

Smer z R2 na R9

```
R2#sh bgp
BGP table version is 27, local router ID is 200.110.2.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.110.255.254                        0 4502 3401 i
*>                  200.110.255.249         0              0 3401 i
*  128.45.0.0/24    200.110.255.249                        0 3401 4502 i
*>                  200.110.255.254         0              0 4502 i
*> 200.33.0.0/21    200.110.255.249                        0 3401 330 i
*                   200.110.255.254                        0 4502 330 i
*> 200.110.0.0/21   0.0.0.0                                32768 i
* i                 10.255.255.4            0    100       0 i
* i                 10.255.255.3            0    100       0 i
s> 200.110.2.0      0.0.0.0                 0              32768 i
*>i200.110.8.0/21   200.110.255.242         0    150       0 65001 i
*>i223.255.255.0    200.110.255.246         0    100       0 5005 i

R2#traceroute 200.110.13.1 source 200.110.2.1
Type escape sequence to abort.
Tracing the route to 200.110.13.1
  1 10.110.23.3 16 msec 48 msec 24 msec
  2 200.110.255.242 44 msec 44 msec 40 msec
  3 10.110.89.9 100 msec *  72 msec
```

Aby sa R4-R10 taktiež stala primárnou linkou, museli sme pomocou atribútu as-path prepend „predĺžiť“ cestu v smere na smerovač R7.

```
R10(config)# ip as-path access-list 1 permit ^$
R10(config-route-map)# route-map R10-R4-out permit 10
R10(config-route-map)# match as-path 1
R10(config-route-map)# set as-path prepend 5005 5005 5005 // predĺženie cesty na R7
R10(config)# router bgp 5005
R10(config-router)# neighbor 200.33.255.245 route-map R10-R4-out out
```

```
R7#sh ip bgp
BGP table version is 14, local router ID is 200.33.7.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
```

```
   Network          Next Hop            Metric LocPrf Weight Path
*>i64.34.0.0/24     200.33.255.253           0    100      0 3401 i
*>i128.45.0.0/24    200.33.255.249           0    100      0 4502 i
*> 200.33.0.0/21    0.0.0.0                  32768 i
* i                 10.255.255.6             0    100      0 i
s> 200.33.7.0       0.0.0.0                  0         32768 i
*>i200.110.0.0/21   200.33.255.249           0    100      0 4502 110 i
*>i200.110.8.0/21   200.33.255.249           0    100      0 4502 110 i
*>i223.255.255.0    200.33.255.249           0    100      0 4502 110 5005 i
*                              200.33.255.246             0             0      5005 5005 5005 5005 i
```

4.6. Distribuovať iba default, AS5005 a peering prefixy do AS65001

Bolo potrebné zabezpečiť, aby smerovače R8 a R9 poznali iba default route s výnimkou ciest do AS 4502 a 5005. To sa zabezpečilo konfiguráciou na R2.

```
R2(config)ip as-path access-list 2 permit _5005$,_4502$
R2(config)#route-map PEERING permit 10
R2(config-route-map)#match as-path 2
R2(config-route-map)#exi
R2(config)#router bgp 110
R2(config-router)#neighbor 10.255.255.3 default-originate
R2(config-router)#neighbor 10.255.255.3 route-map PEERING out
R2(config-router)#neighbor 10.255.255.4 default-originate
R2(config-router)#neighbor 10.255.255.4 route-map PEERING out

R8#sh ip bgp
BGP table version is 18, local router ID is 200.110.12.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 0.0.0.0          200.110.255.241              150      0 110 i
*> 64.34.0.0/24     200.110.255.241              150      0 110 3401 i
*> 128.45.0.0/24    200.110.255.241              150      0 110 4502 i
*> 200.33.0.0/21    200.110.255.241              150      0 110 4502 330 i
*> 200.110.0.0/21   200.110.255.241         0    150      0 110 i
* i200.110.8.0/21   10.255.255.9            0    100      0 i
*>                  0.0.0.0                  32768 i
s> 200.110.12.0     0.0.0.0                  0         32768 i
*> 223.255.255.0    200.110.255.241              150      0 110 5005 i
```

4.7. AS5005 nesme byť nikdy transit

V tejto úlohe bolo potrebné zabezpečiť aby cez smerovač R10 v AS 5005 neprechádzali toky z jedného AS do druhého.

Na R10 sme povolili prevádzku ktorá začínala len v jeho AS.

```
R10(config)# ip as-path access-list 1 permit ^$
R10(config-route-map)# route-map NO_TRANSIT permit 10
R10(config-route-map)# match as-path 1
R10(config)# router bgp 5005
R10(config-router)# neighbor 200.110.255.245 route-map NO_TRANSIT out
R10(config-router)# neighbor 200.33.255.245 route-map NO_TRANSIT out
```

Rovnako bolo potrebné zabezpečiť konfiguráciu R4 a R7, ktoré vystupujú ako ISP a tie by mali byť za to zodpovedné.

```
R4(config)#ip as-path access-list 1 permit _5005$
R4(config)#route-map NO_tran permit 10
R4(config-route-map)#match as-path 1
R4(config)#router bgp 110
R4(config-router)#neighbor 200.110.255.246 route-map NO_tran in

R4#sh ip bgp
BGP table version is 13, local router ID is 200.110.4.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*>i0.0.0.0          10.255.255.2             0    100      0 i
*>i64.34.0.0/24     200.110.255.249          0    100      0 3401 i
*>i128.45.0.0/24    200.110.255.254          0    100      0 4502 i
*>i200.33.0.0/21    200.110.255.254          0    100      0 4502 330 i
* i200.110.0.0/21   10.255.255.2             0    100      0 i
* i                 10.255.255.3             0    100      0 i
*>                  0.0.0.0                  0         32768 i
s> 200.110.4.0      0.0.0.0                  0         32768 i
*>i200.110.8.0/21   200.110.255.242          0    150      0 65001 i
*                   200.110.255.238          0             0 65001 i
*> 223.255.255.0    200.110.255.246          0             0 5005 i // cesta iba na R10 cez 5005
```

```
R7(config)#ip as-path access-list 1 permit _5005$
R7(config)#route-map No_TRANSIT permit 10
R7(config-route-map)#match as-path 1
R7(config)#router bgp 330
```

```
R7(config-router)#neighbor 200.33.255.246 route-map NO_TRANSIT in

R7#sh ip bgp
BGP table version is 14, local router ID is 200.33.7.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*>i64.34.0.0/24     200.33.255.253           0    100      0 3401 i
*>i128.45.0.0/24    200.33.255.249           0    100      0 4502 i
*> 200.33.0.0/21    0.0.0.0                  32768 i
* i                 10.255.255.6             0    100      0 i
s> 200.33.7.0       0.0.0.0                  0         32768 i
*>i200.110.0.0/21   200.33.255.249           0    100      0 4502 110 i
*>i200.110.8.0/21   200.33.255.249           0    100      0 4502 110 i
*>i223.255.255.0    200.33.255.249           0    100      0 4502 110 5005 i
*                               200.33.255.246             0             0      5005 5005 5005 5005 i // cesta iba na
R10 cez 5005
```

4.8. Peering iba pre ISP1 a ISP2, nie pre prefixy naučené z Upstream ISP

V tejto úlohe bnolo potrebné zabezpečiť, aby komunikácia z R1 (AS 3401 neprechádzala cez Peering (AS 4502), ale aby cez neho prechádzala komunikácia od ISP1 a 2.

Na R1 sme nakonfigurovali :

```
R1(config)#ip bgp-community new-format
R1(config)#route-map R1-out permit 10
R1(config-route-map)#set community 3401:1 additive  //označenie prevádzky od R1
R1(config)#router bgp 3401
R1(config-router)#neighbor 64.34.255.254 send-community
R1(config-router)#neighbor 64.34.255.254 route-map R1-out out
R1(config-router)#neighbor 200.33.255.254 send-community
R1(config-router)#neighbor 200.33.255.254 route-map R1-out out
R1(config-router)#neighbor 200.110.255.250 send-community
R1(config-router)#neighbor 200.110.255.250 route-map R1-out out
```

Na R2 a R6 bolo potrebné nakonfigurovať zachytávanie prevádzky z R1 a zakázanie posielania na R5.

```
R2(config)# ip community-list 1 permit 3401:1
R2(config)# route-map R2-R5 deny 10
R2(config-route-map)# match community 1
R2(config)# router bgp 110
```

```
R2(config-router)#neighbor 200.110.255.254 route-map R2-R5 out
```

```
R6(config)# ip community-list 1 permit 3401:1
R6(config)# route-map R6-R5 deny 10
R6(config-route-map)# match community 1
R6(config)# router bgp 330
R6(config-router)#neighbor 200.33.255.249 route-map R6-R5 out
```

Jedninou cestou pre R5 na R1 ostáva:

```
R5#sh bgp
BGP table version is 44, local router ID is 128.45.0.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 64.34.0.0/24     64.34.255.253            0             0 3401 i
*> 128.45.0.0/24    0.0.0.0                  0         32768 i
*> 200.33.0.0/21    200.33.255.250           0             0 330 i
*                   64.34.255.253                          0 3401 330 i
*  200.110.0.0/21   64.34.255.253                          0 3401 110 i
*>                  200.110.255.253          0             0 110 i
*  200.110.8.0/21   64.34.255.253                          0 3401 110 i
*>                  200.110.255.253                        0 110 i
*> 223.255.255.0    200.110.255.253                        0 110 5005 i
*                   64.34.255.253                          0 3401 110 5005 i
```

4.9. Overiť funkčnosť nastavenia politiky vhodnými výpadkami liniek a smerovačov

Overenie vypnutím linky R5-R6

```
R6#traceroute 200.110.12.1 source 200.33.6.1
1 200.33.255.253 0 msec 18 msec 16 msec
2 200.110.255.250 26 msec 30 msec 10 msec
3 10.110.23.3 70 msec 60 msec 52 msec
4 200.110.255.242 80 msec * 66 msec
```

4.10. Overiť, či je možné odkloniť celú prevádzku (upstream, downstream) na linke R4-R10 v prípade plánovanej údržby (linka musí byť plne funkčna a BGP spojenie propaguje všetky prefixy)

Na odklonenie prevádzky bolo potrebné nakonfigurovať

R10

```
R10(config)#route-map R10-out permit 10
R10(config-route-map)#set community 5005:1 additive
R10(config-route-map)#exit

R10(config-router)#router bgp 5005
R10(config-router)#neighbor 200.33.255.245 send-community
R10(config-router)#neighbor 200.33.255.245 route-map R10-out out
R10(config-router)#do clear ip bgp * out
```

POSTUPNE NA OSTATNYCH ROUTROCH NA SVOJICH NEIGHBROV SEND COMMUNITY

```
R5(config)#route-map R5-out2 permit 10
R5(config-route-map)#set community 4502:1 additive

R5(config-router)#router bgp 4502
R5(config-router)#neighbor 200.110.255.253 send-community
R5(config-router)#neighbor 200.110.255.253 route-map R5-out2 out
R5(config-router)#do clear ip bgp * out
```

R2

```
R2(config)#ip community-list 2 permit 4502:1
R2(config)#ip community-list 2 permit 5005:1

R2(config)#route-map R2-out permit 10
R2(config-route-map)#match community 2
```

Pred vypnutím S1/0 na R10

R2

```
R2#traceroute 223.255.255.1 source 200.110.2.1
Type escape sequence to abort.
Tracing the route to 223.255.255.1
  1 10.110.24.4 24 msec 20 msec 28 msec
  2 200.110.255.246 52 msec *  32 msec
```

```
R2#sh ip bgp
BGP table version is 24, local router ID is 200.110.2.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.110.255.254                  0 4502 3401 i
*>                  200.110.255.249         0          0 3401 i
*  128.45.0.0/24    200.110.255.249                  0 3401 4502 i
*>                  200.110.255.254         0          0 4502 i
*> 200.33.0.0/21    200.110.255.249                  0 3401 330 i
*                   200.110.255.254                  0 4502 330 i
*> 200.110.0.0/21   0.0.0.0                          32768 i
* i                 10.255.255.4            0    100     0 i
* i                 10.255.255.3            0    100     0 i
s> 200.110.2.0      0.0.0.0                  0        32768 i
*>i200.110.8.0/21   200.110.255.242          0    150     0 65001 i
*>i223.255.255.0    200.110.255.246          0    100     0 5005 i
```

R10

```
R10(config-if)#do traceroute 200.110.2.1 source 223.255.255.1
Type escape sequence to abort.
Tracing the route to 200.110.2.1
  1 200.110.255.245 [AS 110] 28 msec 32 msec 20 msec
  2 10.110.24.2 [AS 110] 64 msec *  36 msec
```

```
R10(config-if)#do sh bgp
BGP table version is 20, local router ID is 223.255.255.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 0.0.0.0          200.110.255.245                150      0 110 i
*> 64.34.0.0/24     200.110.255.245                150      0 110 3401 i
*                   200.33.255.245                 0 330 3401 i
*> 128.45.0.0/24    200.110.255.245                150      0 110 4502 i
*                   200.33.255.245                 0 330 4502 i
*> 200.33.0.0/21    200.110.255.245                150      0 110 3401 330 i
*                   200.33.255.245         0       0 330 i
*> 200.110.0.0/21   200.110.255.245        0      150      0 110 i
*                   200.33.255.245                 0 330 4502 110 i
*> 200.110.8.0/21   200.110.255.245                150      0 110 i
*                   200.33.255.245                 0 330 4502 110 i
*> 223.255.255.0    0.0.0.0                  0         32768 i
```

Po vypnutí S1/0 na R10

R2

```
R2#traceroute 223.255.255.1 source 200.110.2.1
Type escape sequence to abort.
Tracing the route to 223.255.255.1
  1 200.110.255.249 32 msec 24 msec 20 msec
  2 200.33.255.254 64 msec 28 msec 84 msec
  3 10.110.67.7 64 msec 44 msec 84 msec
  4 200.33.255.246 108 msec *  104 msec
```

```
R2#sh ip bgp
BGP table version is 26, local router ID is 200.110.2.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*  64.34.0.0/24     200.110.255.254                0 4502 3401 i
*>                  200.110.255.249         0      0 3401 i
*  128.45.0.0/24    200.110.255.249                0 3401 4502 i
*>                  200.110.255.254         0      0 4502 i
```

```
*> 200.33.0.0/21    200.110.255.249                0 3401 330 i
*                   200.110.255.254                0 4502 330 i
*> 200.110.0.0/21   0.0.0.0                        32768 i
* i                 10.255.255.4          0    100     0 i
* i                 10.255.255.3          0    100     0 i
s> 200.110.2.0      0.0.0.0                0        32768 i
*>i200.110.8.0/21   200.110.255.242        0    150     0 65001 i
*  223.255.255.0    200.110.255.254                0 4502 330 5005 5005 5005 5005 i
*>                  200.110.255.249                0 3401 330 5005 5005 5005 5005 i
```

R10

```
R10(config-if)#do traceroute 200.110.2.1 source 223.255.255.1
Type escape sequence to abort.
Tracing the route to 200.110.2.1
  1 200.33.255.245 12 msec 24 msec 28 msec
  2 10.110.67.6 48 msec 44 msec 48 msec
  3 200.33.255.249 92 msec 48 msec 40 msec
  4 200.110.255.253 136 msec *  92 msec
```

```
R10#sh bgp
BGP table version is 14, local router ID is 223.255.255.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
              r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete

   Network          Next Hop            Metric LocPrf Weight Path
*> 64.34.0.0/24     200.33.255.245                 0 330 3401 i
*> 128.45.0.0/24    200.33.255.245                 0 330 4502 i
*> 200.33.0.0/21    200.33.255.245         0       0 330 i
*> 200.110.0.0/21   200.33.255.245                 0 330 4502 110 i
*> 200.110.8.0/21   200.33.255.245                 0 330 4502 110 i
*> 223.255.255.0    0.0.0.0                0       32768 i
```