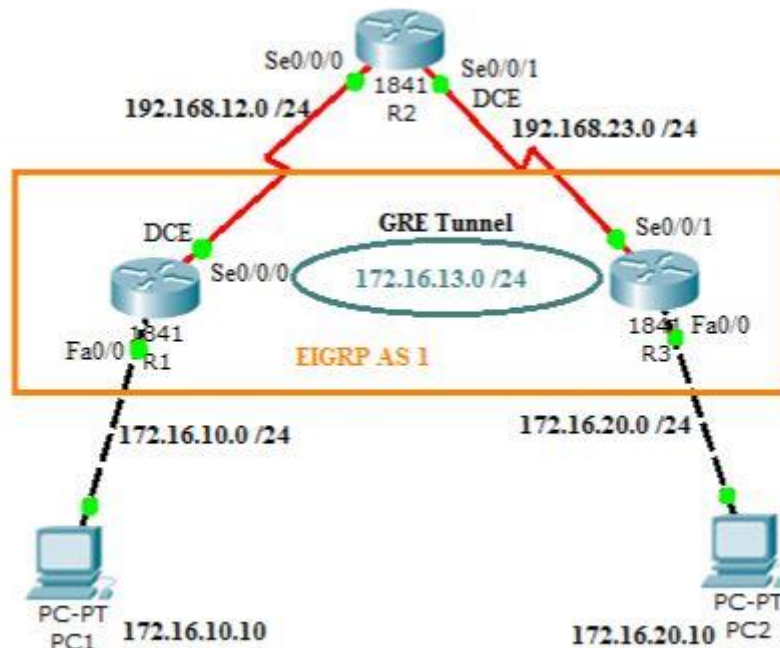


Dokumentácia k cvičeniu č.10 : GRE tunnel, QoS pre-classify

Topológia

Na linku medzi R2 a R3 sme vložili prepínač s ktorým sa smerovače spojili ethernetom a na prepínač sme pripojili PC3 kvôli port-mirroringu.



Generované toky

Na tomto cvičení sme generovali 3 toky, pričom pre nich boli pripravené aj 3 rôzne scenáre. Tok bol posielaný z PC1 na PC2 so zapnutým logovaním.

1. Tok1_vocie: použi prednastavený z D-ITG, kodek G.711, 2 vzorky na paket
2. Tok2_gaming: použi prednastavený z D-ITG
3. Tok3_data: UDP, pakety veľkosti 1500 B

- a. intenzita súčtového toku (všetky 3 toky spolu): 75% z prenosovej kapacity linky (dáta 1p/s)
- b. intenzita súčtového toku (všetky 3 toky spolu): 100% z prenosovej kapacity linky (dáta 3p/s)
- c. intenzita súčtového toku (všetky 3 toky spolu): 125% z prenosovej kapacity linky (dáta 5p/s)

Konfigurácia – WFQ, značkovanie, smerovanie, GRE tunnel, port-mirroring

Keďže v základe bol výstupný front na smerovači R1 nastavený na FIFO, bolo potrebné ho zmeniť na WFQ nasledujúcimi príkazmi:

```
policy-map WFQ
class class-default
fair-queue
int s0/0/0
```

service-policy output WFQ

Následne bolo potrebné nastaviť značkovanie pre jednotlivé toky nasledovne:

1.tok: EF

2.tok: AF11

3.tok: best-effort

Vytvorili sme 3 ACL do ktorých jednotlivé toky spadali, následne sme vytvorili class-mapy kde sme tieto ACL „matchli“, vytvorili sme policy-map, kde sme nastavili značkovanie a aplikovali na vstupné rozhranie smerovača.

access-list 101 permit udp any any eq 9001

access-list 102 permit udp any any eq 9002

access-list 103 permit udp any any eq 9003

class-map match-all tok1

match access-group 101

class-map match-all tok2

match access-group 102

class-map match-all tok3

match access-group 103

policy-map znackovanie

class tok1

set dscp ef

class tok2

set dscp af11

class tok3

set dscp default

int fa0/0

service-policy input znackovanie

Pre zabezpečenie smerovania v celej topológii boli použité tieto príkazy:

R1

ip route 192.168.23.0 255.255.255.0 Serial0/0/0

ip route 172.16.20.0 255.255.255.0 Tunnel0

R2

ip route 192.168.12.0 255.255.255.0 Serial0/0/0

ip route 192.168.23.0 255.255.255.0 FastEthernet0/0

R3

ip route 192.168.12.0 255.255.255.0 FastEthernet0/0

ip route 172.16.10.0 255.255.255.0 Tunnel0

tým sme zabezpečili default-route pre R1 a R3 smerom na R2 a taktiež aby smerovanie z LAN za R1 a R3 išiel cez tunel.

Samotná konfigurácia GRE tunela bola konfigurovaná takto :

R1

```
interface Tunnel0  
ip address 172.16.13.1 255.255.255.0  
tunnel source Serial0/0/0  
tunnel destination 192.168.23.3
```

R3

```
interface Tunnel0  
ip address 172.16.13.3 255.255.255.0  
tunnel source FastEthernet0/0  
tunnel destination 192.168.12.1
```

Na zabezpečenie port-mirroringu sme na prepínači medzi R2 a R3 nastavili:

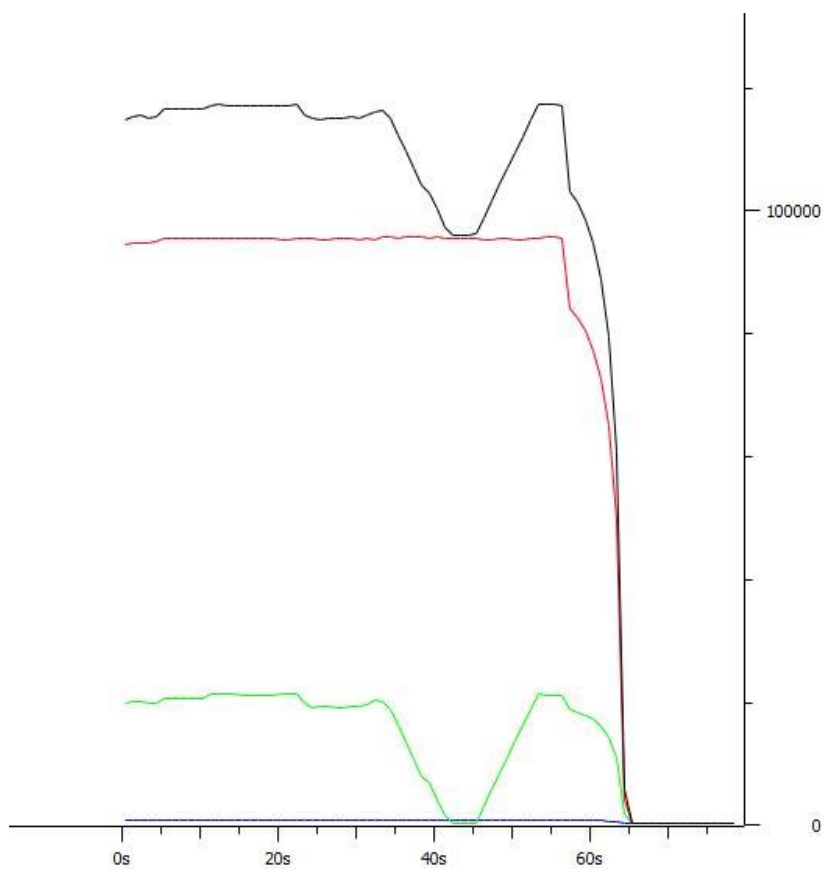
```
monitor session 1 source interface Fa0/1  
monitor session 1 destination interface Fa0/3
```

Graphs			
Graph 1	Color	Filter:	udp.dstport == 9001 udp.dstport == 9002 udp.dstport == 9003
Graph 2	Color	Filter:	udp.dstport == 9001
Graph 3	Color	Filter:	udp.dstport == 9002
Graph 4	Color	Filter:	udp.dstport == 9003

Úloha č.1 – bez značkovania, bez QoS pre-classify

```
▷ Ethernet II, Src: CiscoInc_93:83:01 (00:26:99:93:83:01), Dst: CiscoInc_97:eb:59 (ec:44:76:97:eb:59)
└─ Internet Protocol Version 4, Src: 192.168.12.1, Dst: 192.168.23.3
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    ▷ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        Total Length: 224
        Identification: 0x0061 (97)
    ▷ Flags: 0x00
        Fragment offset: 0
        Time to live: 254
        Protocol: Generic Routing Encapsulation (47)
        Header checksum: 0x1739 [validation disabled]
        [Header checksum status: Unverified]
        Source: 192.168.12.1
        Destination: 192.168.23.3
        [Source GeoIP: Unknown]
        [Destination GeoIP: Unknown]
    ▷ Generic Routing Encapsulation (IP)
└─ Internet Protocol Version 4, Src: 172.16.10.10, Dst: 172.16.20.10
    0100 .... = Version: 4
    .... 0101 = Header Length: 20 bytes (5)
    ▷ Differentiated Services Field: 0x00 (DSCP: CS0, ECN: Not-ECT)
        Total Length: 200
        Identification: 0x00b1 (177)
    ▷ Flags: 0x02 (Don't Fragment)
        Fragment offset: 0
        Time to live: 127
        Protocol: UDP (17)
        Header checksum: 0x843f [validation disabled]
        [Header checksum status: Unverified]
        Source: 172.16.10.10
        Destination: 172.16.20.10
        [Source GeoIP: Unknown]
        [Destination GeoIP: Unknown]
    ▷ User Datagram Protocol, Src Port: 55797, Dst Port: 9002
    ▷ Data (172 bytes)
```

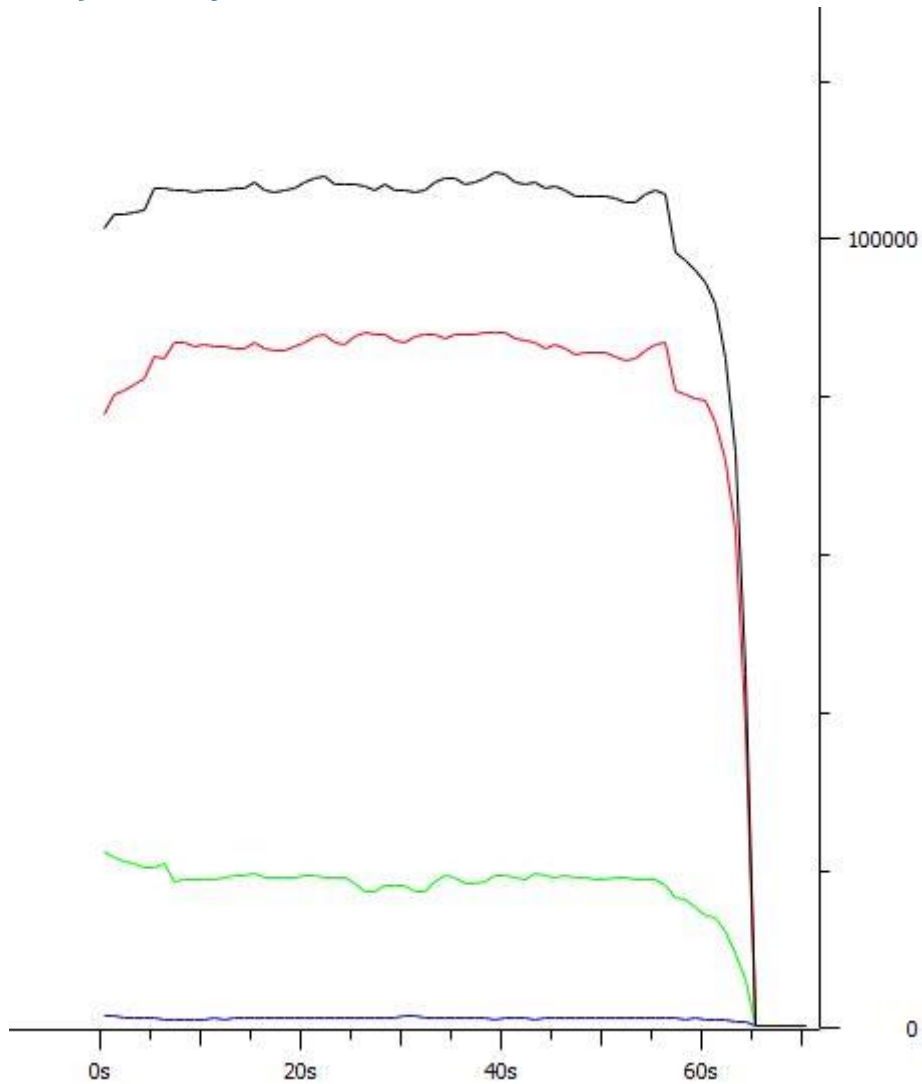
a) Súčtový tok 75%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.226000 s
Total packets	=	4820
Minimum delay	=	-148.944000 s
Maximum delay	=	-148.693000 s
Average delay	=	-148.855846 s
Average jitter	=	0.008030 s
Delay standard deviation	=	0.060813 s
Bytes received	=	654520
Average bitrate	=	86.941852 Kbit/s
Average packet rate	=	80.031880 pkt/s
Packets dropped	=	0 (0.00 %)
Average loss-burst size	=	0 pkt
Error lines	=	0

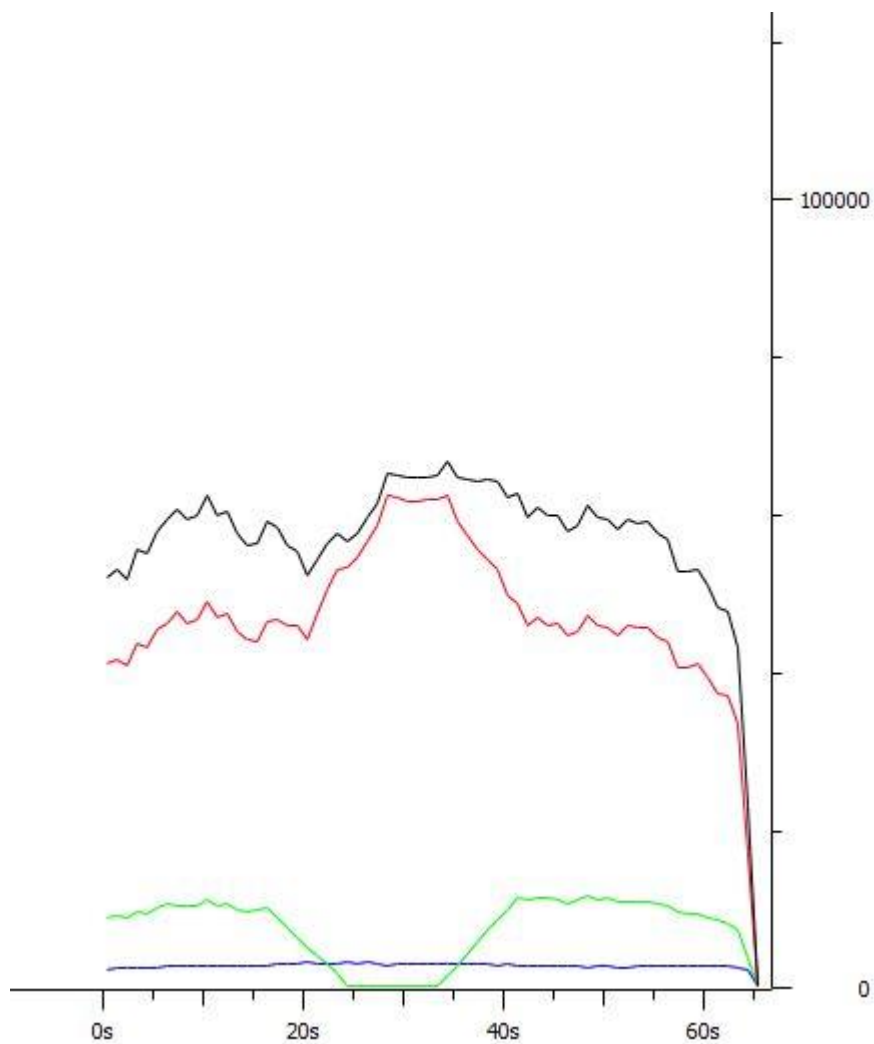
b) Súčtový tok 100%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.242000 s
Total packets	=	4121
Minimum delay	=	-148.779000 s
Maximum delay	=	-148.377000 s
Average delay	=	-148.481000 s
Average jitter	=	0.011455 s
Delay standard deviation	=	0.049588 s
Bytes received	=	671315
Average bitrate	=	89.149099 Kbit/s
Average packet rate	=	68.407423 pkt/s
Packets dropped	=	0 (0.00 %)
Average loss-burst size	=	0 pkt
Error lines	=	0

c) Súčtový tok 125%



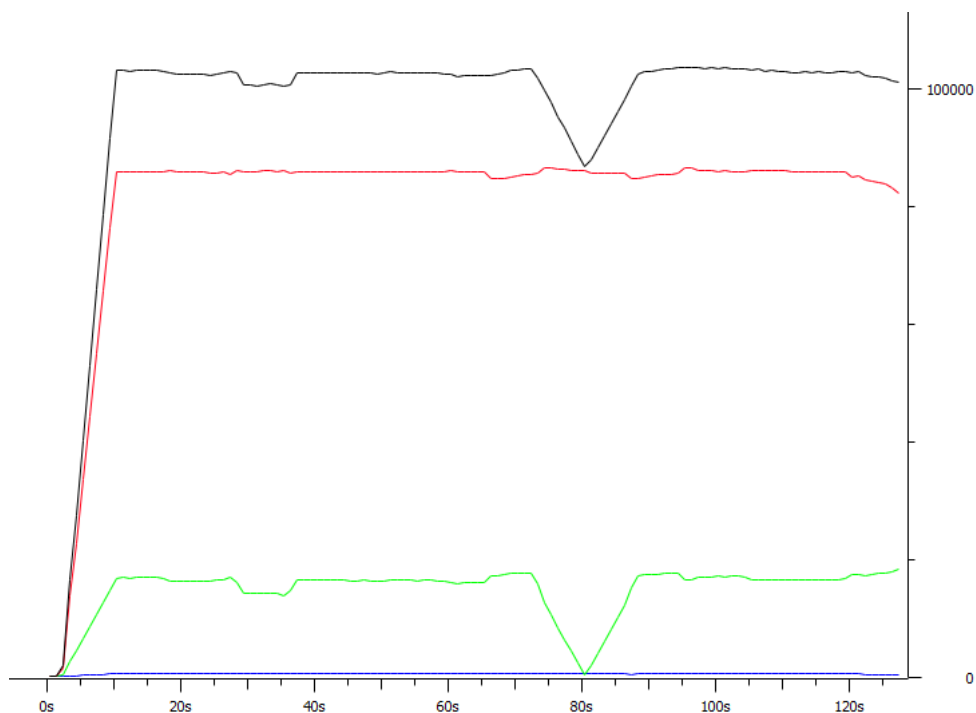
***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.242000 s
Total packets	=	4451
Minimum delay	=	-148.779000 s
Maximum delay	=	-148.377000 s
Average delay	=	-148.481000 s
Average jitter	=	0.011455 s
Delay standard deviation	=	0.049588 s
Bytes received	=	671315
Average bitrate	=	89.149099 Kbit/s
Average packet rate	=	68.407423 pkt/s
Packets dropped	=	0 (0.00 %)
Average loss-burst size	=	0 pkt
Error lines	=	0

Úloha č. 2 : Značkovanie, bez QoS pre-classify

```
▷ Frame 30: 238 bytes on wire (1904 bits), 238 bytes captured (1904 bits) on interface 0
▷ Ethernet II, Src: CiscoInc_93:83:01 (00:26:99:93:83:01), Dst: CiscoInc_97:eb:59 (ec:44:76:97:eb:59)
# Internet Protocol Version 4, Src: 192.168.12.1, Dst: 192.168.23.3
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
▷ Differentiated Services Field: 0xb8 (DSCP: EF PHB, ECN: Not-ECT)
    Total Length: 224
    Identification: 0xb2c7 (45767)
▷ Flags: 0x00
    Fragment offset: 0
    Time to live: 254
    Protocol: Generic Routing Encapsulation (47)
    Header checksum: 0x641a [validation disabled]
    [Header checksum status: Unverified]
    Source: 192.168.12.1
    Destination: 192.168.23.3
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
▷ Generic Routing Encapsulation (IP)
# Internet Protocol Version 4, Src: 172.16.10.10, Dst: 172.16.20.10
  0100 .... = Version: 4
  .... 0101 = Header Length: 20 bytes (5)
▷ Differentiated Services Field: 0xb8 (DSCP: EF PHB, ECN: Not-ECT)
    Total Length: 200
    Identification: 0x28e9 (10473)
▷ Flags: 0x02 (Don't Fragment)
    Fragment offset: 0
    Time to live: 127
    Protocol: UDP (17)
    Header checksum: 0x5b4f [validation disabled]
    [Header checksum status: Unverified]
    Source: 172.16.10.10
    Destination: 172.16.20.10
    [Source GeoIP: Unknown]
    [Destination GeoIP: Unknown]
# User Datagram Protocol, Src Port: 54310, Dst Port: 8080
```

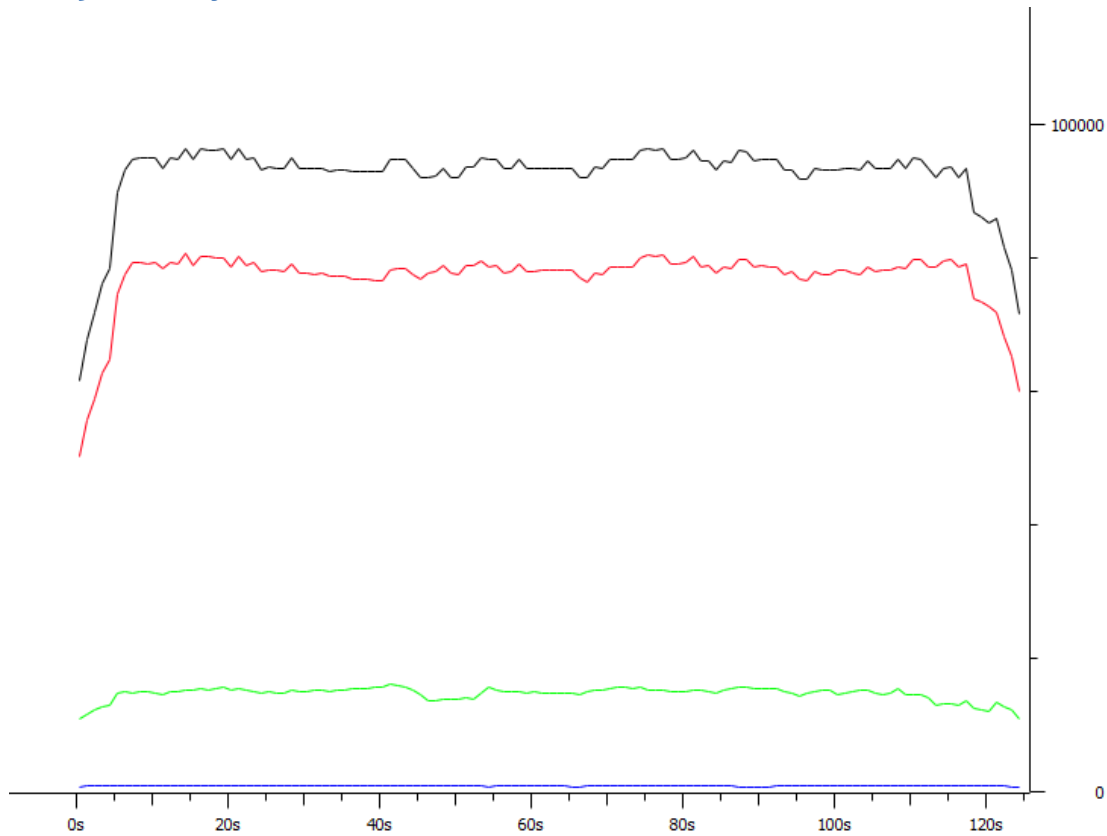
a) Súčtový tok 75%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.242000 s
Total packets	=	4236
Minimum delay	=	-148.779000 s
Maximum delay	=	-148.377000 s
Average delay	=	-148.481000 s
Average jitter	=	0.011455 s
Delay standard deviation	=	0.049588 s
Bytes received	=	671315
Average bitrate	=	88.238099 Kbit/s
Average packet rate	=	69.685423 pkt/s
Packets dropped	=	0 (0.00 %)
Average loss-burst size	=	0 pkt
Error lines	=	0

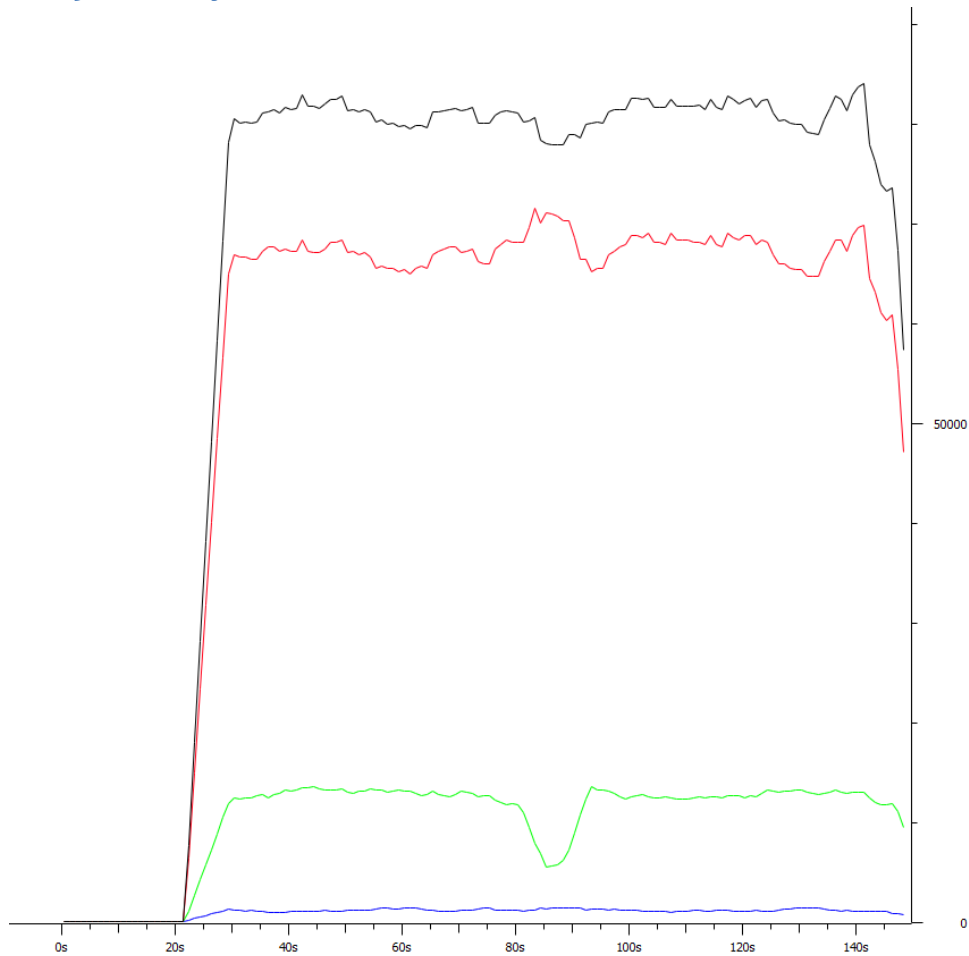
b) Súčtový tok 100%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.242000 s
Total packets	=	4626
Minimum delay	=	-148.779000 s
Maximum delay	=	-148.377000 s
Average delay	=	-148.481000 s
Average jitter	=	0.011455 s
Delay standard deviation	=	0.049588 s
Bytes received	=	671315
Average bitrate	=	87.268189 Kbit/s
Average packet rate	=	66.508323 pkt/s
Packets dropped	=	575 (12.44 %)
Average loss-burst size	=	4.641892 pkt
Error lines	=	0

c) Súčtový tok 125%

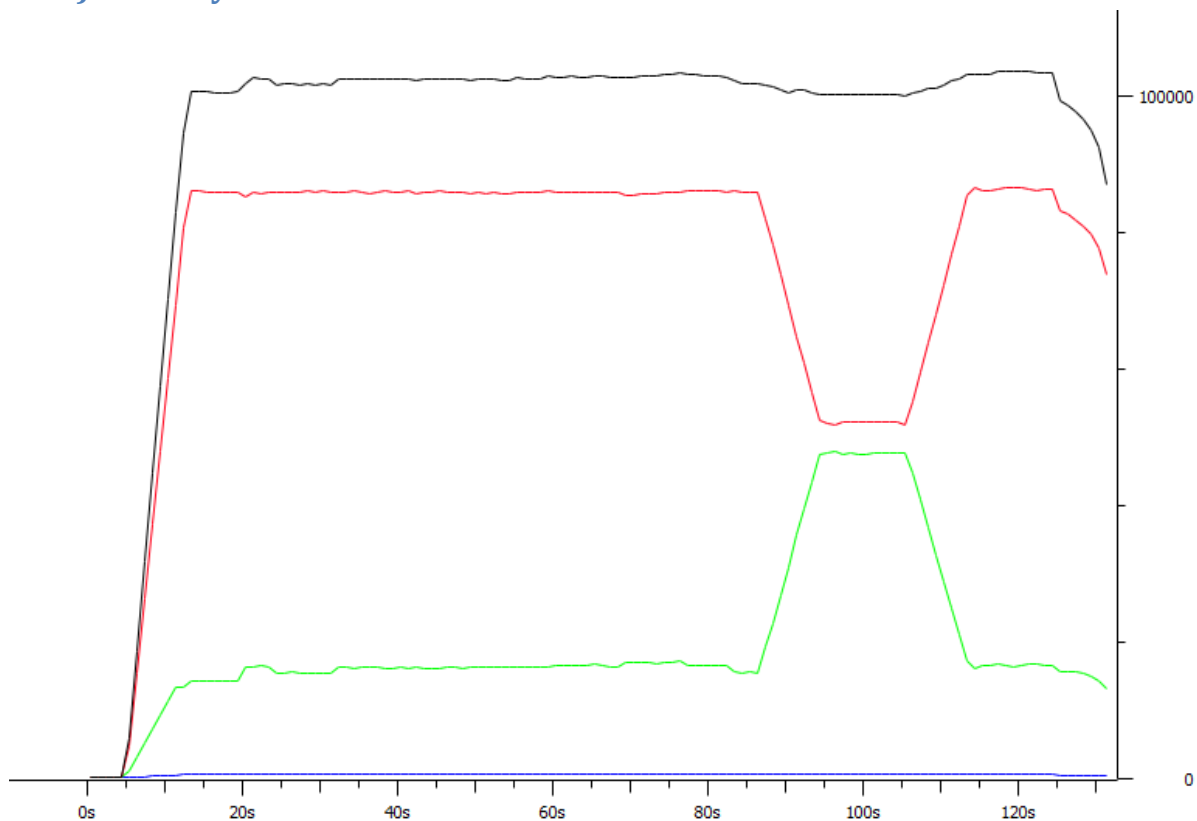


***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.226000 s
Total packets	=	4786
Minimum delay	=	-148.935000 s
Maximum delay	=	-148.685000 s
Average delay	=	-148.842846 s
Average jitter	=	0.008120 s
Delay standard deviation	=	0.059713 s
Bytes received	=	654520
Average bitrate	=	89.868852 Kbit/s
Average packet rate	=	79.128765 pkt/s
Packets dropped	=	1430 (29.88 %)
Average loss-burst size	=	3.5864212 pkt
Error lines	=	0

Úloha č. 3 : Značkovanie, QoS pre-classify

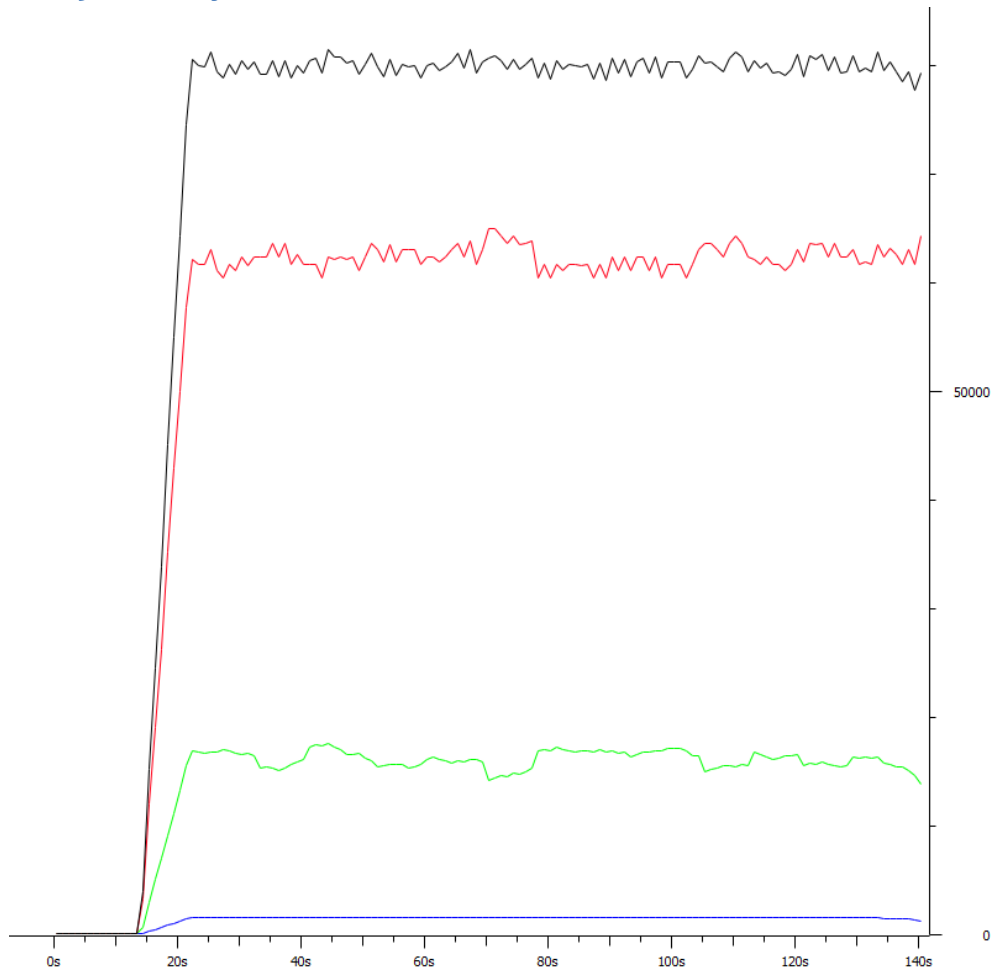
a) Súčtový tok 75%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.116000 s
Total packets	=	4250
Minimum delay	=	-148.852000 s
Maximum delay	=	-148.753000 s
Average delay	=	-148.492846 s
Average jitter	=	0.007930 s
Delay standard deviation	=	0.059813 s
Bytes received	=	654520
Average bitrate	=	86.941852 Kbit/s
Average packet rate	=	80.031880 pkt/s
Packets dropped	=	0 (0.00%)
Average loss-burst size	=	0 pkt
Error lines	=	0

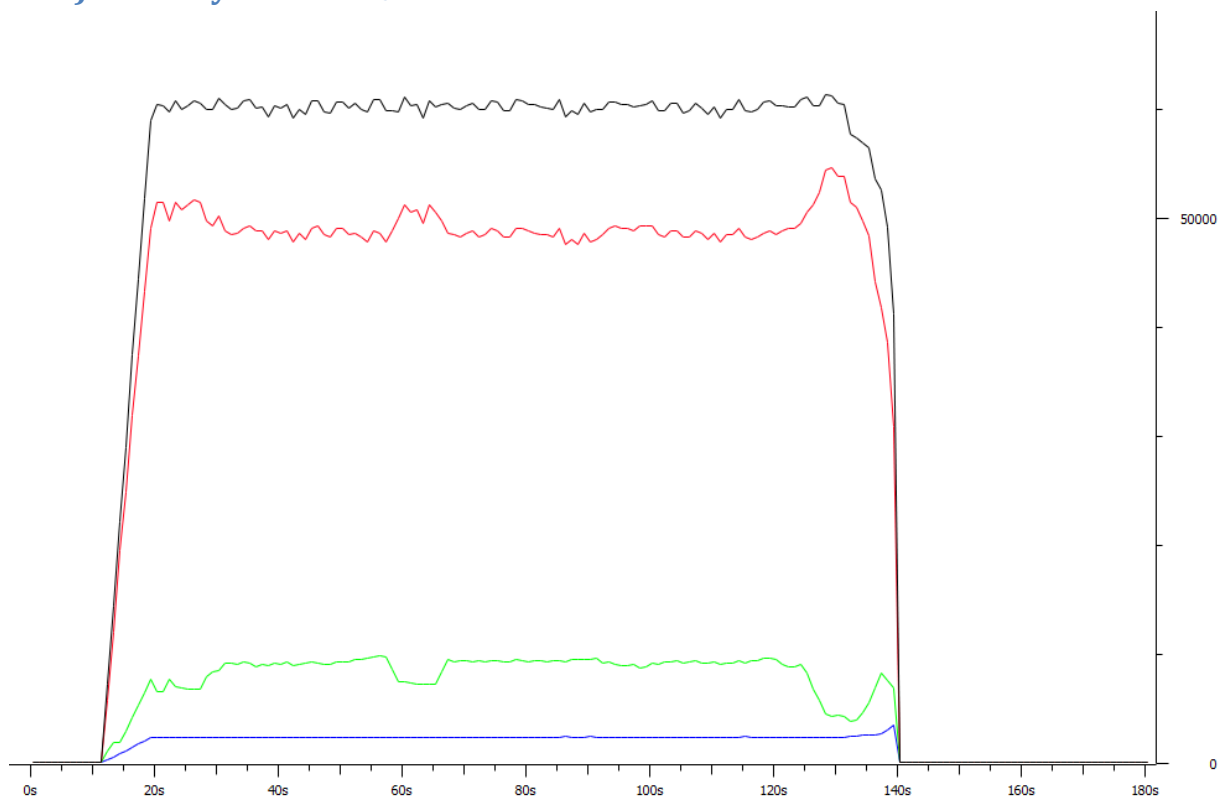
b) Súčtový tok 100%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.258000 s
Total packets	=	4750
Minimum delay	=	-148.925000 s
Maximum delay	=	-148.725000 s
Average delay	=	-148.846826 s
Average jitter	=	0.007920 s
Delay standard deviation	=	0.059813 s
Bytes received	=	654520
Average bitrate	=	85.128852 Kbit/s
Average packet rate	=	79.128880 pkt/s
Packets dropped	=	454 (9.55 %)
Average loss-burst size	=	2.964602 pkt
Error lines	=	0

c) Súčtový tok 125%



***** TOTAL RESULTS *****

Number of flows	=	3
Total time	=	60.028000 s
Total packets	=	4685
Minimum delay	=	-148.852000 s
Maximum delay	=	-148.873000 s
Average delay	=	-148.798754 s
Average jitter	=	0.007920 s
Delay standard deviation	=	0.061513 s
Bytes received	=	654520
Average bitrate	=	88.513852 Kbit/s
Average packet rate	=	78.564880 pkt/s
Packets dropped	=	1340 (28.60 %)
Average loss-burst size	=	2.845361 pkt
Error lines	=	0
