Experimenty MLP s LFI

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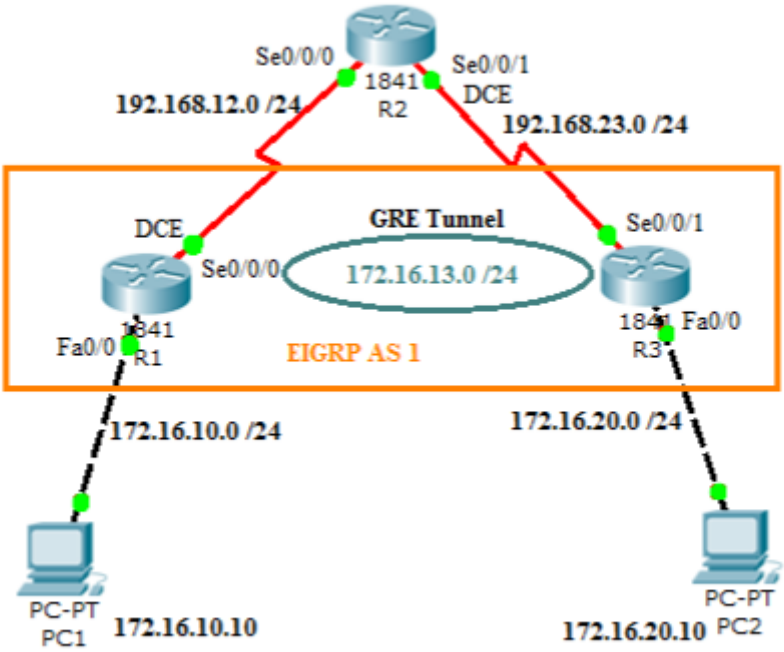
Topológia



Generované toky

Generovali sme 3 UDP toky cez D-ITG:

- hlasový tok: konštantný, intenzita 50 pak/s; veľkosti paketov: konšt., 160B telo (s hlavičkami 218B) o využite možnosť v D-ITG vybrať application – Voice s kodekom G.711 (2 samples per packet)
- dátový tok: konštantný, veľkosť paketu 1500B
    - intenzita toku 1p/s
    - Intenzita toku 3p/s
    - Intenzita toku 5p/s
- predvolený D-ITG Gaming tok: CounterStrike active

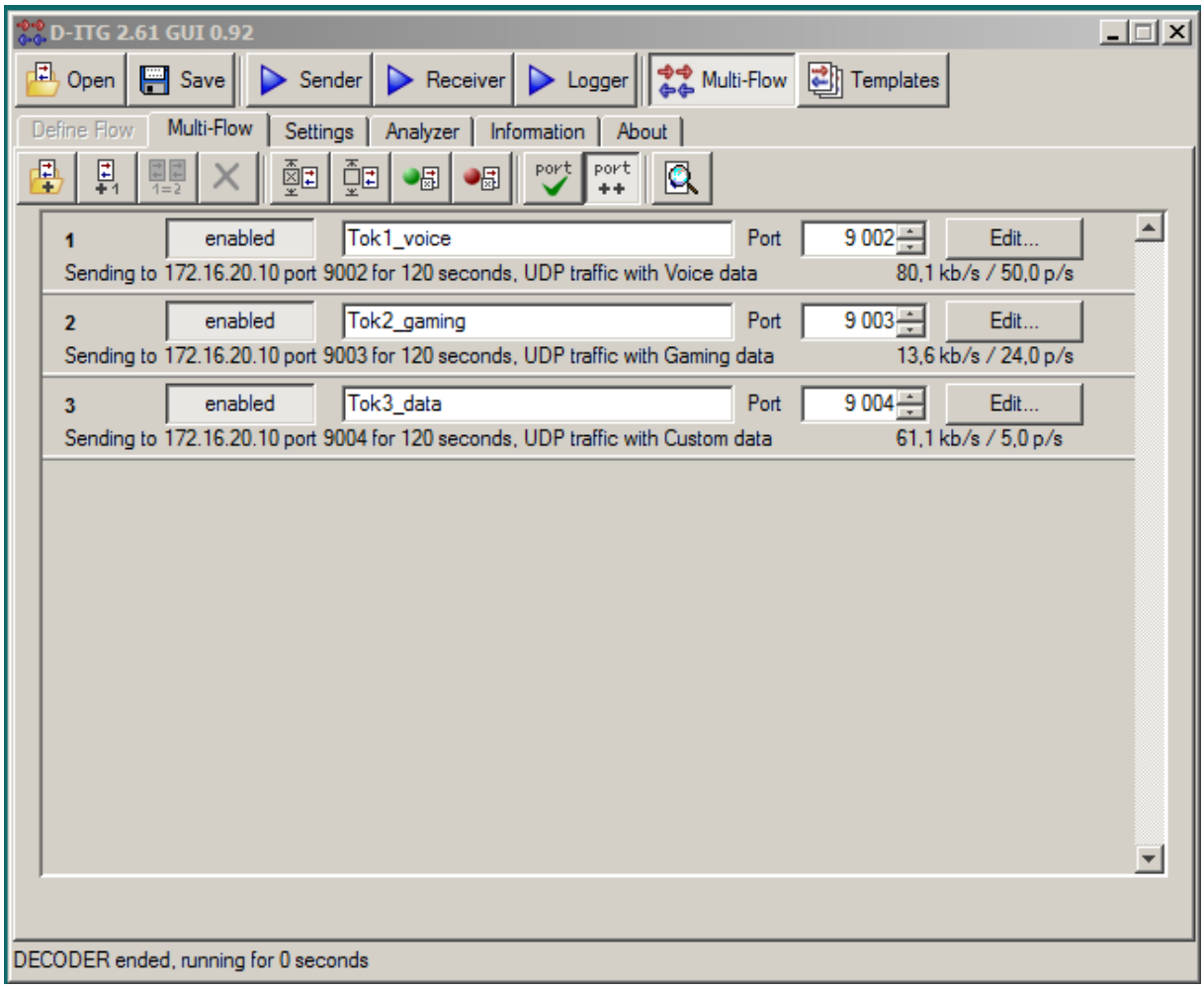
1.tok
Konštantný hlasový tok s kodekom G.711

- intenzita 50 p/s
- veľkosť paketu 200B

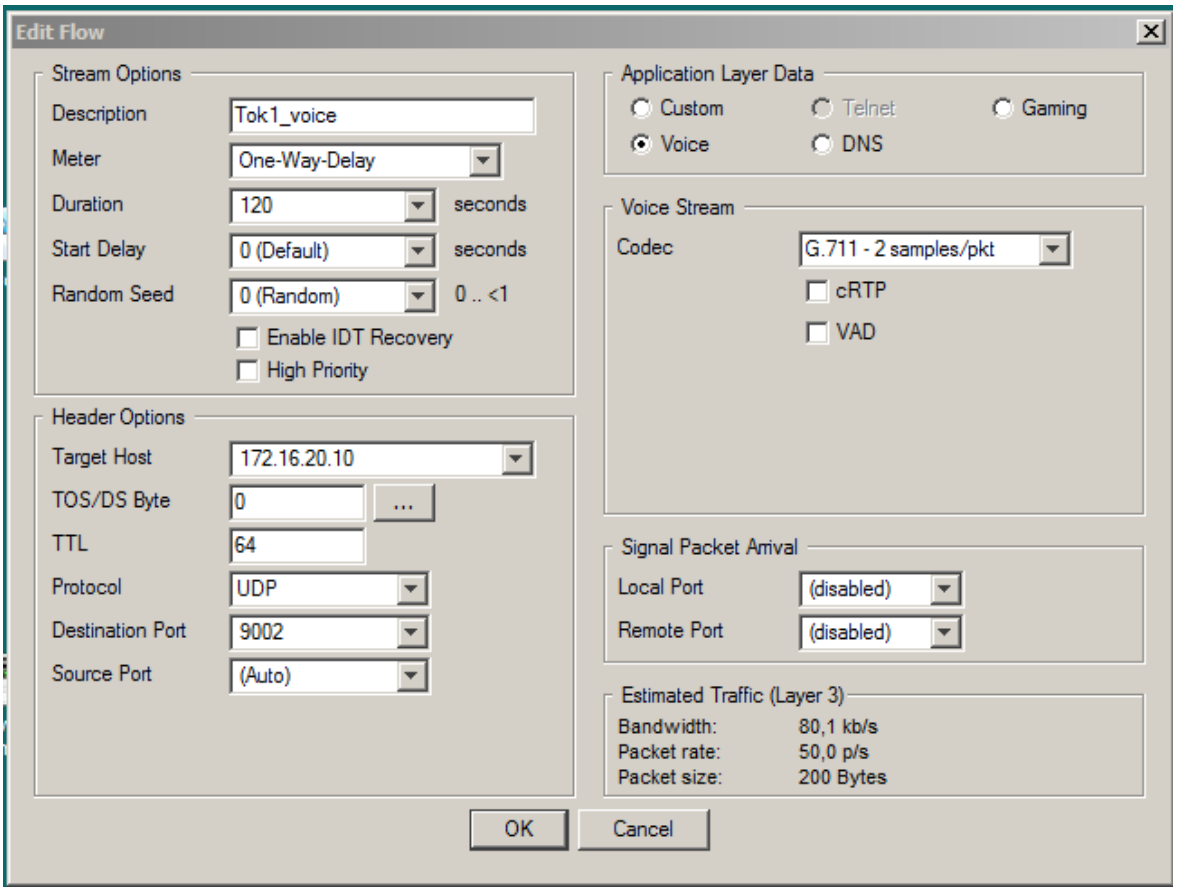
2.tok
Gaming tok

3.tok
Náhodný dátový tok

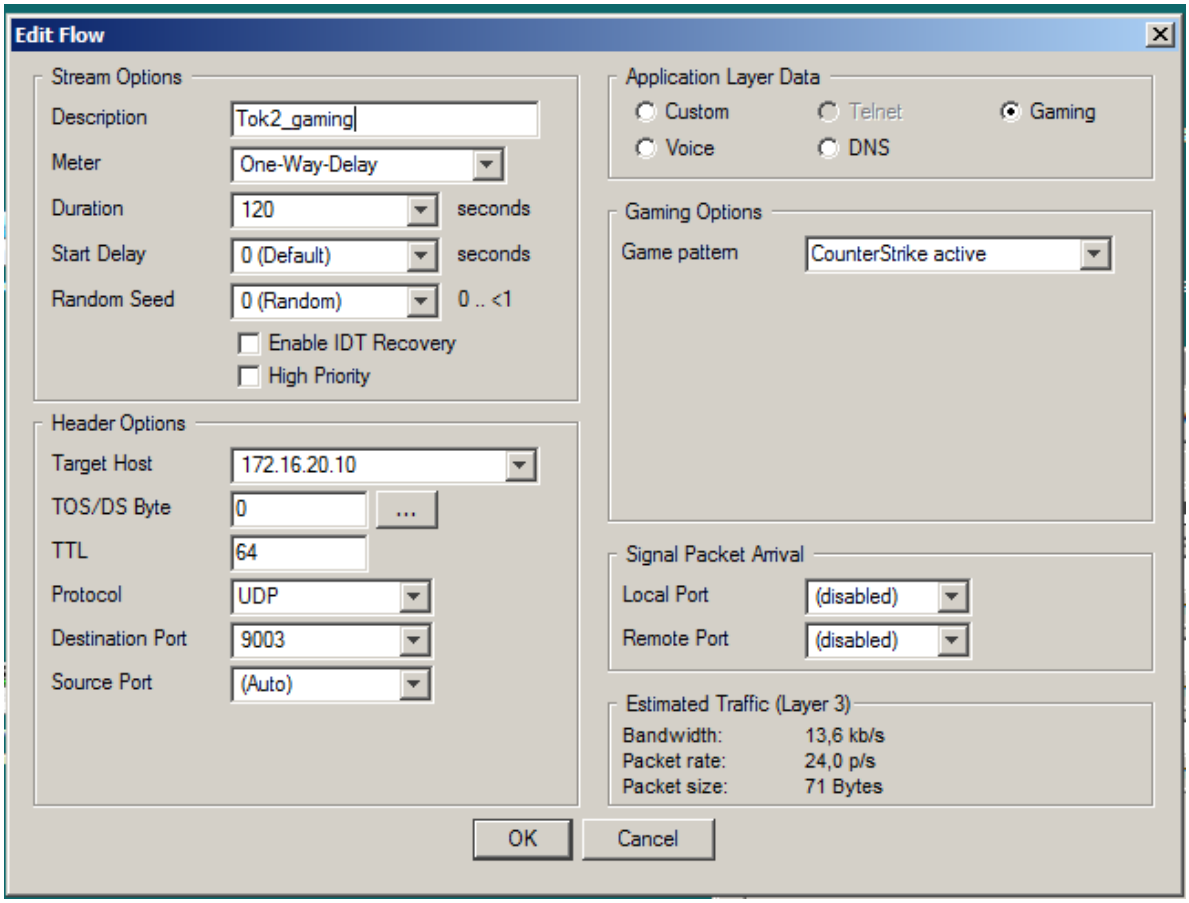
- intenzita 1 p/s, 3p/s, 5p/s
- veľkosť 1500B



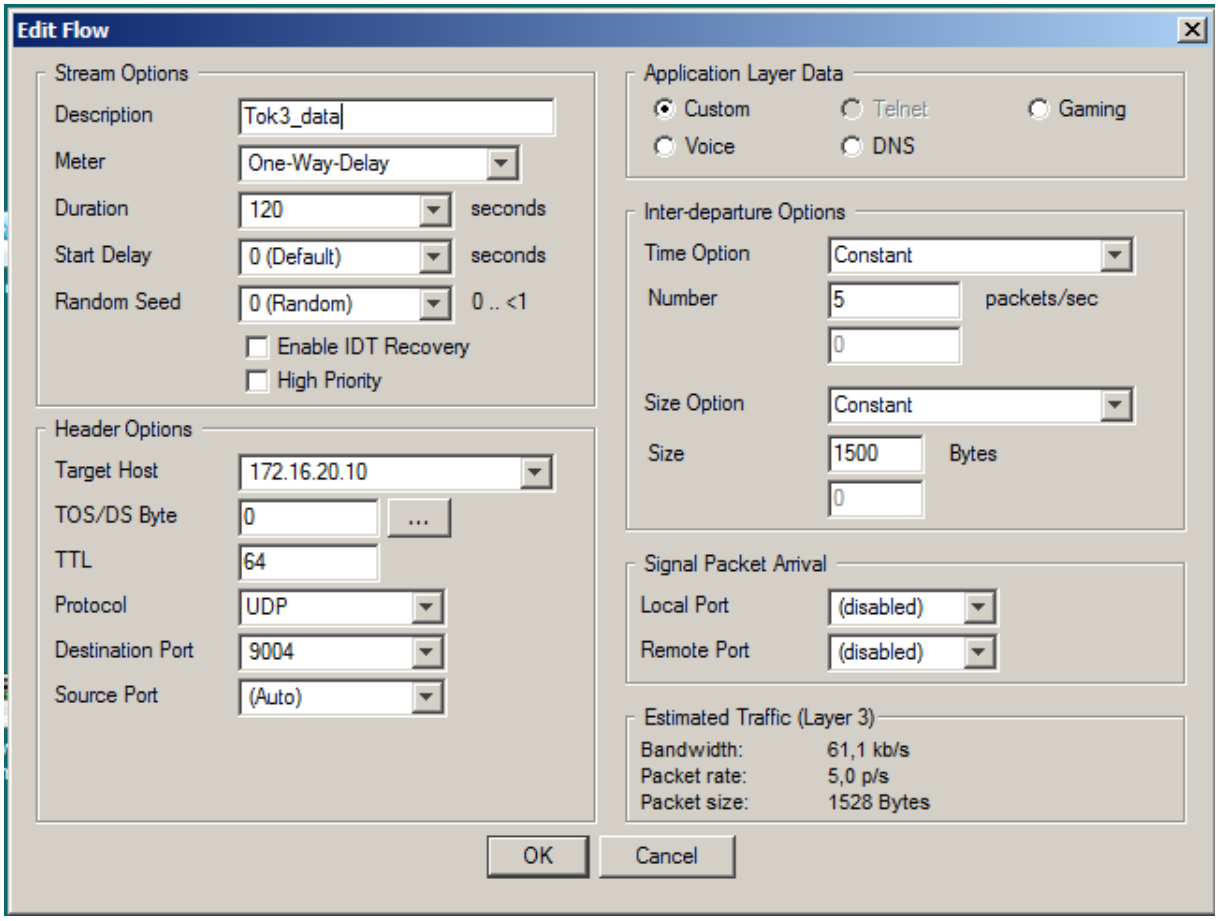
Obrázok 1 Nastavenie Multiflow



Obrázok 2 Generovanie VOICE



Obrázok 2 Generovanie Gaming



Obrázok 3 Generovanie DATA

Základná konfigurácia

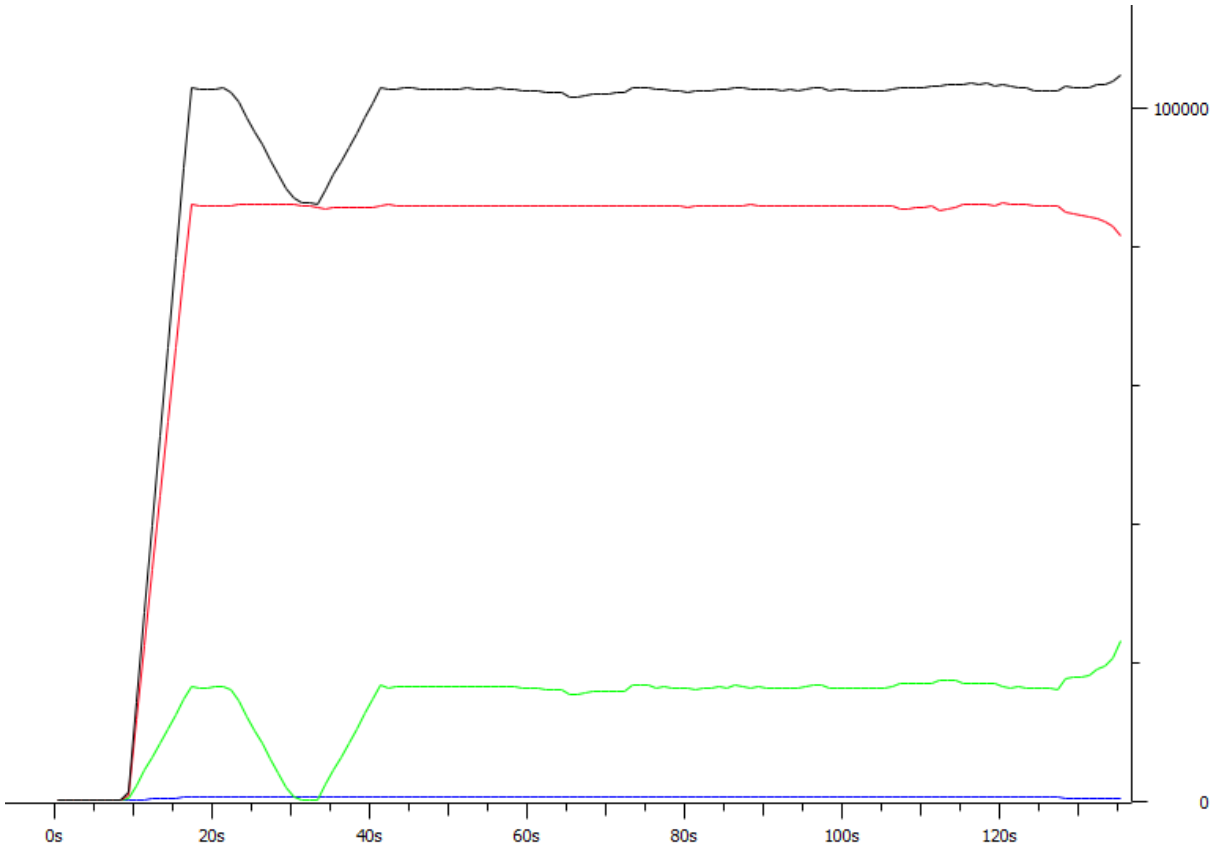
```
policy-map WFQ
 class class-default
  fair-queue

interface Tunnel0
 ip address 172.16.13.1 255.255.255.0
 tunnel source Serial0/3/0
 tunnel destination 192.168.23.3
!
interface FastEthernet0/0
 ip address 172.16.10.1 255.255.255.0
 duplex auto
 speed auto

interface Serial0/3/0
 bandwidth 128
 ip address 192.168.12.1 255.255.255.0
 clock rate 128000
 service-policy output WFQ

ip route 0.0.0.0 0.0.0.0 192.168.12.2
ip route 172.16.20.0 255.255.255.0 Tunnel0
```

Úloha 1

-bez značkovania paketov na vstupe
-bez použitia QOS preclassify

1) Scenár

- Súčtový tok je 75%, 1 dátový paket

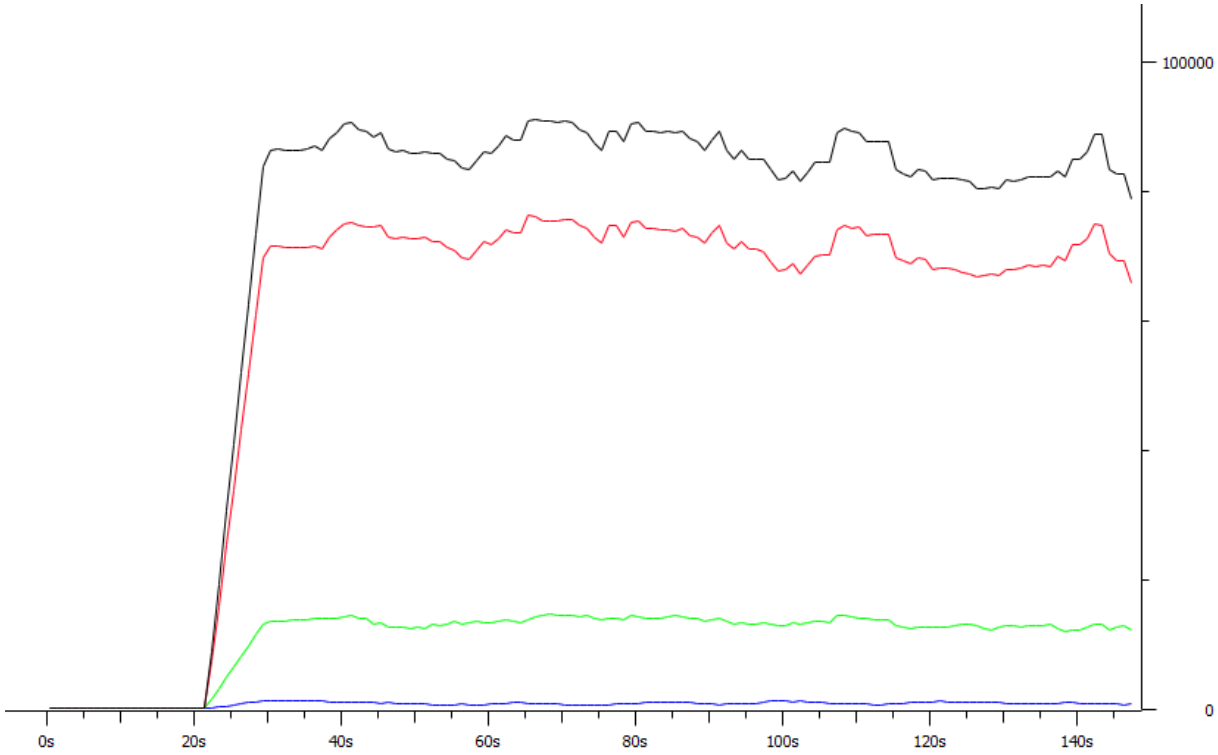


Flow number: 1 **From 172.16.10.10:60248** **To 172.16.20.10:9002** ---------- Total time = 119.981000 s Total packets = 6000 Minimum delay = -87.331000 s Maximum delay = -86.533000 s Average delay = -87.049648 s Average jitter = 0.005617 s Delay standard deviation = 0.211430 s Bytes received = 1032000 Average bitrate = 68.810895 Kbit/s Average packet rate = 50.007918 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt	**Flow number: 2** **From 172.16.10.10:60250** **To 172.16.20.10:9003** ---------- Total time = 119.856000 s Total packets = 2988 Minimum delay = -87.340000 s Maximum delay = -86.541000 s Average delay = -87.051941 s Average jitter = 0.010044 s Delay standard deviation = 0.212830 s Bytes received = 130370 Average bitrate = 8.701775 Kbit/s Average packet rate = 24.929916 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt
Flow number: 3 **From 172.16.10.10:60249**	**TOTAL RESULT** ----------

To 172.16.20.10:9004 ---------- Total time = 118.998000 s Total packets = 120 Minimum delay = -87.239000 s Maximum delay = -86.556000 s Average delay = -87.008242 s Average jitter = 0.016555 s Delay standard deviation = 0.205261 s Bytes received = 180000 Average bitrate = 12.101044 Kbit/s Average packet rate = 1.008420 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt	Number of flows = 3 Total time = 119.987000 s Total packets = 9108 Minimum delay = -87.340000 s Maximum delay = -86.533000 s Average delay = -87.049855 s Average jitter = 0.007929 s Delay standard deviation = 0.211868 s Bytes received = 1342370 Average bitrate = 89.501029 Kbit/s Average packet rate = 75.908223 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0 pkt Error lines = 0

2) Scenár

- Súčtový tok je 100%, 3 dátové pakety

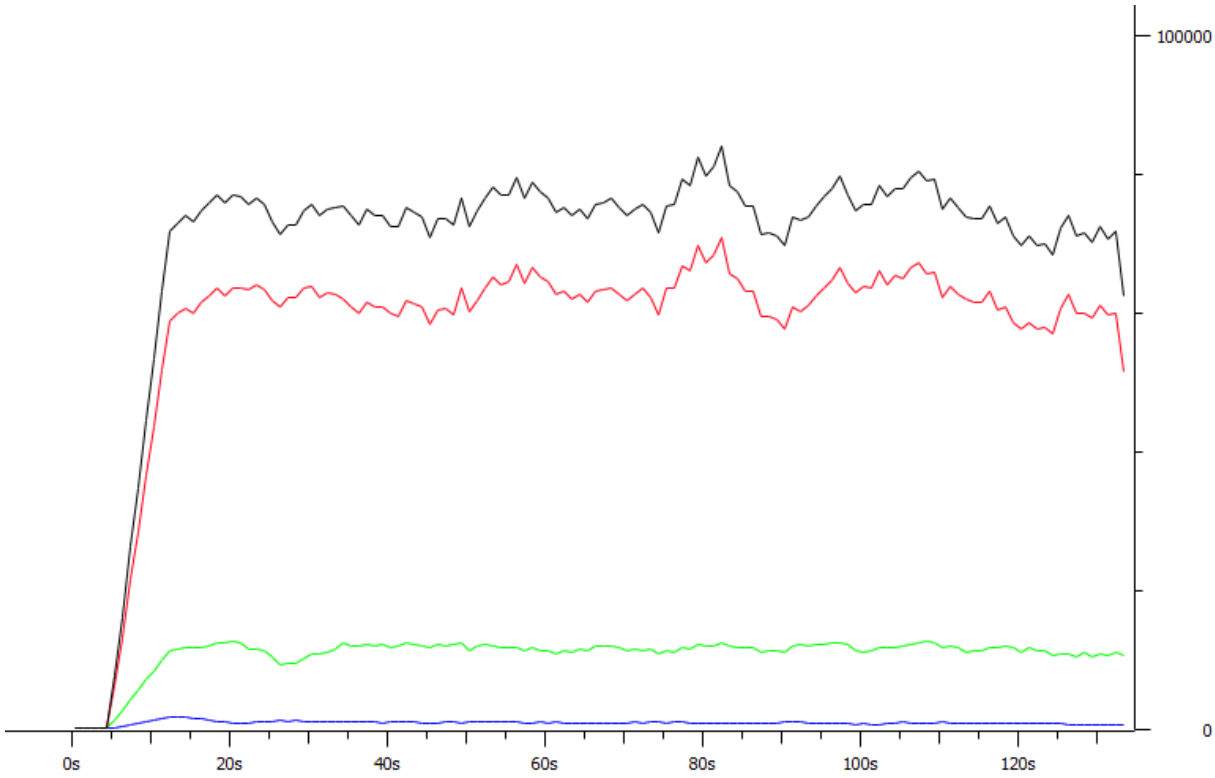


Flow number: 1 **From 172.16.10.10:60251** **To 172.16.20.10:9002** ---------- Total time = 122.274000 s Total packets = 5126 Minimum delay = -87.241000 s Maximum delay = -84.655000 s Average delay = -85.006671 s	**Flow number: 2** **From 172.16.10.10:60253** **To 172.16.20.10:9003** ---------- Total time = 122.128000 s Total packets = 2395 Minimum delay = -87.168000 s Maximum delay = -84.651000 s Average delay = -85.013266 s

Average jitter = 0.011376 s Delay standard deviation = 0.434702 s Bytes received = 881672 Average bitrate = 57.685003 Kbit/s Average packet rate = 41.922240 pkt/s Packets dropped = 874 (14.57 %) Average loss-burst size = 2.601190 pkt	Average jitter = 0.021820 s Delay standard deviation = 0.436891 s Bytes received = 104085 Average bitrate = 6.818092 Kbit/s Average packet rate = 19.610573 pkt/s Packets dropped = 432 (15.28 %) Average loss-burst size = 1.435216 pkt
Flow number: 3 **From 172.16.10.10:60252** **To 172.16.20.10:9004** --- Total time = 121.546000 s Total packets = 220 Minimum delay = -87.139000 s Maximum delay = -84.656000 s Average delay = -85.009864 s Average jitter = 0.038009 s Delay standard deviation = 0.512833 s Bytes received = 330000 Average bitrate = 21.720172 Kbit/s Average packet rate = 1.810014 pkt/s Packets dropped = 139 (38.72 %) Average loss-burst size = 2.074627 pkt	**TOTAL RESULT** --- Number of flows = 3 Total time = 122.274000 s Total packets = 7741 Minimum delay = -87.241000 s Maximum delay = -84.651000 s Average delay = -85.008802 s Average jitter = 0.016538 s Delay standard deviation = 0.437800 s Bytes received = 1315757 Average bitrate = 86.085807 Kbit/s Average packet rate = 63.308635 pkt/s Packets dropped = 1445 (15.73 %) Average loss-burst size = 2.052557 pkt Error lines = 0

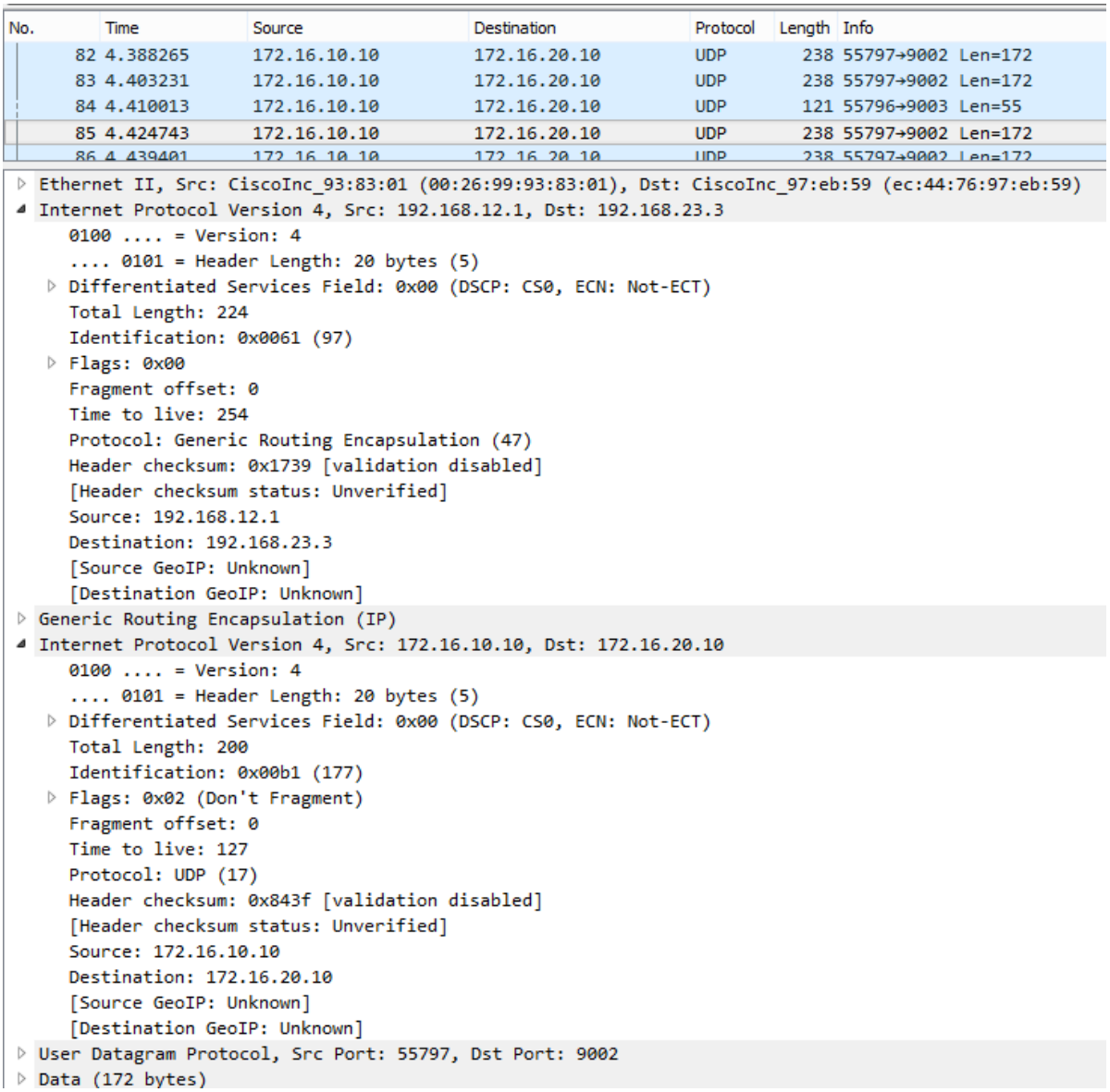
3) Scenár

- Súčtový tok je 120%, 5 dátových paketov



Flow number: 1 **From 172.16.10.10:63326** **To 172.16.20.10:9002** ---------- Total time = 122.225000 s Total packets = 4467 Minimum delay = -87.073000 s Maximum delay = -84.184000 s Average delay = -84.598326 s Average jitter = 0.015587 s Delay standard deviation = 0.380022 s Bytes received = 768324 Average bitrate = 50.289155 Kbit/s Average packet rate = 36.547351 pkt/s Packets dropped = 1531 (25.53 %) Average loss-burst size = 2.538972 pkt	**Flow number: 2** **From 172.16.10.10:63328** **To 172.16.20.10:9003** ---------- Total time = 122.099000 s Total packets = 2073 Minimum delay = -86.990000 s Maximum delay = -84.186000 s Average delay = -84.606478 s Average jitter = 0.027836 s Delay standard deviation = 0.382307 s Bytes received = 90219 Average bitrate = 5.911203 Kbit/s Average packet rate = 16.978026 pkt/s Packets dropped = 1145 (35.58 %) Average loss-burst size = 2.405462 pkt
Flow number: 3 **From 172.16.10.10:63327** **To 172.16.20.10:9004** ---------- Total time = 122.006000 s Total packets = 229 Minimum delay = -86.975000 s Maximum delay = -84.238000 s Average delay = -84.636651 s	**TOTAL RESULT** ---------- Number of flows = 3 Total time = 122.231000 s Total packets = 6769 Minimum delay = -87.073000 s Maximum delay = -84.184000 s Average delay = -84.602119 s Average jitter = 0.022458 s

Average jitter = 0.062329 s Delay standard deviation = 0.515925 s Bytes received = 343500 Average bitrate = 22.523482 Kbit/s Average packet rate = 1.876957 pkt/s Packets dropped = 371 (61.83 %) Average loss-burst size = 3.016260 pkt	Delay standard deviation = 0.386168 s Bytes received = 1202043 Average bitrate = 78.673528 Kbit/s Average packet rate = 55.378750 pkt/s Packets dropped = 3047 (31.04 %) Average loss-burst size = 2.534942 pkt Error lines = 0



Úloha 2

-značkovanie paketov na vstupe
-bez použitia qos preclassify

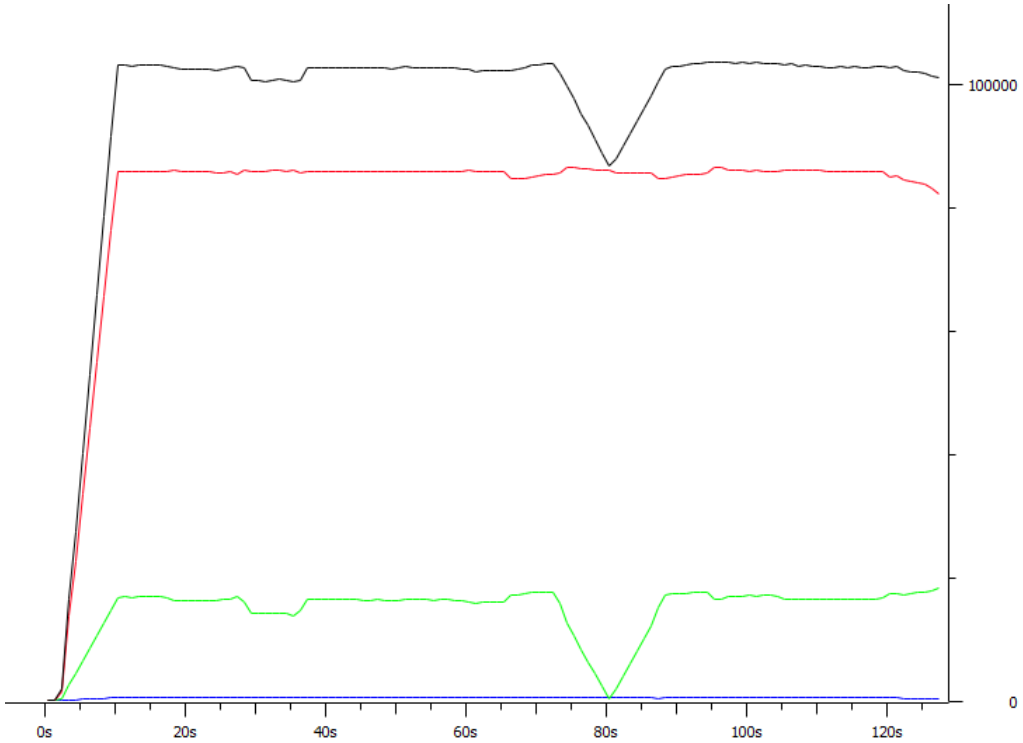
Konfigurácia:

```
access-list 102 permit udp any any eq 9002
access-list 103 permit udp any any eq 9003
access-list 104 permit udp any any eq 9004
```

```
class-map match-all znackuj2
 match access-group 103
class-map match-all znackuj3
 match access-group 104
class-map match-all znackuj1
 match access-group 102
!
policy-map znackujP
 class znackuj1
  set dscp ef
 class znackuj2
  set dscp af11
 class znackuj3
  set dscp default
 interface FastEthernet0/0
 ip address 172.16.10.1 255.255.255.0
 duplex auto
 speed auto
 service-policy input znackujP
```

1) Scenár

- Súčtový tok je 75%, 1 dátový paket

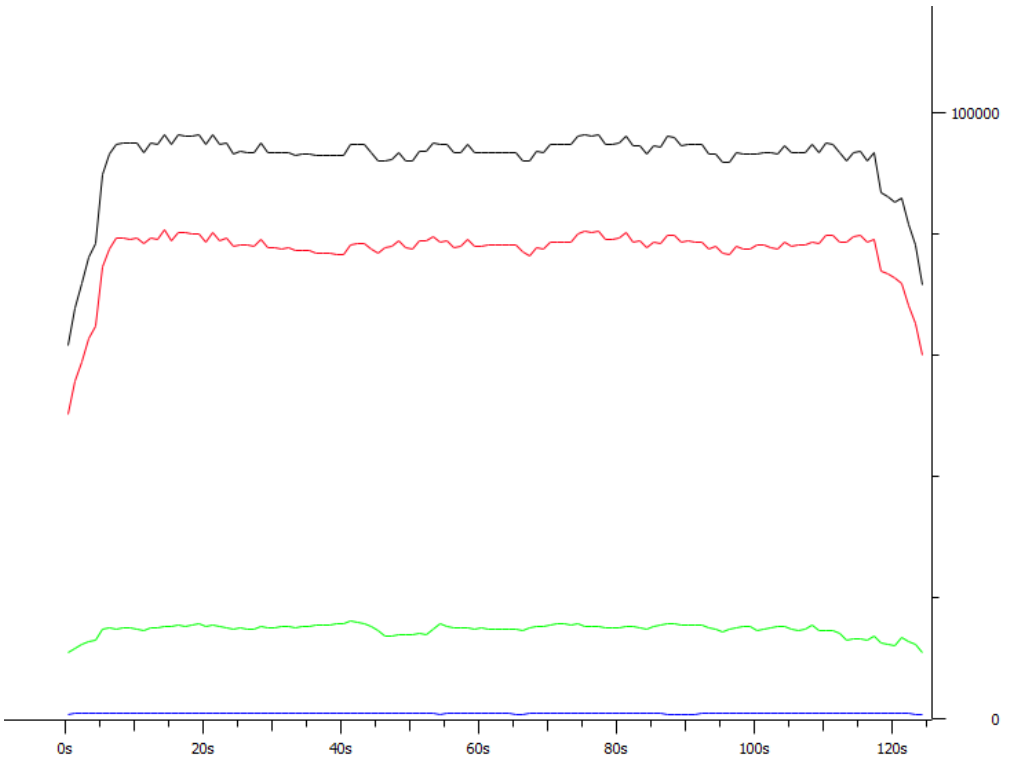


Flow number: 1 **From 172.16.10.10:54210** **To 172.16.20.10:9002** ---------- Total time = 120.030000 s Total packets = 5998	**Flow number: 2** **From 172.16.10.10:54211** **To 172.16.20.10:9003** ---------- Total time = 120.029000 s Total packets = 2707

Minimum delay = 7.353000 s Maximum delay = 7.536000 s Average delay = 7.409242 s Average jitter = 0.005289 s Delay standard deviation = 0.037676 s Bytes received = 1031656 Average bitrate = 68.759877 Kbit/s Average packet rate = 49.970841 pkt/s Packets dropped = 2 (0.03 %) Average loss-burst size = 2.000000 pkt	Minimum delay = 7.341000 s Maximum delay = 7.537000 s Average delay = 7.406230 s Average jitter = 0.009964 s Delay standard deviation = 0.037221 s Bytes received = 117595 Average bitrate = 7.837773 Kbit/s Average packet rate = 22.552883 pkt/s Packets dropped = 16 (0.59 %) Average loss-burst size = 16.000000 pkt
Flow number: 3 **From 172.16.10.10:54212** **To 172.16.20.10:9004** ---------- Total time = 119.046000 s Total packets = 120 Minimum delay = 7.441000 s Maximum delay = 7.525000 s Average delay = 7.453117 s Average jitter = 0.006630 s Delay standard deviation = 0.017417 s Bytes received = 180000 Average bitrate = 12.096165 Kbit/s Average packet rate = 1.008014 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt	**TOTAL RESULT** Number of flows = 3 Total time = 120.046000 s Total packets = 8825 Minimum delay = 7.341000 s Maximum delay = 7.537000 s Average delay = 7.408915 s Average jitter = 0.007105 s Delay standard deviation = 0.037719 s Bytes received = 1329251 Average bitrate = 88.582777 Kbit/s Average packet rate = 73.513486 pkt/s Packets dropped = 18 (0.20 %) Average loss-burst size = 9.000000 pkt Error lines = 0

2) Scenár

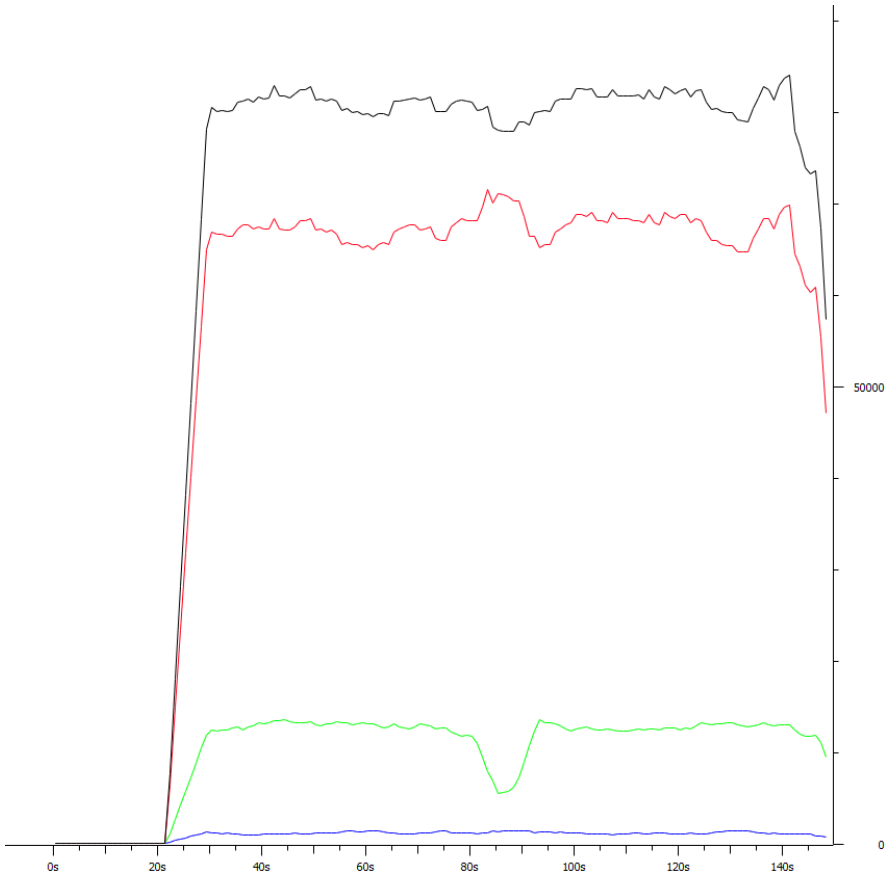
- Súčtový tok je 100%, 3 dátové pakety



Flow number: 1 **From 172.16.10.10:53955** **To 172.16.20.10:9002** ---------- Total time = 120.165000 s Total packets = 5490 Minimum delay = -87.563000 s Maximum delay = -87.232000 s Average delay = -87.339926 s Average jitter = 0.008245 s Delay standard deviation = 0.042007 s Bytes received = 944280 Average bitrate = 62.865560 Kbit/s Average packet rate = 45.687180 pkt/s Packets dropped = 510 (8.50 %) Average loss-burst size = 2.040000 pkt	**Flow number: 2** **From 172.16.10.10:53953** **To 172.16.20.10:9003** ---------- Total time = 120.249000 s Total packets = 2600 Minimum delay = -87.644000 s Maximum delay = -87.257000 s Average delay = -87.343368 s Average jitter = 0.015275 s Delay standard deviation = 0.043508 s Bytes received = 113175 Average bitrate = 7.529377 Kbit/s Average packet rate = 21.621801 pkt/s Packets dropped = 341 (11.59 %) Average loss-burst size = 1.631579 pkt
Flow number: 3 **From 172.16.10.10:53954** **To 172.16.20.10:9004** ---------- Total time = 119.900000 s Total packets = 180 Minimum delay = -87.542000 s Maximum delay = -87.244000 s Average delay = -87.297439 s Average jitter = 0.022441 s Delay standard deviation = 0.029091 s Bytes received = 270000 Average bitrate = 18.015013 Kbit/s Average packet rate = 1.501251 pkt/s Packets dropped = 180 (50.00 %) Average loss-burst size = 1.285714 pkt	**TOTAL RESULT** Number of flows = 3 Total time = 120.292000 s Total packets = 8270 Minimum delay = -87.644000 s Maximum delay = -87.232000 s Average delay = -87.340084 s Average jitter = 0.011264 s Delay standard deviation = 0.042754 s Bytes received = 1327455 Average bitrate = 88.282180 Kbit/s Average packet rate = 68.749377 pkt/s Packets dropped = 1031 (11.08 %) Average loss-burst size = 1.721202 pkt Error lines = 0

3) Scenár

- Súčtový tok je 120%, 5 dátových paketov



Flow number: 1
From 172.16.10.10:53957
To 172.16.20.10:9002

Total time = 120.211000 s
Total packets = 4734
Minimum delay = -87.000000 s
Maximum delay = -86.600000 s
Average delay = -86.728033 s
Average jitter = 0.015219 s
Delay standard deviation = 0.056572 s
Bytes received = 814248
Average bitrate = 54.187920 Kbit/s
Average packet rate = 39.380756 pkt/s
Packets dropped = 1266 (21.10 %)
Average loss-burst size = 2.567951 pkt

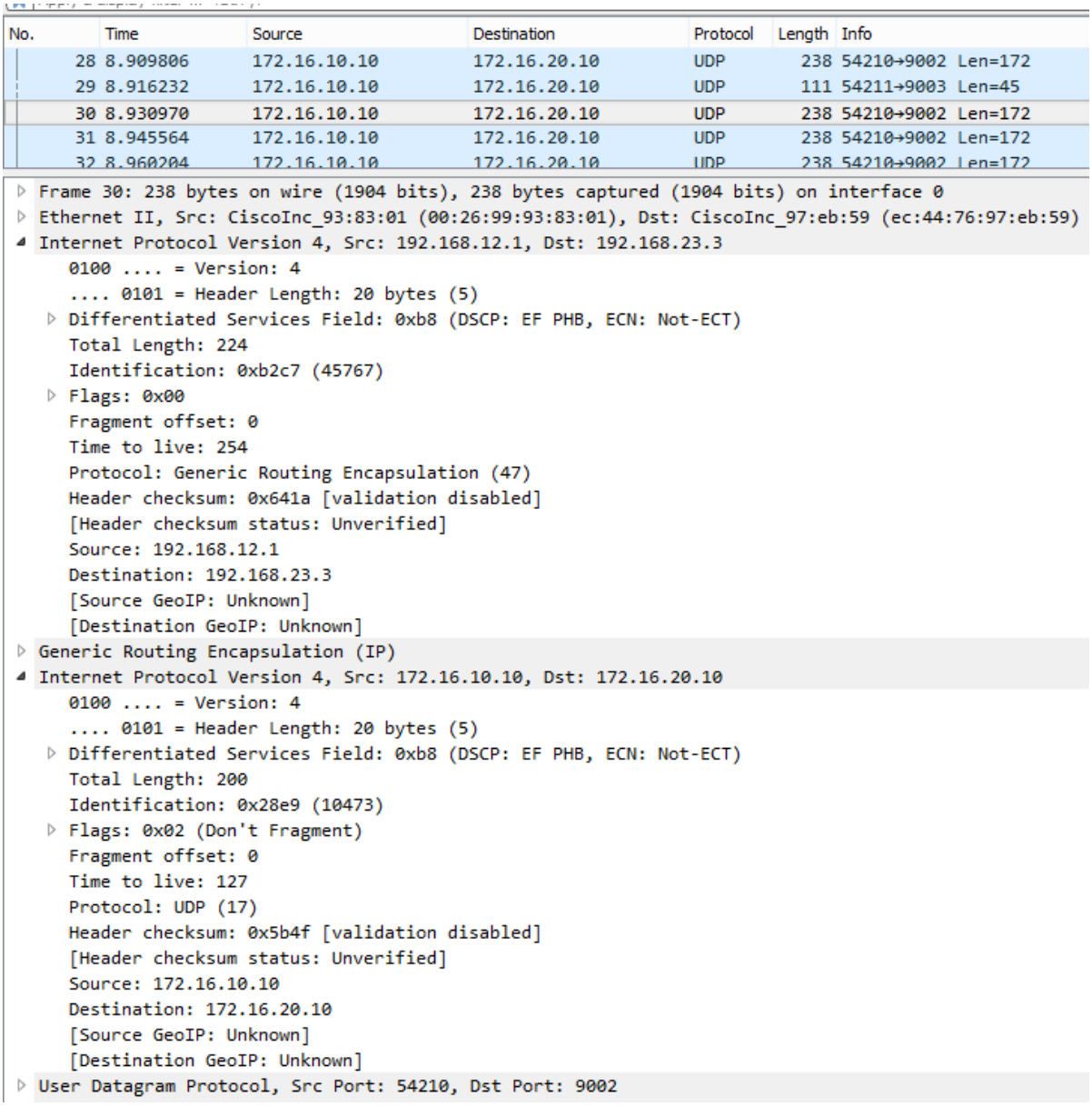
Flow number: 2
From 172.16.10.10:53958
To 172.16.20.10:9003

Total time = 120.154000 s
Total packets = 2169
Minimum delay = -87.004000 s
Maximum delay = -86.611000 s
Average delay = -86.735360 s
Average jitter = 0.029835 s
Delay standard deviation = 0.055801 s
Bytes received = 94390
Average bitrate = 6.284601 Kbit/s
Average packet rate = 18.051833 pkt/s
Packets dropped = 712 (24.71 %)
Average loss-burst size = 1.687204 pkt

Flow number: 3
From 172.16.10.10:53956
To 172.16.20.10:9004

Total time = 120.141000 s
Total packets = 292
Minimum delay = -86.975000 s
Maximum delay = -86.592000 s
Average delay = -86.673151 s

Average jitter = 0.061055 s Delay standard deviation = 0.046817 s Bytes received = 438000 Average bitrate = 29.165730 Kbit/s Average packet rate = 2.430478 pkt/s Packets dropped = 308 (51.33 %) Average loss-burst size = 2.281481 pkt



Úloha 3

-bez značkovania paketov na vstupe

- značkovanie sa do gre tunela prenáša, nemusíme teda značkovať

-s použitím qos preclassify

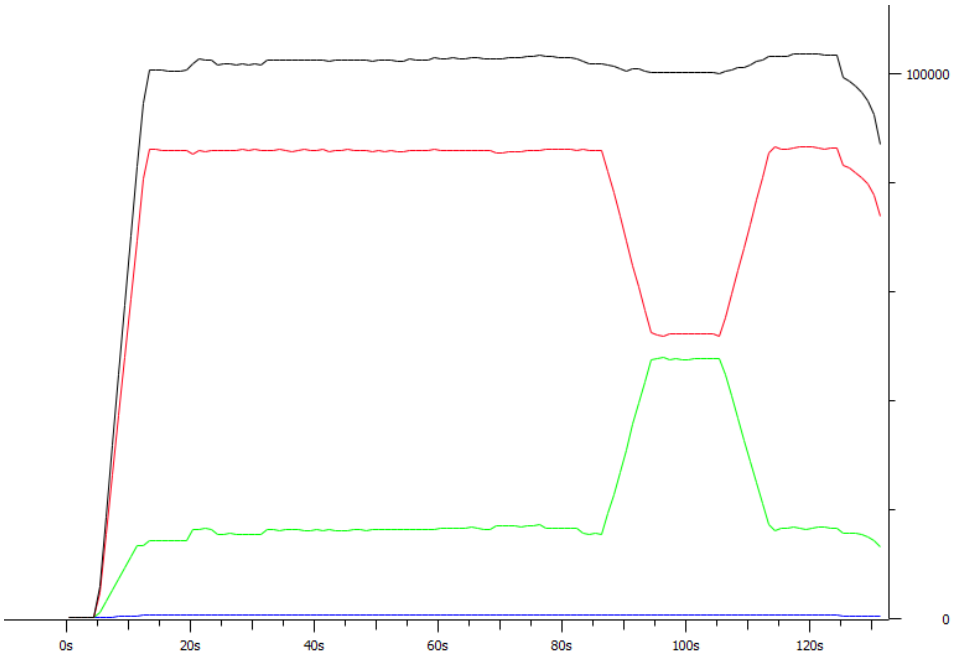
Konfigurácia:

```
interface Tunnel0
 ip address 172.16.13.1 255.255.255.0
```

```
 qos pre-classify
 tunnel source Serial0/3/0
 tunnel destination 192.168.23.3

interface FastEthernet0/0
 ip address 172.16.10.1 255.255.255.0
 duplex auto
 speed auto
```

1) Scenár

- Súčtový tok je 75%, 1 dátový paket

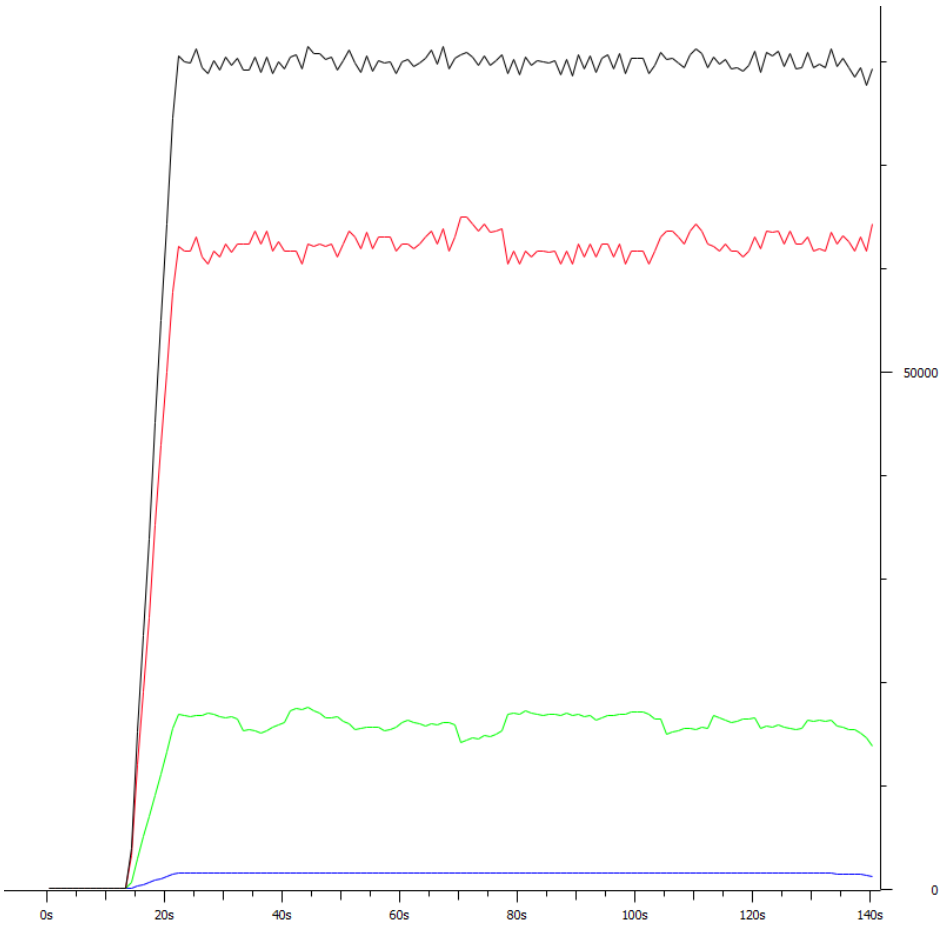


Flow number: 1 **From 172.16.10.10:51245** **To 172.16.20.10:9002** ---------- Total time = 120.055000 s Total packets = 5635 Minimum delay = -86.164000 s Maximum delay = -85.351000 s Average delay = -86.012566 s Average jitter = 0.008965 s Delay standard deviation = 0.194274 s Bytes received = 969220 Average bitrate = 64.585065 Kbit/s Average packet rate = 46.936821 pkt/s Packets dropped = 362 (6.04 %) Average loss-burst size = 2.350649 pkt	**Flow number: 2** **From 172.16.10.10:51246** **To 172.16.20.10:9003** ---------- Total time = 120.047000 s Total packets = 3705 Minimum delay = -86.175000 s Maximum delay = -85.603000 s Average delay = -85.997164 s Average jitter = 0.021607 s Delay standard deviation = 0.163620 s Bytes received = 160675 Average bitrate = 10.707473 Kbit/s Average packet rate = 30.862912 pkt/s Packets dropped = 170200 (97.87 %) Average loss-burst size = 721.186441 pkt
Flow number: 3 **From 172.16.10.10:51247** **To 172.16.20.10:9004** ---------- Total time = 119.067000 s Total packets = 120 Minimum delay = -86.071000 s Maximum delay = -85.709000 s Average delay = -86.001458 s Average jitter = 0.031908 s Delay standard deviation = 0.100780 s Bytes received = 180000	

Average bitrate = 12.094031 Kbit/s Average packet rate = 1.007836 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt

2) Scenár

- Súčtový tok je 100%, 3 dátové pakety

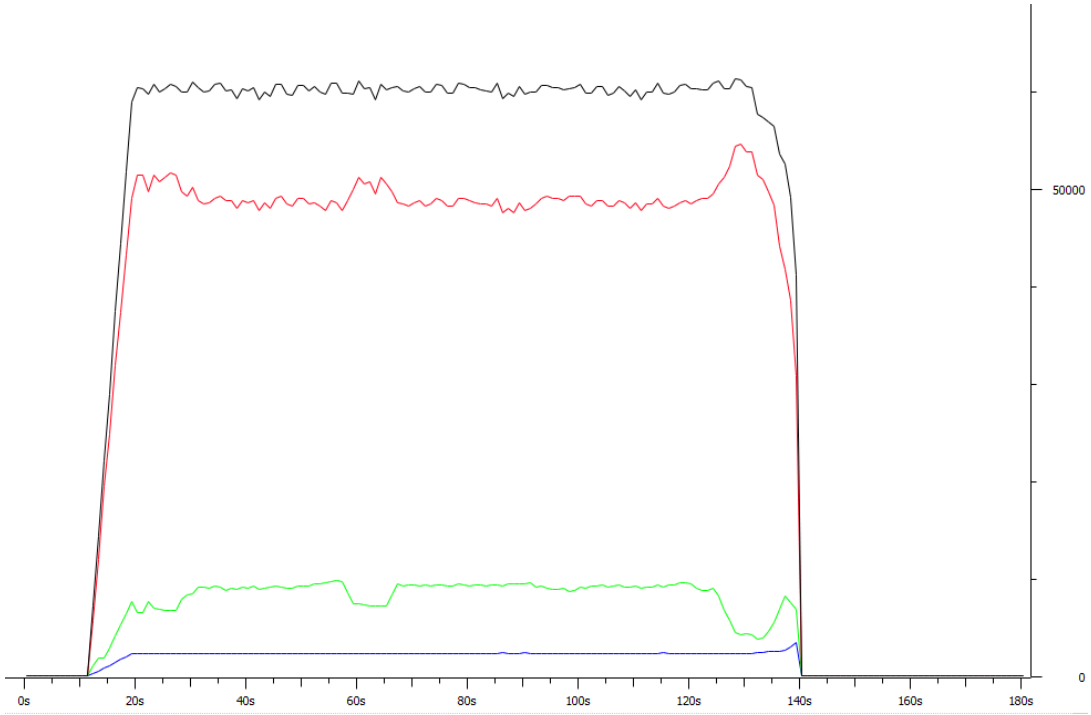


Flow number: 1 **From 172.16.10.10:63717** **To 172.16.20.10:9002** ---------- Total time = 120.137000 s Total packets = 4370 Minimum delay = -86.990000 s Maximum delay = -86.255000 s Average delay = -86.460573 s Average jitter = 0.022796 s Delay standard deviation = 0.070837 s Bytes received = 751640 Average bitrate = 50.052190 Kbit/s	**Flow number: 2** **From 172.16.10.10:63719** **To 172.16.20.10:9003** ---------- Total time = 120.016000 s Total packets = 2837 Minimum delay = -86.974000 s Maximum delay = -86.727000 s Average delay = -86.886344 s Average jitter = 0.041694 s Delay standard deviation = 0.050148 s Bytes received = 123410 Average bitrate = 8.226237 Kbit/s

Average packet rate = 36.375138 pkt/s Packets dropped = 1611 (26.94 %) Average loss-burst size = 3.420382 pkt	Average packet rate = 23.638515 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt
Flow number: 3 **From 172.16.10.10:63718** **To 172.16.20.10:9004** ---------- Total time = 119.844000 s Total packets = 360 Minimum delay = -86.889000 s Maximum delay = -86.596000 s Average delay = -86.746400 s Average jitter = 0.049858 s Delay standard deviation = 0.049589 s Bytes received = 540000 Average bitrate = 36.046861 Kbit/s Average packet rate = 3.003905 pkt/s Packets dropped = 0 (0.00 %) Average loss-burst size = 0.000000 pkt	

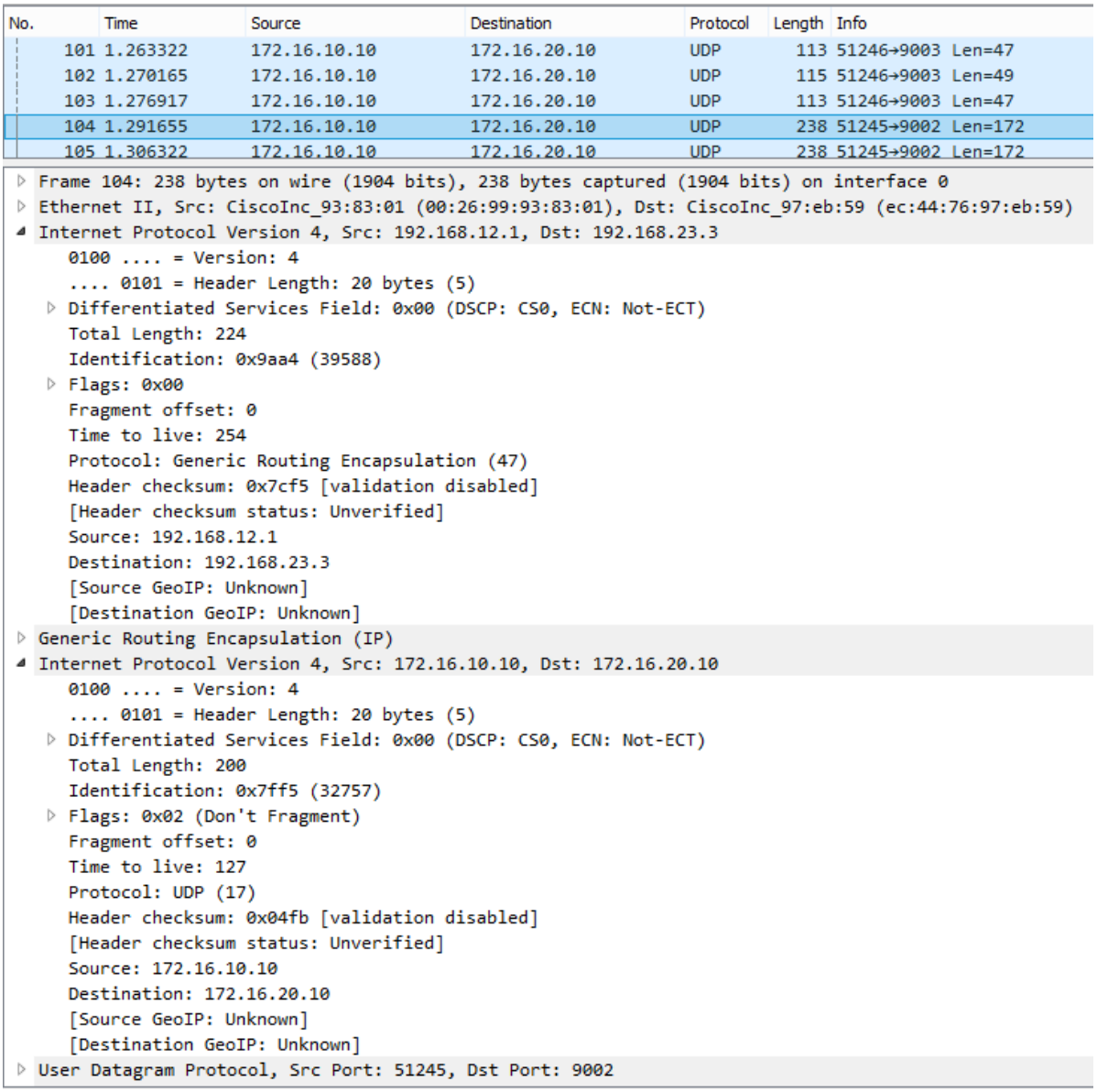
3) Scenár

- Súčtový tok je 120%, 5 dátových paketov



Flow number: 1 **From 172.16.10.10:62838** **To 172.16.20.10:9002** ---------- Total time = 120.168000 s Total packets = 3462	**Flow number: 2** **From 172.16.10.10:62839** **To 172.16.20.10:9003** ---------- Total time = 120.546000 s Total packets = 1505

Minimum delay = -87.538000 s Maximum delay = -86.794000 s Average delay = -87.011105 s Average jitter = 0.030279 s Delay standard deviation = 0.073483 s Bytes received = 595464 Average bitrate = 39.642101 Kbit/s Average packet rate = 28.809666 pkt/s Packets dropped = 2520 (42.13 %) Average loss-burst size = 2.661035 pkt	Minimum delay = -87.534000 s Maximum delay = -86.809000 s Average delay = -87.022385 s Average jitter = 0.052307 s Delay standard deviation = 0.070053 s Bytes received = 64979 Average bitrate = 4.312312 Kbit/s Average packet rate = 12.484861 pkt/s Packets dropped = 1181 (43.97 %) Average loss-burst size = 1.661041 pkt
Flow number: 3 **From 172.16.10.10:62840** **To 172.16.20.10:9004** --- Total time = 120.746000 s Total packets = 573 Minimum delay = -87.436000 s Maximum delay = -85.965000 s Average delay = -86.232873 s Average jitter = 0.034308 s Delay standard deviation = 0.293478 s Bytes received = 859500 Average bitrate = 56.945986 Kbit/s Average packet rate = 4.745499 pkt/s Packets dropped = 27 (4.50 %) Average loss-burst size = 1.000000 pkt	



No.	Time	Source	Destination	Protocol	Length	Info
101	1.263322	172.16.10.10	172.16.20.10	UDP	113	51246→9003 Len=47
102	1.270165	172.16.10.10	172.16.20.10	UDP	115	51246→9003 Len=49
103	1.276917	172.16.10.10	172.16.20.10	UDP	113	51246→9003 Len=47
104	1.291655	172.16.10.10	172.16.20.10	UDP	238	51245→9002 Len=172
105	1.306322	172.16.10.10	172.16.20.10	UDP	238	51245→9002 Len=172

```
▷ Frame 104: 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: 0x00 (DSCP: CS0, ECN: Not-ECT)
    Total Length: 224
    Identification: 0x9aa4 (39588)
  ▷ Flags: 0x00
    Fragment offset: 0
    Time to live: 254
    Protocol: Generic Routing Encapsulation (47)
    Header checksum: 0x7cf5 [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: 0x7ff5 (32757)
  ▷ Flags: 0x02 (Don't Fragment)
    Fragment offset: 0
    Time to live: 127
    Protocol: UDP (17)
    Header checksum: 0x04fb [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: 51245, Dst Port: 9002
```