Περιεχόμενα

Ζητούμενο 1

Εργαστήριο 5

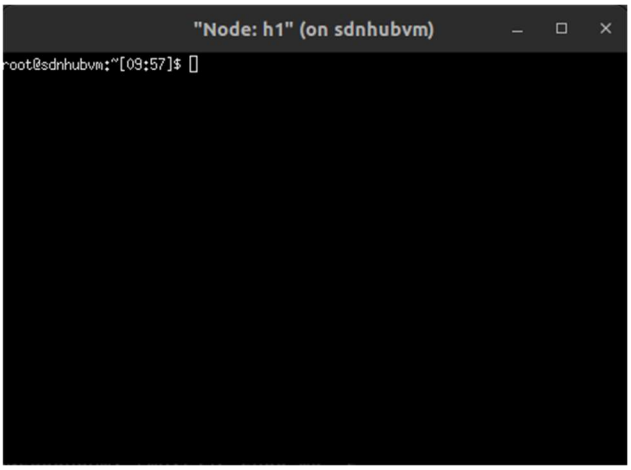
Β. Σενάριο 1

1. Δημιουργία δικτυώματος

```
ubuntu@sdnhubvm:~[09:35]$ sudo -E mn --
controller=remote,ip=83.212.79.210,port=6633 --topo single,6 --mac --switch ovsk
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4 h5 h6
*** Adding switches:
s1
*** Adding links:
(h1, s1) (h2, s1) (h3, s1) (h4, s1) (h5, s1) (h6, s1)
*** Configuring hosts
h1 h2 h3 h4 h5 h6
*** Starting controller
c0
*** Starting 1 switches
s1 ...
*** Starting CLI:
```

2. Ενεργοποιήστε xterm για τους host 1 και 2

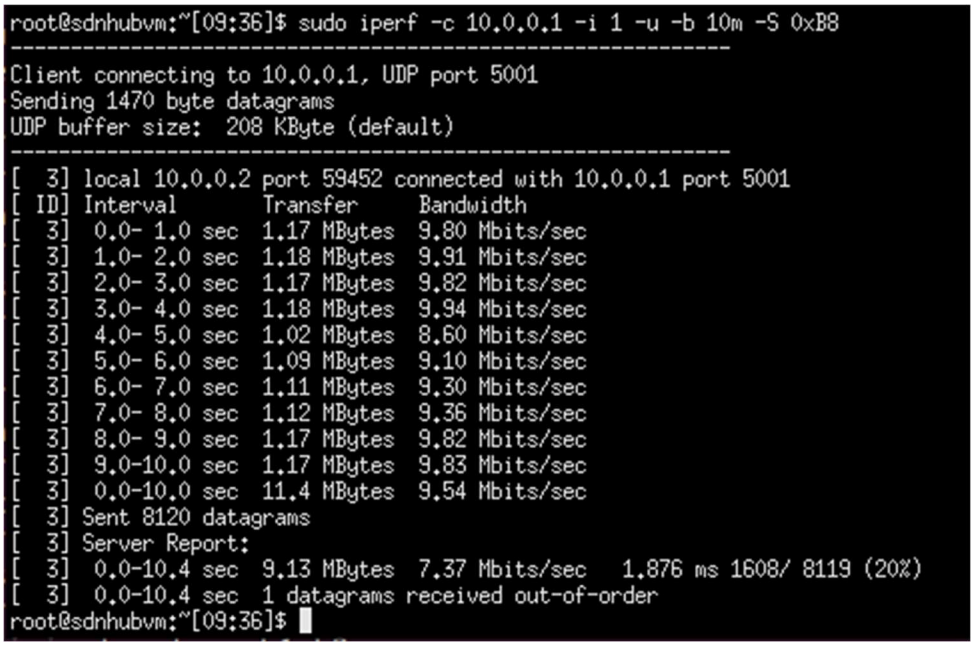
```
sudo -X user@83.212.79.210
sudo -X -p 3022 ubuntu@127.0.0.1
mininet> xterm h1 h2
```



3. Ορισμός h1 ως server

```
root@sdnhubvm:~[09:36]$ sudo iperf -s -u -i 1
------------------------------------------------------------
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size:  208 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.1 port 5001 connected with 10.0.0.2 port 59452
[ ID] Interval       Transfer     Bandwidth        Jitter   Lost/Total Datagrams
[  3]  0.0- 1.0 sec   594 KBytes  4.87 Mbits/sec   1.106 ms    0/  414 (0%)
[  3]  1.0- 2.0 sec  1011 KBytes  8.28 Mbits/sec   1.357 ms    0/  704 (0%)
[  3]  2.0- 3.0 sec   775 KBytes  6.35 Mbits/sec   8.571 ms  540/ 1080 (50%)
[  3]  3.0- 4.0 sec   389 KBytes  3.19 Mbits/sec   4.085 ms    0/  271 (0%)
[  3]  4.0- 5.0 sec   718 KBytes  5.88 Mbits/sec   1.518 ms 1069/ 1569 (68%)
[  3]  5.0- 6.0 sec   973 KBytes  7.97 Mbits/sec   3.498 ms    0/  678 (0%)
[  3]  6.0- 7.0 sec   970 KBytes  7.95 Mbits/sec   1.561 ms    0/  676 (0%)
[  3]  7.0- 8.0 sec  1.01 MBytes  8.49 Mbits/sec   1.179 ms    0/  722 (0%)
[  3]  8.0- 9.0 sec  1.22 MBytes  10.3 Mbits/sec   1.684 ms    0/  873 (0%)
[  3]  9.0-10.0 sec   966 KBytes  7.91 Mbits/sec   1.835 ms    0/  673 (0%)
[  3]  0.0-10.4 sec  9.13 MBytes  7.37 Mbits/sec   1.876 ms 1608/ 8119 (20%)
[  3]  0.0-10.4 sec  1 datagrams received out-of-order
read failed: Connection refused
```

4. Ορισμός h2 ως client



Γ. Σενάριο 2

1. Δημιουργία ουρών και κανόνα QoS

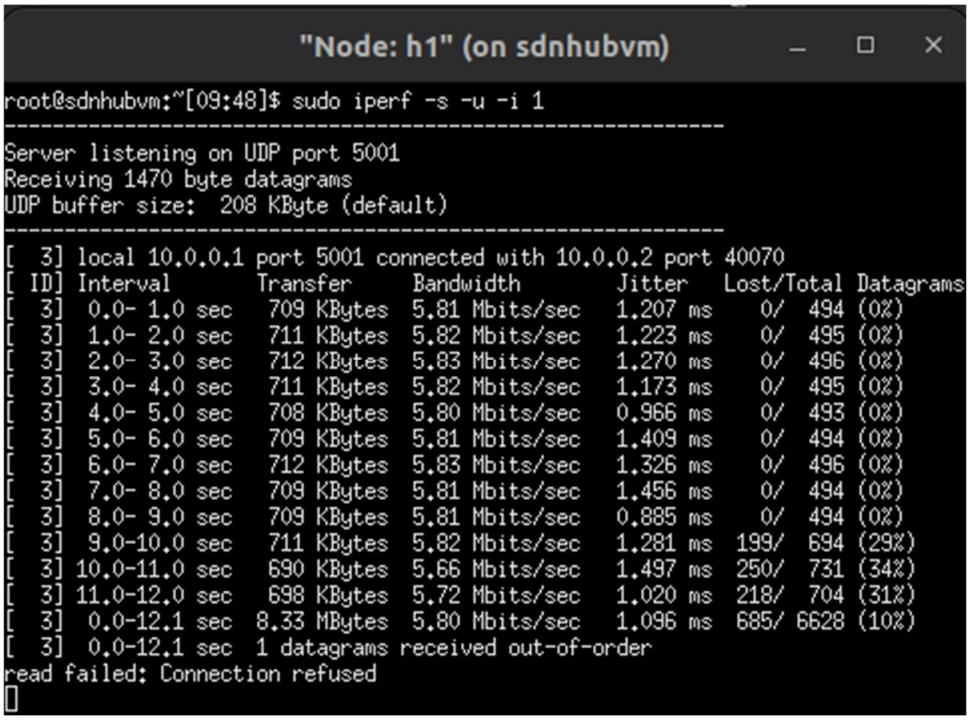
mininet> sudo ovs-vsctl set port s1-eth1 qos=@newqos -- --id=@newqos create qos type=linux-htb other-config:max-rate=6000000 queues=0=@q0,1=@q1 -- --id=@q0 create queue other-config:min-rate=3000000 other-config:max-rate=6000000 -- --id=@q1 create queue other-config:min-rate=1000000 other-config:max-rate=3000000

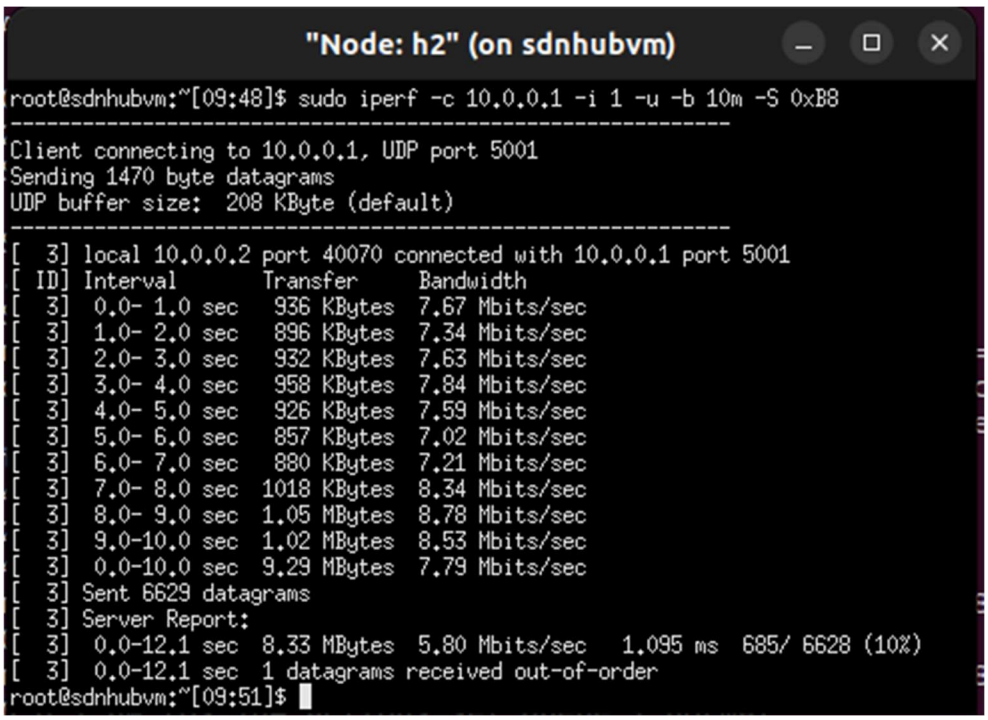
2. Δημιουργία ροών και αντιστοίχιση με ουρές

mininet> sh ovs-ofctl add-flow s1 priority=1500,dl_type=0x800,nw_proto=17,nw_src=10.0.0.2,nw_dst=10.0.0.1,nw_tos=184,actions=set_queue:0,normal
mininet> sh ovs-ofctl add-flow s1 priority=1400,dl_type=0x800,nw_proto=17,nw_src=10.0.0.2,nw_dst=10.0.0.1,nw_tos=184,actions=set_queue:1,normal

3. Κίνηση μεταξύ h1 και h2

Παρατηρούμε ότι φτάνει μέχρι 6Mbits/sec.


"Node: h1" (on sdnhubvm)
root@sdnhubvm:~[09:48]$ sudo iperf -s -u -i 1
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 208 KByte (default)
[3] local 10.0.0.1 port 5001 connected with 10.0.0.2 port 40070
[ID] Interval Transfer Bandwidth Jitter Lost/Total Datagrams
[3] 0.0- 1.0 sec 709 KBytes 5.81 Mbits/sec 1.207 ms 0/ 494 (0%)
[3] 1.0- 2.0 sec 711 KBytes 5.82 Mbits/sec 1.223 ms 0/ 495 (0%)
[3] 2.0- 3.0 sec 712 KBytes 5.83 Mbits/sec 1.270 ms 0/ 496 (0%)
[3] 3.0- 4.0 sec 711 KBytes 5.82 Mbits/sec 1.173 ms 0/ 495 (0%)
[3] 4.0- 5.0 sec 708 KBytes 5.80 Mbits/sec 0.966 ms 0/ 493 (0%)
[3] 5.0- 6.0 sec 709 KBytes 5.81 Mbits/sec 1.409 ms 0/ 494 (0%)
[3] 6.0- 7.0 sec 712 KBytes 5.83 Mbits/sec 1.326 ms 0/ 496 (0%)
[3] 7.0- 8.0 sec 709 KBytes 5.81 Mbits/sec 1.456 ms 0/ 494 (0%)
[3] 8.0- 9.0 sec 709 KBytes 5.81 Mbits/sec 0.885 ms 0/ 494 (0%)
[3] 9.0-10.0 sec 711 KBytes 5.82 Mbits/sec 1.281 ms 199/ 694 (29%)
[3] 10.0-11.0 sec 690 KBytes 5.66 Mbits/sec 1.497 ms 250/ 731 (34%)
[3] 11.0-12.0 sec 698 KBytes 5.72 Mbits/sec 1.020 ms 218/ 704 (31%)
[3] 0.0-12.1 sec 8.33 MBytes 5.80 Mbits/sec 1.096 ms 685/ 6628 (10%)
[3] 0.0-12.1 sec 1 datagrams received out-of-order
read failed: Connection refused


"Node: h2" (on sdnhubvm)
root@sdnhubvm:~[09:48]$ sudo iperf -c 10.0.0.1 -i 1 -u -b 10m -S 0xB8
Client connecting to 10.0.0.1, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 208 KByte (default)
[3] local 10.0.0.2 port 40070 connected with 10.0.0.1 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 936 KBytes 7.67 Mbits/sec
[3] 1.0- 2.0 sec 896 KBytes 7.34 Mbits/sec
[3] 2.0- 3.0 sec 932 KBytes 7.63 Mbits/sec
[3] 3.0- 4.0 sec 958 KBytes 7.84 Mbits/sec
[3] 4.0- 5.0 sec 926 KBytes 7.59 Mbits/sec
[3] 5.0- 6.0 sec 857 KBytes 7.02 Mbits/sec
[3] 6.0- 7.0 sec 880 KBytes 7.21 Mbits/sec
[3] 7.0- 8.0 sec 1018 KBytes 8.34 Mbits/sec
[3] 8.0- 9.0 sec 1.05 MBytes 8.78 Mbits/sec
[3] 9.0-10.0 sec 1.02 MBytes 8.53 Mbits/sec
[3] 0.0-10.0 sec 9.29 MBytes 7.79 Mbits/sec
[3] Sent 6629 datagrams
[3] Server Report:
[3] 0.0-12.1 sec 8.33 MBytes 5.80 Mbits/sec 1.095 ms 685/ 6628 (10%)
[3] 0.0-12.1 sec 1 datagrams received out-of-order
root@sdnhubvm:~[09:51]$

4. Εποπτεία και τροποποίηση ουρών

```
mininet> sh ovs-vsctl list port s1-eth1
_uuid               : a279af44-7152-4eea-b4b9-2af5014dd242
bond_active_slave   : []
bond_downdelay      : 0
bond_fake_iface     : false
bond_mode           : []
bond_updelay        : 0
external_ids        : {}
fake_bridge         : false
interfaces          : [1e58cded-3605-4c43-a619-5229a64bf718]
lacp                : []
mac                 : []
name                : "s1-eth1"
other_config        : {}
qos                 : a87f49c2-d676-4444-8221-ec5ee76f9585
rstp_statistics     : {}
rstp_status         : {}
statistics          : {}
status              : {}
tag                 : []
trunks              : []
vlan_mode           : []
mininet> sh ovs-vsctl list qos
_uuid               : 508ab7c1-261e-4deb-a4cf-0d7f6ae804e8
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=1907d432-e427-4827-8c39-ae30bb1109ba, 1=9db4c04b-de65-
4b7f-9fe1-4dabcc24abf3}
type                : linux-htb

_uuid               : a202d7e1-63cb-42a2-95ef-3f003cc84213
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=a6e54629-b667-4851-8eed-557b474e73cf, 1=c747e108-b333-
4e2f-a245-8b1bf550d744}
type                : linux-htb

_uuid               : 015fef99-252b-4689-a4ba-801b05e362f8
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=ba0696d1-cb8a-4627-9902-676bbe1f3093, 1=ed47e4ae-1a62-
4e28-a872-afc70d48c86c}
```

```
type                : linux-htb

_uuid               : d9642691-2d2d-48bb-a39b-5d3accc13502
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=224c1231-094e-4c5e-900e-90c77cc2db3f, 1=0128e44e-dfc1-4a6f-
a93d-bef3c59ca11e}
type                : linux-htb

_uuid               : e43b1a51-180f-46fc-9ebb-36cd88d8ba5e
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=6c47edb0-46b8-413c-b0ce-357aa8616189, 1=6903ec90-d8a0-
4b1c-b860-56f978a84b31}
type                : linux-htb

_uuid               : a87f49c2-d676-4444-8221-ec5ee76f9585
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=0eca28a7-0384-458f-8e61-5e7a0ed45963, 1=a93c4e0f-f08e-4340-
ad53-7f21b4c0c5fd}
type                : linux-htb

_uuid               : 26f88642-50d1-4d22-a558-5426585efc00
external_ids        : {}
other_config        : {max-rate="3000000"}
queues              : {0=88e22e7f-4977-4ee8-aa7e-8240e6488158}
type                : linux-htb

_uuid               : 4592d16a-280a-4e54-923d-c5717e4323f7
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=fc342c5e-d753-41fd-a68a-ed010acd4b3b, 1=bd2e8d6e-65fd-40da-
827d-9ad054dfcdfc}
type                : linux-htb

_uuid               : ae765b5b-bcc4-4e21-a7ac-4c807b419fcf
external_ids        : {}
other_config        : {max-rate="6000000"}
queues              : {0=6b6ca30d-2755-49bc-a96e-831008203b67, 1=a3707a40-a613-
436a-b9cb-086b9dc4a5bd}
type                : linux-htb

_uuid               : 0a1e8324-27b5-4b66-b23f-73f300d6f946
external_ids        : {}
other_config        : {max-rate="6000000"}
```

```
queues            : {0=2c9554ac-8a0d-4b3a-8190-09a0cc0376b3, 1=2cce43c3-5d94-
4a05-ad56-8b644f0a4331}
type              : linux-htb

_uuid             : d3142654-f459-457b-9a16-699919038240
external_ids      : {}
other_config      : {max-rate="3000000"}
queues            : {0=a0b7b2dd-e402-4e14-a886-2b0ca27e9303}
type              : linux-htb

_uuid             : 2f7a637c-d79f-4815-a485-93c0457a2f94
external_ids      : {}
other_config      : {max-rate="6000000"}
queues            : {0=f286b86e-aa5d-4996-a3d0-4c882ef03f8d, 1=658755b9-cf3b-4fa4-
85ce-4d01f99c7880}
type              : linux-htb

_uuid             : 19157f4d-131a-4591-ba31-a05eaf0f8e59
external_ids      : {}
other_config      : {max-rate="6000000"}
queues            : {0=0f8168f6-27fc-4e71-aec6-ea19084a2e1a, 1=baf6d95f-725a-4ed3-
b0d2-3602dafa9ed0}
type              : linux-htb

_uuid             : 84296cb7-b761-4a9d-919c-d566ad9d9ad2
external_ids      : {}
other_config      : {max-rate="6000000"}
queues            : {0=5e9bedba-4cfb-4207-b06b-26be53112046}
type              : linux-htb


mininet> sh ovs-vsctl list queue
_uuid             : a3707a40-a613-436a-b9cb-086b9dc4a5bd
dscp              : []
external_ids      : {}
other_config      : {max-rate="3000000", min-rate="1000000"}

_uuid             : 6c47edb0-46b8-413c-b0ce-357aa8616189
dscp              : []
external_ids      : {}
other_config      : {max-rate="6000000", min-rate="3000000"}

_uuid             : 6903ec90-d8a0-4b1c-b860-56f978a84b31
dscp              : []
external_ids      : {}
other_config      : {max-rate="3000000", min-rate="1000000"}
```

```
_uuid               : ba0696d1-cb8a-4627-9902-676bbe1f3093
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : 224c1231-094e-4c5e-900e-90c77cc2db3f
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : 1907d432-e427-4827-8c39-ae30bb1109ba
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : 2cce43c3-5d94-4a05-ad56-8b644f0a4331
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 0f8168f6-27fc-4e71-aec6-ea19084a2e1a
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}
_uuid               : 0eca28a7-0384-458f-8e61-5e7a0ed45963
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : c747e108-b333-4e2f-a245-8b1bf550d744
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 658755b9-cf3b-4fa4-85ce-4d01f99c7880
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : a6e54629-b667-4851-8eed-557b474e73cf
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : 5e9bedba-4cfb-4207-b06b-26be53112046
```

```
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 9db4c04b-de65-4b7f-9fe1-4dabcc24abf3
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 2c9554ac-8a0d-4b3a-8190-09a0cc0376b3
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : 6b6ca30d-2755-49bc-a96e-831008203b67
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : a0b7b2dd-e402-4e14-a886-2b0ca27e9303
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : fc342c5e-d753-41fd-a68a-ed010acd4b3b
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : f286b86e-aa5d-4996-a3d0-4c882ef03f8d
dscp                : []
external_ids        : {}
other_config        : {max-rate="6000000", min-rate="3000000"}

_uuid               : bd2e8d6e-65fd-40da-827d-9ad054dfcdfc
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : ed47e4ae-1a62-4e28-a872-afc70d48c86c
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 0128e44e-dfc1-4a6f-a93d-bef3c59ca11e
dscp                : []
```

```
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : 88e22e7f-4977-4ee8-aa7e-8240e6488158
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : baf6d95f-725a-4ed3-b0d2-3602dafa9ed0
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}

_uuid               : a93c4e0f-f08e-4340-ad53-7f21b4c0c5fd
dscp                : []
external_ids        : {}
other_config        : {max-rate="3000000", min-rate="1000000"}
```

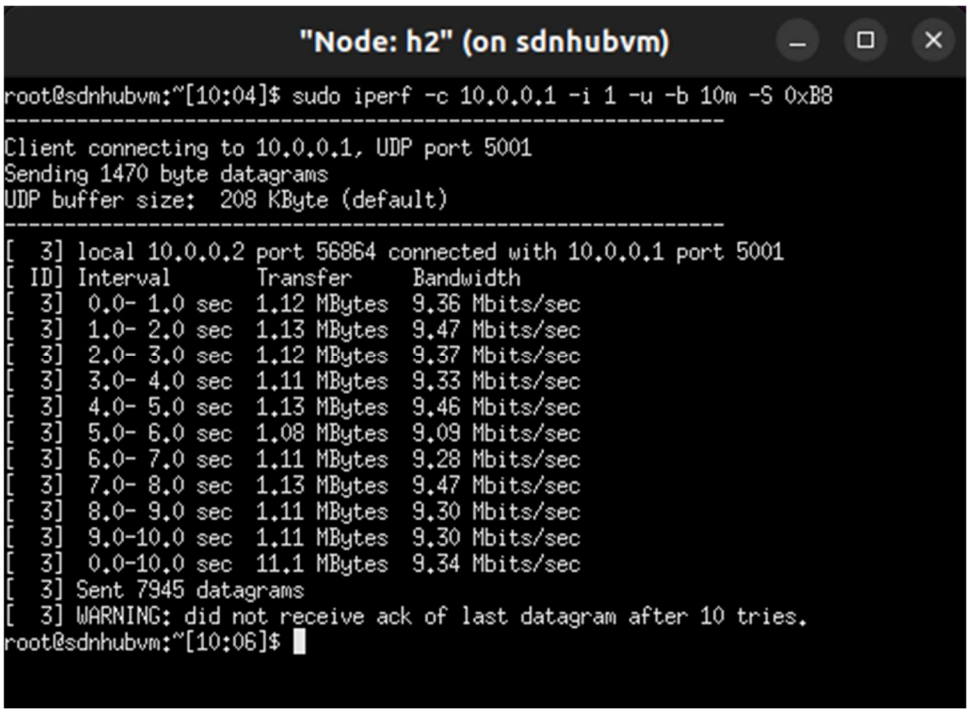
```
mininet> sh ovs-ofctl queue-stats s1
OFPST_QUEUE reply (xid=0x2): 2 queues
  port 1 queue 0: bytes=9008941, pkts=6058, errors=687, duration=?
  port 1 queue 1: bytes=0, pkts=0, errors=0, duration=?
```

Αφαιρούμε την ουρά q0.

```
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size:  208 KByte (default)
------------------------------------------------------------
[  3] local 10.0.0.1 port 5001 connected with 10.0.0.2 port 56864
[ ID] Interval       Transfer     Bandwidth        Jitter   Lost/Total Datagrams
[  3]  0.0- 1.0 sec   356 KBytes  2.92 Mbits/sec   2.668 ms    0/  248 (0%)
[  3]  1.0- 2.0 sec   356 KBytes  2.92 Mbits/sec   2.920 ms    0/  248 (0%)
[  3]  2.0- 3.0 sec   356 KBytes  2.92 Mbits/sec   2.972 ms    0/  248 (0%)
[  3]  3.0- 4.0 sec   356 KBytes  2.92 Mbits/sec   2.817 ms    0/  248 (0%)
[  3]  4.0- 5.0 sec   356 KBytes  2.92 Mbits/sec   2.825 ms    0/  248 (0%)
[  3]  5.0- 6.0 sec   356 KBytes  2.92 Mbits/sec   1.744 ms   91/  339 (27%)
[  3]  6.0- 7.0 sec   356 KBytes  2.92 Mbits/sec   1.525 ms  549/  797 (69%)
[  3]  7.0- 8.0 sec   356 KBytes  2.92 Mbits/sec   1.260 ms  544/  792 (69%)
[  3]  8.0- 9.0 sec   356 KBytes  2.92 Mbits/sec   1.405 ms  557/  805 (69%)
[  3]  9.0-10.0 sec   356 KBytes  2.92 Mbits/sec   1.171 ms  529/  777 (68%)
[  3] 10.0-11.0 sec   356 KBytes  2.92 Mbits/sec   1.847 ms  540/  788 (69%)
[  3] 11.0-12.0 sec   356 KBytes  2.92 Mbits/sec   1.337 ms  557/  805 (69%)
[  3] 12.0-13.0 sec   356 KBytes  2.92 Mbits/sec   0.944 ms  540/  788 (69%)
[  3] 13.0-14.0 sec   356 KBytes  2.92 Mbits/sec   1.305 ms  544/  792 (69%)
[  3]  0.0-14.0 sec  4.88 MBytes  2.92 Mbits/sec   1.113 ms 4463/ 7942 (56%)
[  3]  0.0-14.0 sec  1 datagrams received out-of-order
read failed: Connection refused
```

Αυτό έγινε γιατί αφού διαγράψαμε την ουρά q0 που είχε μεγαλύτερη προτεραιότητα, θα

τρέξει την ουρά q1 που έχει μικρότερη προτεραιότητα. Παρατηρούμε ότι φτάνει μέχρι 3Mbits/sec.



Γ. Σενάριο 3

1. Ενεργοποίηση xterm για τον host h3

mininet> xterm h3

2. Ενεργοποίηση αναλυτή πακέτων Wireshark

sudo wireshark

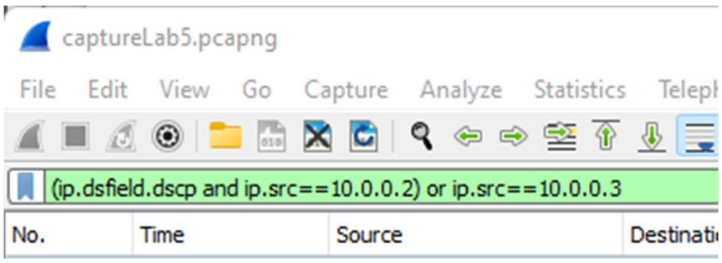
3. Ορισμός h3 ως client

Ξεκινάμε το capture και τρέχουμε τα παρακάτω.

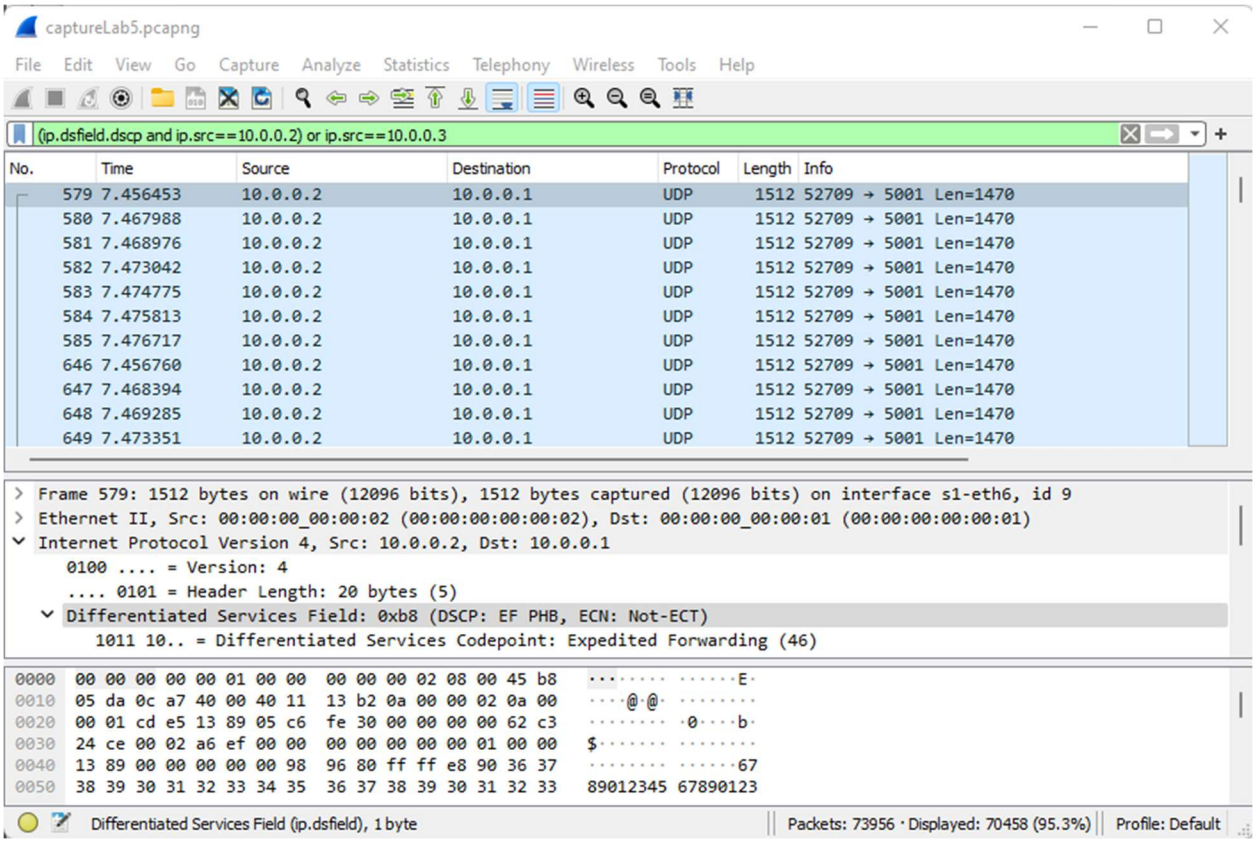
H1: sudo -s -u -i 1
H2: sudo iperf -c 10.0.0.1 -i 1 -u -b 10m -S 0xB8 -t 60
H3: sudo iperf -c 10.0.0.1 -i 1 -u -b 10m -t 60

και παράγεται το αρχείο captureLab5.pcapng.

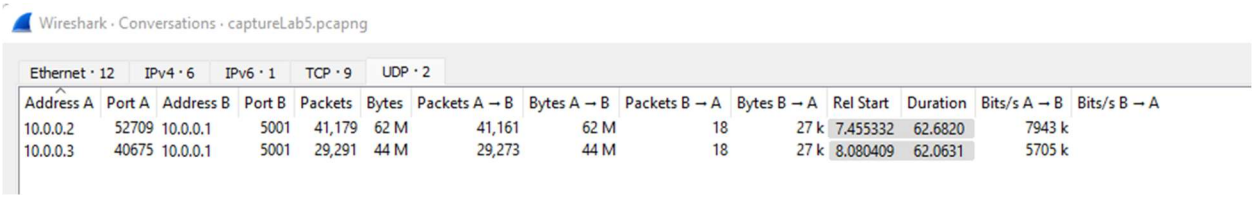
4. Εφαρμογή φίλτρου στον αναλυτή πακέτων



5. Πεδίο DiffServ στην επικεφαλίδα IP



6. Στατιστικά και αποτίμηση απόδοσης h2 και h3

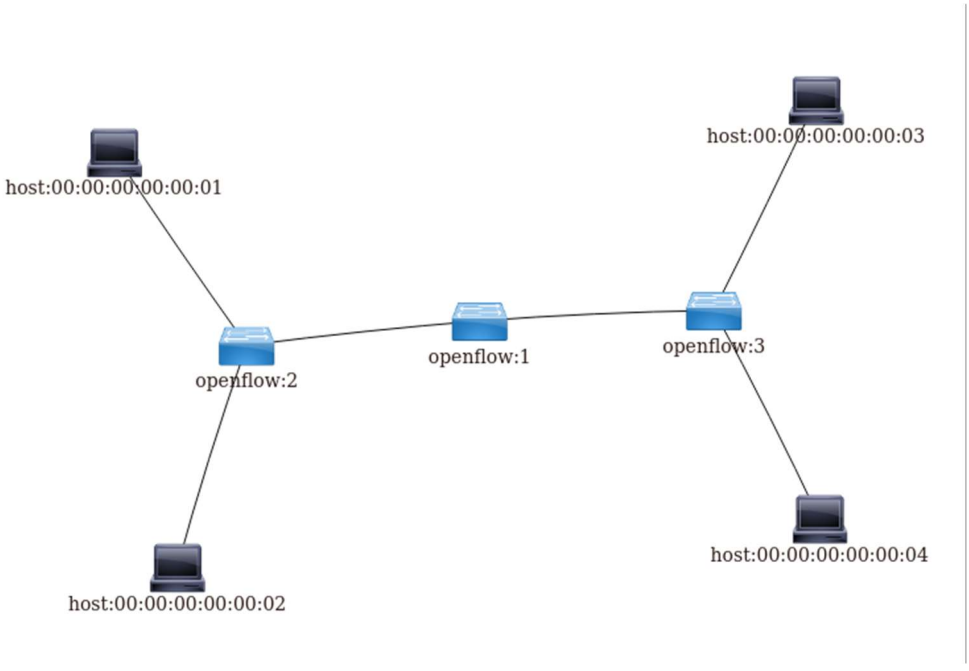


Host	Packet to h1	Arrival rate (packets/sec)	Interarrival time (msec)	Tx (MB)
10.0.0.2	41179	686,32	1,45705	62
10.0.0.3	29273	487,88	2,04967	44

Ζητούμενο 2

Δημιουργία δικτυώματος

```
ubuntu@sdnhubvm:~[07:01]$ sudo -E mn --
controller=remote,ip=83.212.79.210,port=6633 --topo tree,depth=2,fanout=2 --mac --
switch ovsk
*** Creating network
*** Adding controller
*** Adding hosts:
h1 h2 h3 h4
*** Adding switches:
s1 s2 s3
*** Adding links:
(s1, s2) (s1, s3) (s2, h1) (s2, h2) (s3, h3) (s3, h4)
*** Configuring hosts
h1 h2 h3 h4
*** Starting controller
c0
*** Starting 3 switches
s1 s2 s3 ...
*** Starting CLI:
```



Ζητούμενο 3

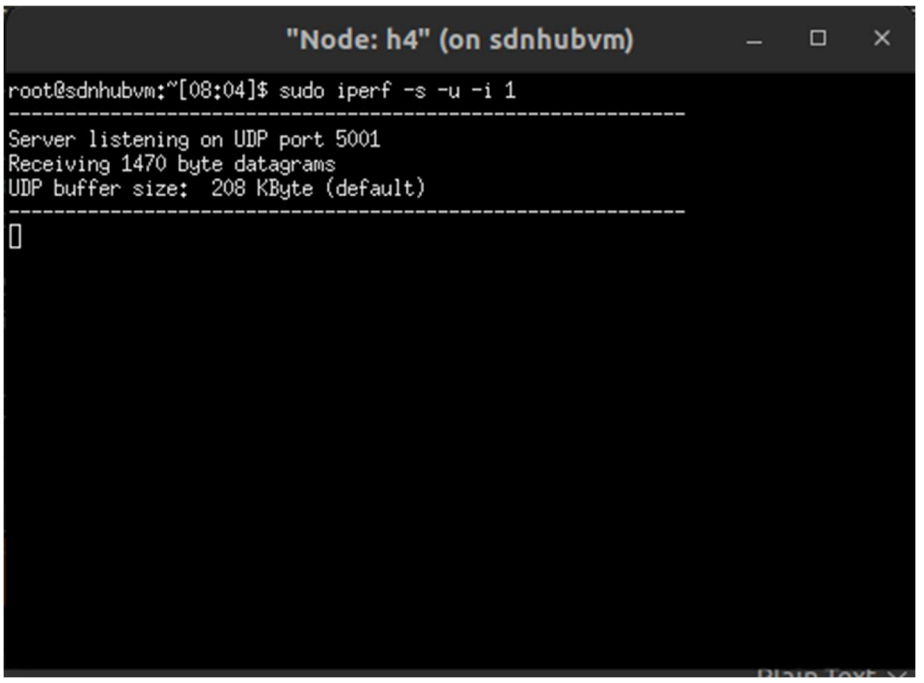
Εισάγουμε τις κατάλληλες ροές, ουρές και κανόνες QoS.

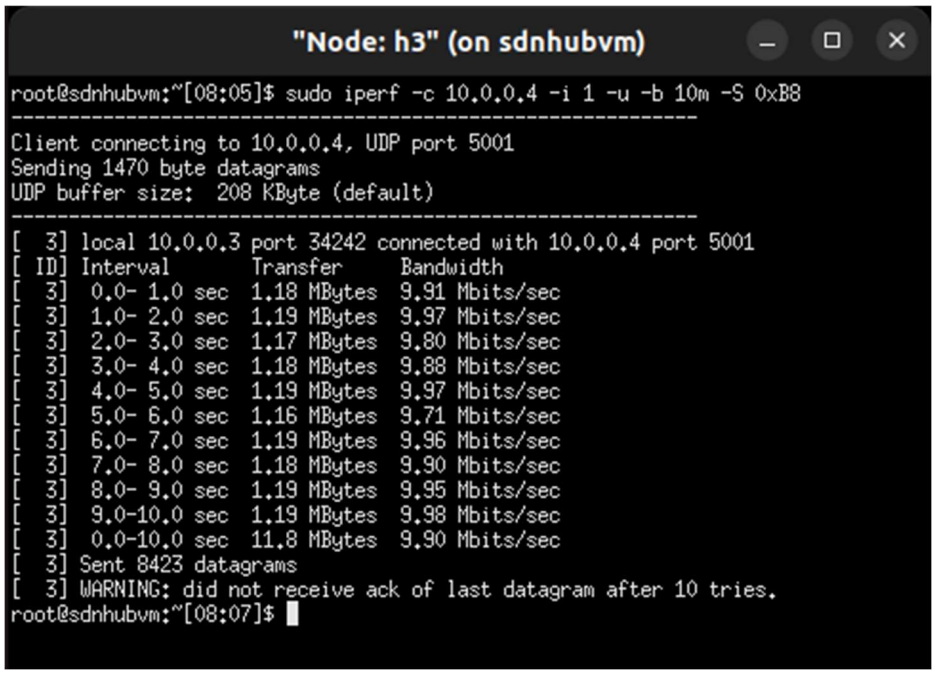
```
mininet> sh ovs-vsctl set port s2-eth1 qos=@qos0 -- --id=@qos0 create qos type=linux-htb other-config:max-rate=8000000 queues=0=@q0 -- --id=@q0 create queue other-config:min-rate=1000000 other-config:max-rate=8000000

mininet> sh ovs-vsctl set port s2-eth2 qos=@qos1 -- --id=@qos1 create qos type=linux-htb other-config:max-rate=8000000 queues=1=@q1 -- --id=@q1 create queue other-config:min-rate=1000000 other-config:max-rate=8000000

mininet> sh ovs-ofctl add-flow s2 priority=1500,dl_type=0x800,nw_src=10.0.0.1,nw_tos=184,actions=set_queue:0,normal

mininet> sh ovs-ofctl add-flow s2 priority=1500,dl_type=0x800,nw_src=10.0.0.2,nw_tos=184,actions=set_queue:1,normal


mininet> sh ovs-ofctl add-flow s3 priority=1500,dl_type=0x800,nw_src=10.0.0.3,actions=drop

mininet> sh ovs-vsctl set port s3-eth2 qos=@qos2 -- --id=@qos2 create qos type=linux-htb other-config:max-rate=4000000 queues=2=@q2 -- --id=@q2 create queue other-config:min-rate=1000000 other-config:max-rate=4000000

mininet> sh ovs-ofctl add-flow s3 priority=1500,dl_type=0x800,nw_src=10.0.0.1,nw_dst=10.0.0.4,nw_tos=184,actions=set_queue:2,normal

mininet> sh ovs-ofctl add-flow s3 priority=1500,dl_type=0x800,nw_src=10.0.0.2,nw_dst=10.0.0.4,nw_tos=184,actions=set_queue:2,normal
```

Ζητούμενο 4

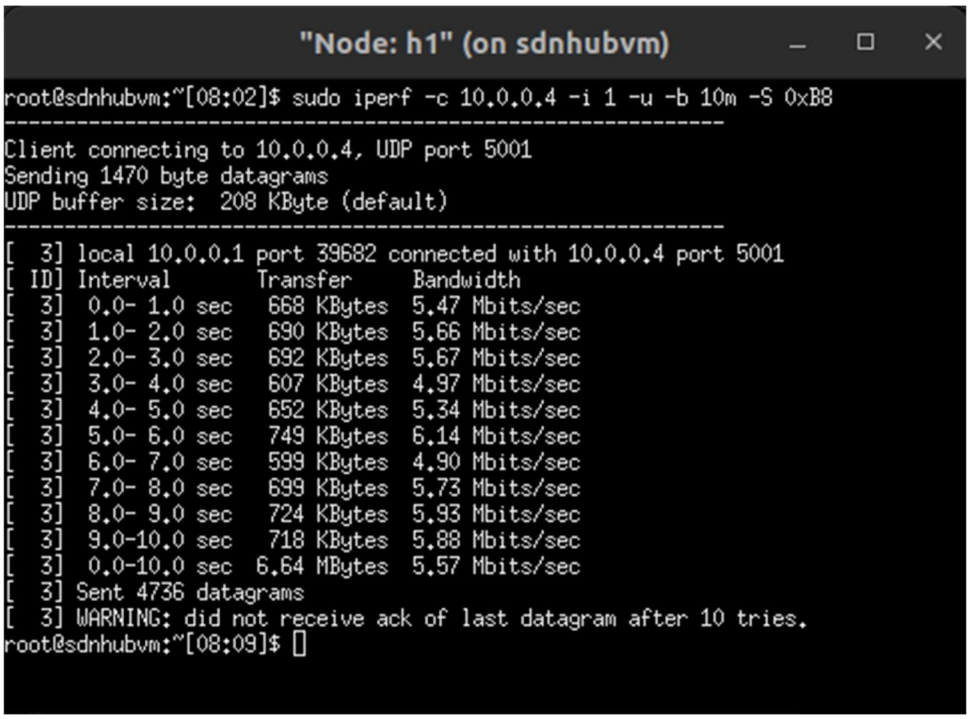
Πραγματοποιούμε δοκιμές.

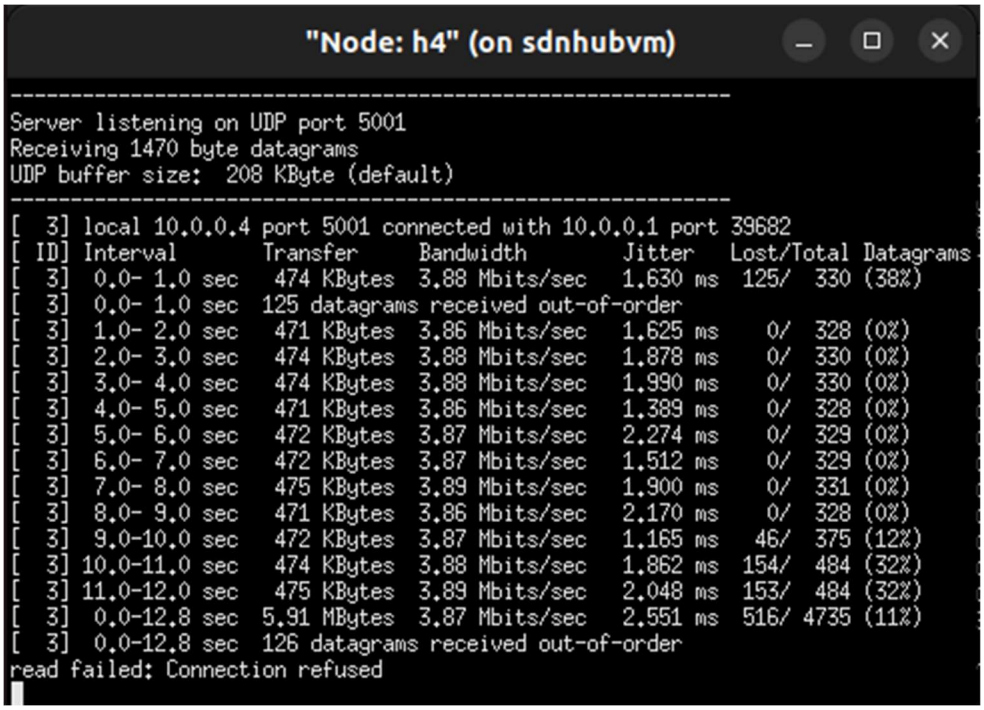
Επικοινωνία h3 με h4.



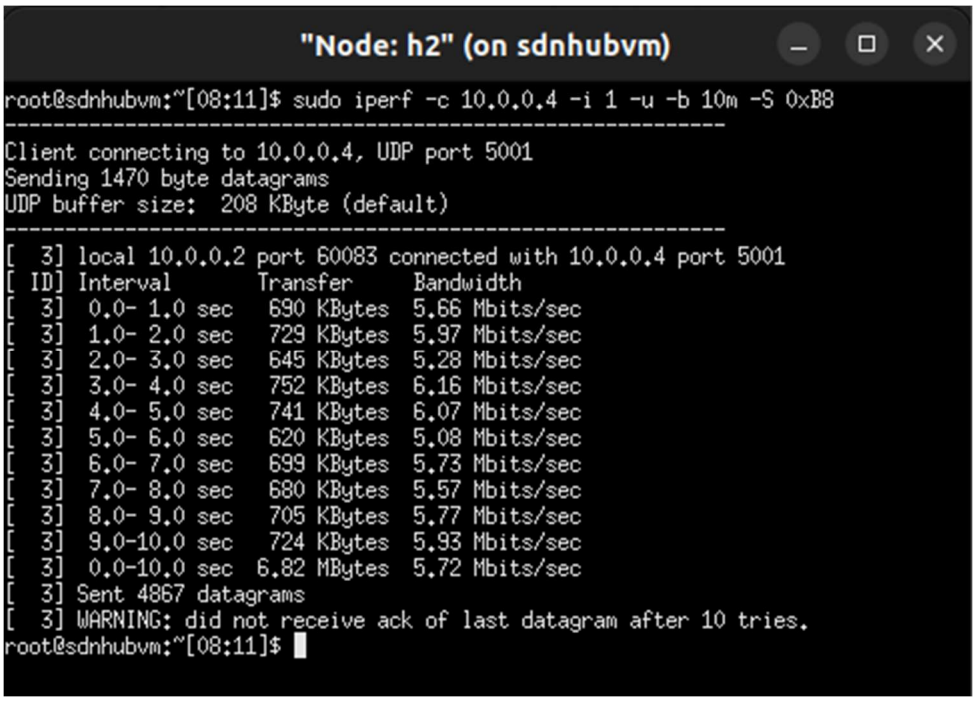


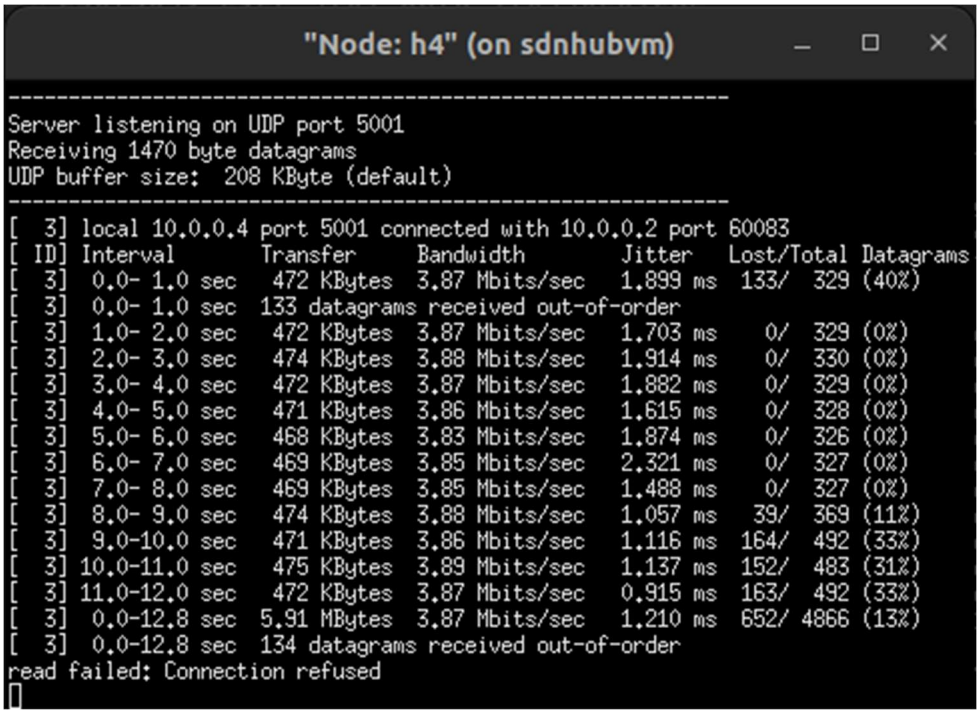
Επικοινωνία h1 με h4.



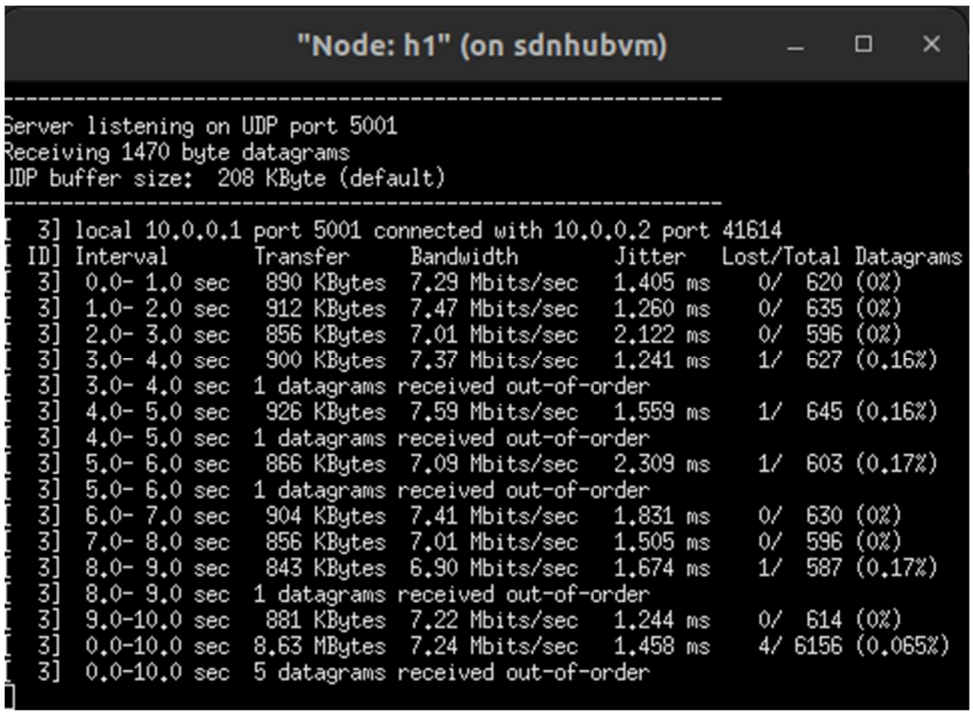


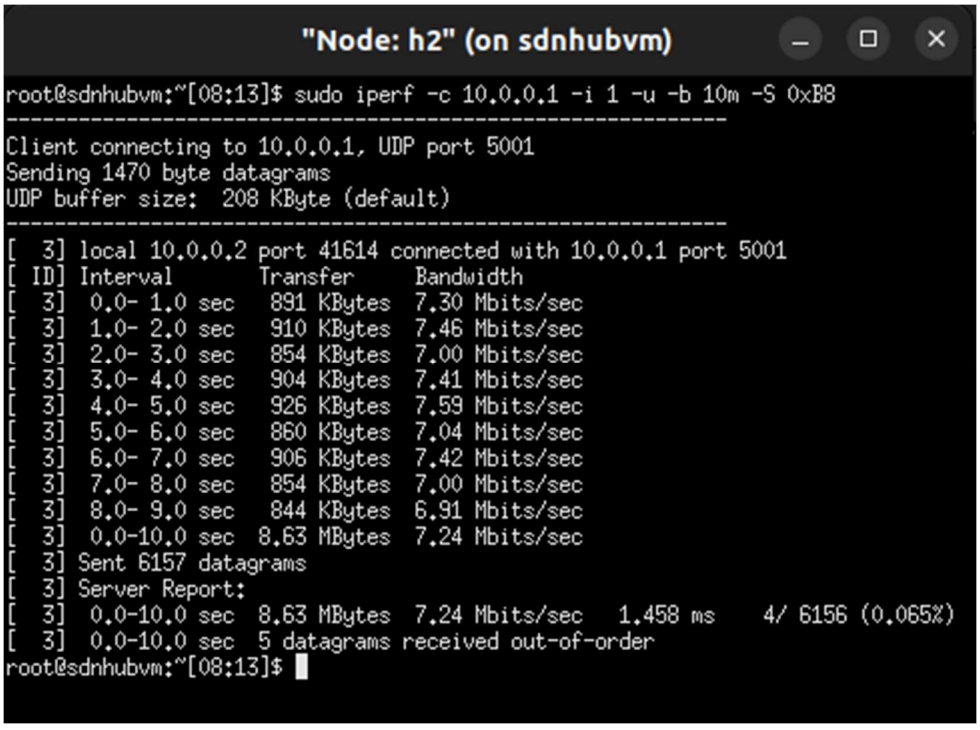
Επικοινωνία h2 με h4.





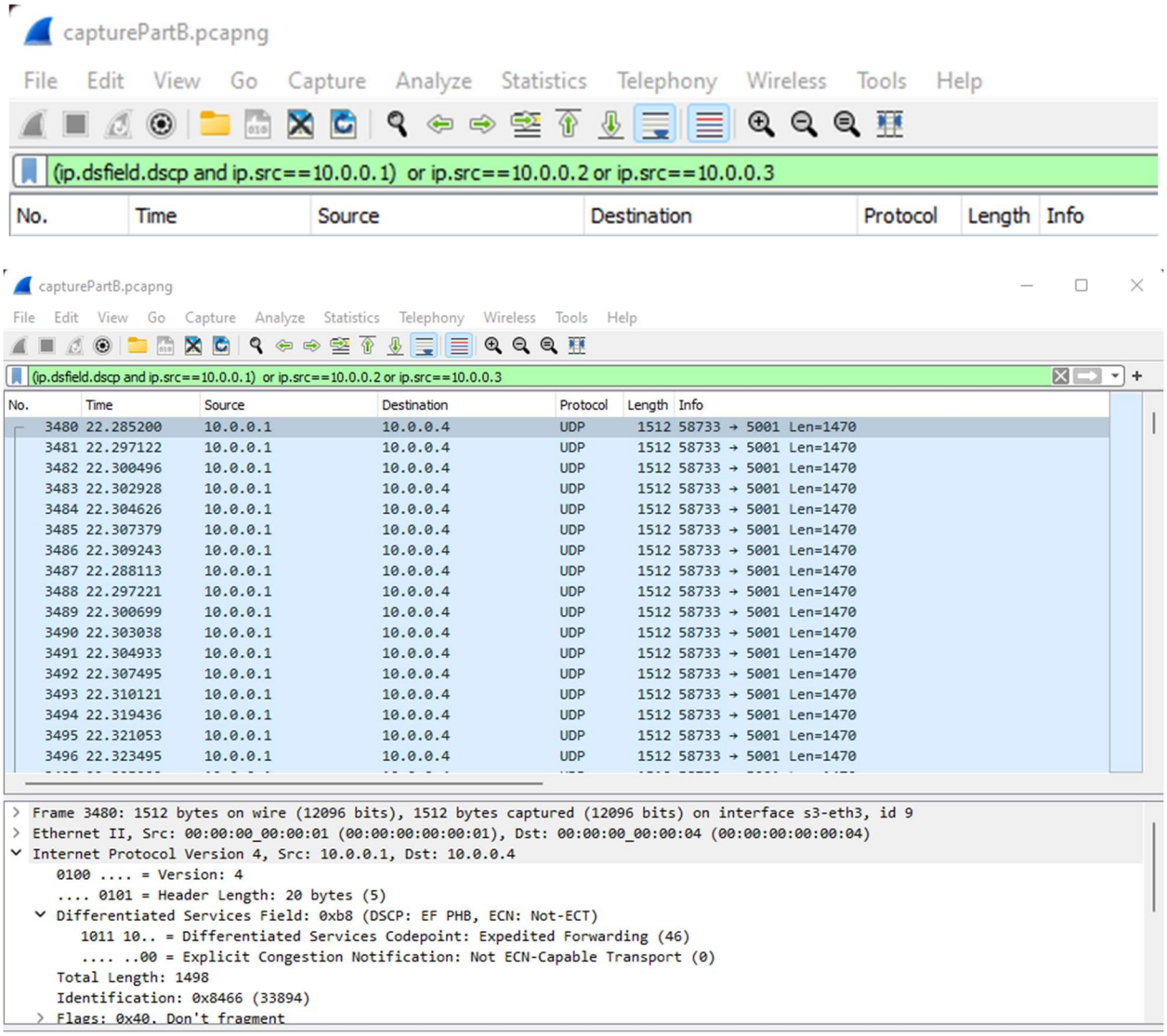
Επικοινωνία h1 με h2.


"Node: h1" (on sdnhubvm)
Server listening on UDP port 5001
Receiving 1470 byte datagrams
UDP buffer size: 208 KByte (default)
[3] local 10.0.0.1 port 5001 connected with 10.0.0.2 port 41614
[ID] Interval Transfer Bandwidth Jitter Lost/Total Datagrams
[3] 0.0- 1.0 sec 890 KBytes 7.29 Mbits/sec 1.405 ms 0/ 620 (0%)
[3] 1.0- 2.0 sec 912 KBytes 7.47 Mbits/sec 1.260 ms 0/ 635 (0%)
[3] 2.0- 3.0 sec 856 KBytes 7.01 Mbits/sec 2.122 ms 0/ 596 (0%)
[3] 3.0- 4.0 sec 900 KBytes 7.37 Mbits/sec 1.241 ms 1/ 627 (0.16%)
[3] 3.0- 4.0 sec 1 datagrams received out-of-order
[3] 4.0- 5.0 sec 926 KBytes 7.59 Mbits/sec 1.559 ms 1/ 645 (0.16%)
[3] 4.0- 5.0 sec 1 datagrams received out-of-order
[3] 5.0- 6.0 sec 866 KBytes 7.09 Mbits/sec 2.309 ms 1/ 603 (0.17%)
[3] 5.0- 6.0 sec 1 datagrams received out-of-order
[3] 6.0- 7.0 sec 904 KBytes 7.41 Mbits/sec 1.831 ms 0/ 630 (0%)
[3] 7.0- 8.0 sec 856 KBytes 7.01 Mbits/sec 1.505 ms 0/ 596 (0%)
[3] 8.0- 9.0 sec 843 KBytes 6.90 Mbits/sec 1.674 ms 1/ 587 (0.17%)
[3] 8.0- 9.0 sec 1 datagrams received out-of-order
[3] 9.0-10.0 sec 881 KBytes 7.22 Mbits/sec 1.244 ms 0/ 614 (0%)
[3] 0.0-10.0 sec 8.63 MBytes 7.24 Mbits/sec 1.458 ms 4/ 6156 (0.065%)
[3] 0.0-10.0 sec 5 datagrams received out-of-order


"Node: h2" (on sdnhubvm)
root@sdnhubvm:~[08:13]$ sudo iperf -c 10.0.0.1 -i 1 -u -b 10m -S 0xB8
Client connecting to 10.0.0.1, UDP port 5001
Sending 1470 byte datagrams
UDP buffer size: 208 KByte (default)
[3] local 10.0.0.2 port 41614 connected with 10.0.0.1 port 5001
[ID] Interval Transfer Bandwidth
[3] 0.0- 1.0 sec 891 KBytes 7.30 Mbits/sec
[3] 1.0- 2.0 sec 910 KBytes 7.46 Mbits/sec
[3] 2.0- 3.0 sec 854 KBytes 7.00 Mbits/sec
[3] 3.0- 4.0 sec 904 KBytes 7.41 Mbits/sec
[3] 4.0- 5.0 sec 926 KBytes 7.59 Mbits/sec
[3] 5.0- 6.0 sec 860 KBytes 7.04 Mbits/sec
[3] 6.0- 7.0 sec 906 KBytes 7.42 Mbits/sec
[3] 7.0- 8.0 sec 854 KBytes 7.00 Mbits/sec
[3] 8.0- 9.0 sec 844 KBytes 6.91 Mbits/sec
[3] 0.0-10.0 sec 8.63 MBytes 7.24 Mbits/sec
[3] Sent 6157 datagrams
[3] Server Report:
[3] 0.0-10.0 sec 8.63 MBytes 7.24 Mbits/sec 1.458 ms 4/ 6156 (0.065%)
[3] 0.0-10.0 sec 5 datagrams received out-of-order
root@sdnhubvm:~[08:13]$

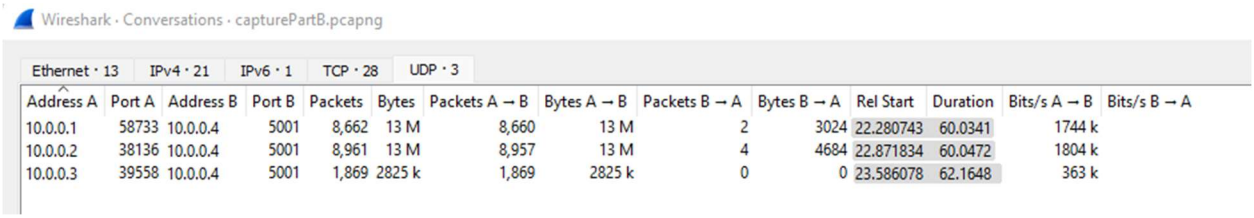
Ζητούμενο 5

Κάνουμε capture με το wireshark και παράγεται το αρχείο capturePartB.pcapng.



Ζητούμενο 6

Στατιστικά.



Host	Packet to h4	Arrival rate (packets/sec)	Interarrival time (msec)	Tx (MB)
10.0.0.1	8662	144,37	6,92681	13
10.0.0.2	8961	149,35	6,69568	13
10.0.0.3	1869	31,15	32,10273	2,825

Παρατηρήσεις

Όπου χρησιμοποιήθηκε screenshot αντί για κείμενο σε περιπτώσεις τερματικού, έγινε γιατί δεν υπήρχε η δυνατότητα αντιγραφής από το συγκεκριμένο τερματικό. Τα τερματικά του xterm έτρεξαν με την εντολή ssh -X -p 3022 ubuntu@83.212.79.210 για την ενεργοποίηση του X11Forwarding και στην συνέχεια μέσα στο mininet xtrem h*. Όλα σε περιβάλλον Ubuntu. Αυτή η μέθοδος δεν έδινε την δυνατότητα αντιγραφής από τα συγκεκριμένα τερματικά.