

REPORT

IAP Assignment 2

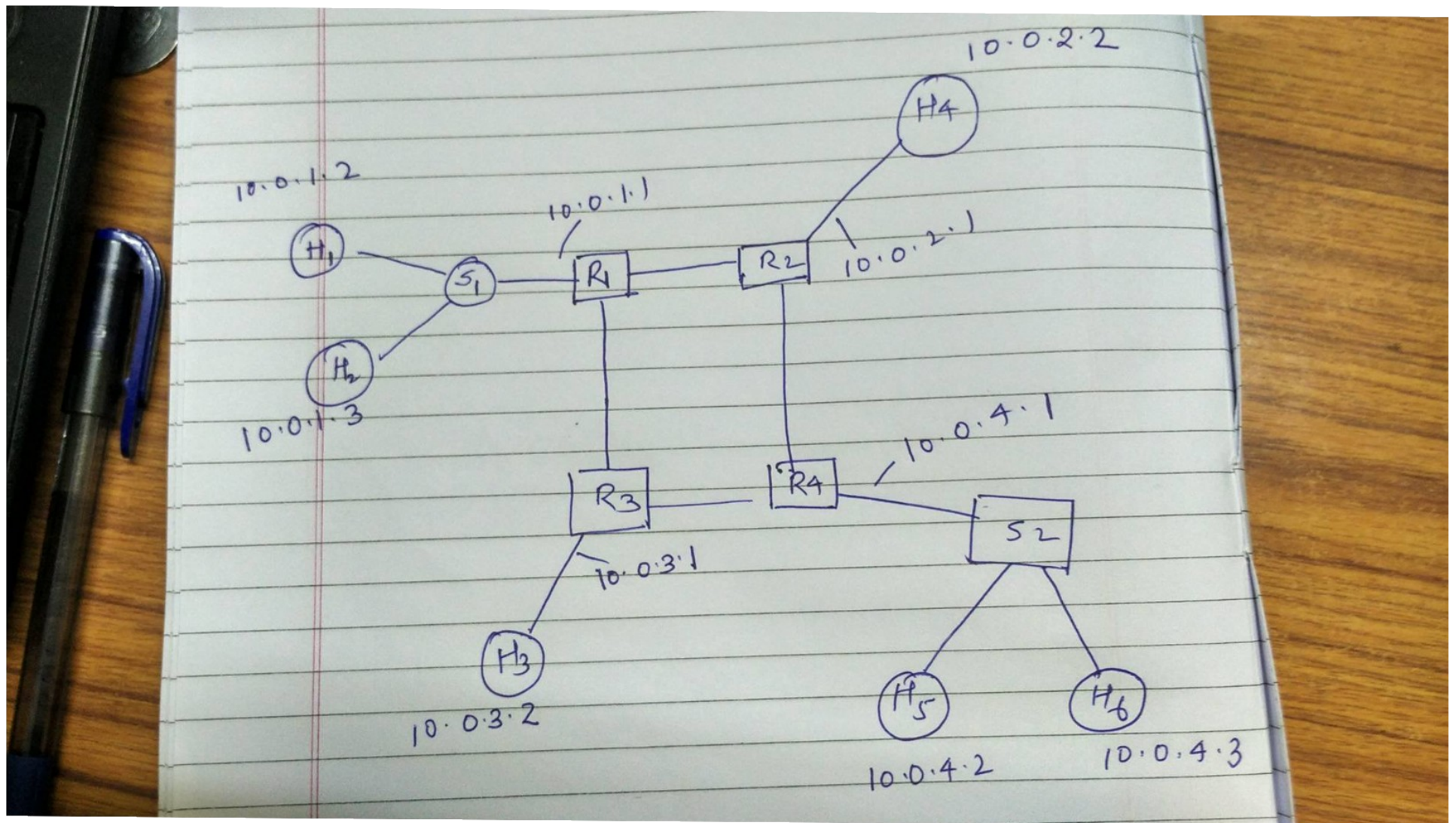
Group 14

Bhusan kulkarni 12CS30016

Gaurav Kumar 12CS10020

Ankit Kumar Gupta 12CS10006

Q1)



Q2)

- Routing table for r1

IP	Netmask	Next Hop	Interface
• 10.0.1.2	255.255.255.255	10.0.1.2	eth2
• 10.0.1.3	255.255.255.255	10.0.1.3	eth2
• 10.0.2.0	255.255.255.0	10.0.2.1	eth3
• 10.0.3.0	255.255.255.0	10.0.3.1	eth1
• 10.0.4.0	255.255.255.0	10.0.3.1	eth1

Rotuing table for r2

IP	Netmask	Next Hop	Interface
• 10.0.2.2	255.255.255.255	10.0.2.2	eth2
• 10.0.1.0	255.255.255.0	10.0.1.1	eth1
• 10.0.3.0	255.255.255.0	10.0.1.1	eth1
• 10.0.4.0	255.255.255.0	10.0.4.1	eth3

Q2)

- Routing table for r3

IP	Netmask	Next Hop	Interface
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- 10.0.3.2 255.255.255.255 10.0.3.2 eth3
- 10.0.2.0 255.255.255.0 10.0.1.1 eth1
- 10.0.1.0 255.255.255.0 10.0.1.1 eth1
- 10.0.4.0 255.255.255.0 10.0.4.1 eth2

Rotuing table for r4

IP	Netmask	Next Hop	Interface
----	---------	----------	-----------

- 10.0.4.2 255.255.255.255 10.0.4.2 eth2
- 10.0.4.3 255.255.255.255 10.0.4.3 eth2
- 10.0.2.0 255.255.255.0 10.0.2.1 eth3
- 10.0.3.0 255.255.255.0 10.0.3.1 eth1
- 10.0.1.0 255.255.255.0 10.0.3.1 eth1

Q3)ping from h1-h2

gaurav@gaurav-Inspiron-5520: ~/Desktop/IAP-master/IAP_2_14

```
mininet> h1 ping h2
```

```
PING 10.0.1.3 (10.0.1.3) 56(84) bytes of data.
```

```
64 bytes from 10.0.1.3: icmp_seq=1 ttl=64 time=11.0 ms
64 bytes from 10.0.1.3: icmp_seq=2 ttl=64 time=0.558 ms
64 bytes from 10.0.1.3: icmp_seq=3 ttl=64 time=0.094 ms
64 bytes from 10.0.1.3: icmp_seq=4 ttl=64 time=0.059 ms
64 bytes from 10.0.1.3: icmp_seq=5 ttl=64 time=0.081 ms
64 bytes from 10.0.1.3: icmp_seq=6 ttl=64 time=0.073 ms
64 bytes from 10.0.1.3: icmp_seq=7 ttl=64 time=0.453 ms
64 bytes from 10.0.1.3: icmp_seq=8 ttl=64 time=0.071 ms
64 bytes from 10.0.1.3: icmp_seq=9 ttl=64 time=0.071 ms
64 bytes from 10.0.1.3: icmp_seq=10 ttl=64 time=0.115 ms
64 bytes from 10.0.1.3: icmp_seq=11 ttl=64 time=0.068 ms
64 bytes from 10.0.1.3: icmp_seq=12 ttl=64 time=0.067 ms
64 bytes from 10.0.1.3: icmp_seq=13 ttl=64 time=0.079 ms
64 bytes from 10.0.1.3: icmp_seq=14 ttl=64 time=0.070 ms
64 bytes from 10.0.1.3: icmp_seq=15 ttl=64 time=0.080 ms
64 bytes from 10.0.1.3: icmp_seq=16 ttl=64 time=0.070 ms
64 bytes from 10.0.1.3: icmp_seq=17 ttl=64 time=0.067 ms
64 bytes from 10.0.1.3: icmp_seq=18 ttl=64 time=0.302 ms
```

Ping from h1-h3

gaurav@gaurav-Inspiron-5520: ~/Desktop/IAP-master/IAP_2_14



mininet> h1 ping h3

PING 10.0.3.2 (10.0.3.2) 56(84) bytes of data.

64 bytes from 10.0.3.2: icmp_seq=1 ttl=62 time=26.2 ms

64 bytes from 10.0.3.2: icmp_seq=2 ttl=62 time=17.5 ms

64 bytes from 10.0.3.2: icmp_seq=3 ttl=62 time=22.2 ms

64 bytes from 10.0.3.2: icmp_seq=4 ttl=62 time=45.1 ms

64 bytes from 10.0.3.2: icmp_seq=5 ttl=62 time=17.6 ms

64 bytes from 10.0.3.2: icmp_seq=6 ttl=62 time=23.5 ms

64 bytes from 10.0.3.2: icmp_seq=7 ttl=62 time=13.9 ms

64 bytes from 10.0.3.2: icmp_seq=8 ttl=62 time=18.0 ms

64 bytes from 10.0.3.2: icmp_seq=9 ttl=62 time=41.4 ms

64 bytes from 10.0.3.2: icmp_seq=10 ttl=62 time=14.7 ms

64 bytes from 10.0.3.2: icmp_seq=11 ttl=62 time=19.3 ms

64 bytes from 10.0.3.2: icmp_seq=12 ttl=62 time=11.7 ms

64 bytes from 10.0.3.2: icmp_seq=13 ttl=62 time=14.5 ms

64 bytes from 10.0.3.2: icmp_seq=14 ttl=62 time=36.8 ms

Ping from h1 to h4

gaurav@gaurav-Inspiron-5520: ~/Desktop/IAP-master/IAP_2_14

11:17 PM

```
mininet> h1 ping h4
```

```
PING 10.0.2.2 (10.0.2.2) 56(84) bytes of data.
```

```
64 bytes from 10.0.2.2: icmp_seq=2 ttl=62 time=42.1 ms
64 bytes from 10.0.2.2: icmp_seq=3 ttl=62 time=16.6 ms
64 bytes from 10.0.2.2: icmp_seq=4 ttl=62 time=41.5 ms
64 bytes from 10.0.2.2: icmp_seq=5 ttl=62 time=14.4 ms
64 bytes from 10.0.2.2: icmp_seq=6 ttl=62 time=37.0 ms
64 bytes from 10.0.2.2: icmp_seq=7 ttl=62 time=43.8 ms
64 bytes from 10.0.2.2: icmp_seq=8 ttl=62 time=17.3 ms
64 bytes from 10.0.2.2: icmp_seq=9 ttl=62 time=42.4 ms
64 bytes from 10.0.2.2: icmp_seq=10 ttl=62 time=14.9 ms
64 bytes from 10.0.2.2: icmp_seq=11 ttl=62 time=38.5 ms
64 bytes from 10.0.2.2: icmp_seq=12 ttl=62 time=12.6 ms
64 bytes from 10.0.2.2: icmp_seq=13 ttl=62 time=36.2 ms
64 bytes from 10.0.2.2: icmp_seq=14 ttl=62 time=10.0 ms
64 bytes from 10.0.2.2: icmp_seq=15 ttl=62 time=34.0 ms
64 bytes from 10.0.2.2: icmp_seq=16 ttl=62 time=56.8 ms
64 bytes from 10.0.2.2: icmp_seq=17 ttl=62 time=31.2 ms
64 bytes from 10.0.2.2: icmp_seq=18 ttl=62 time=12.5 ms
64 bytes from 10.0.2.2: icmp_seq=19 ttl=62 time=37.6 ms
```

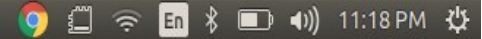
Ping from h1 to h5

gaurav@gaurav-Inspiron-5520: ~/Desktop/IAP-master/IAP_2_14

```
mininet> h1 ping h5
PING 10.0.4.2 (10.0.4.2) 56(84) bytes of data.
64 bytes from 10.0.4.2: icmp_seq=3 ttl=61 time=41.4 ms
64 bytes from 10.0.4.2: icmp_seq=4 ttl=61 time=18.6 ms
64 bytes from 10.0.4.2: icmp_seq=5 ttl=61 time=46.3 ms
64 bytes from 10.0.4.2: icmp_seq=6 ttl=61 time=26.1 ms
64 bytes from 10.0.4.2: icmp_seq=7 ttl=61 time=56.6 ms
64 bytes from 10.0.4.2: icmp_seq=8 ttl=61 time=39.7 ms
64 bytes from 10.0.4.2: icmp_seq=9 ttl=61 time=16.6 ms
64 bytes from 10.0.4.2: icmp_seq=10 ttl=61 time=43.6 ms
64 bytes from 10.0.4.2: icmp_seq=11 ttl=61 time=21.5 ms
64 bytes from 10.0.4.2: icmp_seq=12 ttl=61 time=51.2 ms
64 bytes from 10.0.4.2: icmp_seq=13 ttl=61 time=31.4 ms
64 bytes from 10.0.4.2: icmp_seq=14 ttl=61 time=57.3 ms
64 bytes from 10.0.4.2: icmp_seq=15 ttl=61 time=34.8 ms
64 bytes from 10.0.4.2: icmp_seq=16 ttl=61 time=61.8 ms
64 bytes from 10.0.4.2: icmp_seq=17 ttl=61 time=40.3 ms
64 bytes from 10.0.4.2: icmp_seq=18 ttl=61 time=20.6 ms
64 bytes from 10.0.4.2: icmp_seq=19 ttl=61 time=48.5 ms
64 bytes from 10.0.4.2: icmp_seq=20 ttl=61 time=25.2 ms
64 bytes from 10.0.4.2: icmp_seq=21 ttl=61 time=53.4 ms
64 bytes from 10.0.4.2: icmp_seq=22 ttl=61 time=32.6 ms
64 bytes from 10.0.4.2: icmp_seq=23 ttl=61 time=13.5 ms
64 bytes from 10.0.4.2: icmp_seq=24 ttl=61 time=41.0 ms
```


Ping from h1 to h6

gaurav@gaurav-Inspiron-5520: ~/Desktop/IAP-master/IAP_2_14

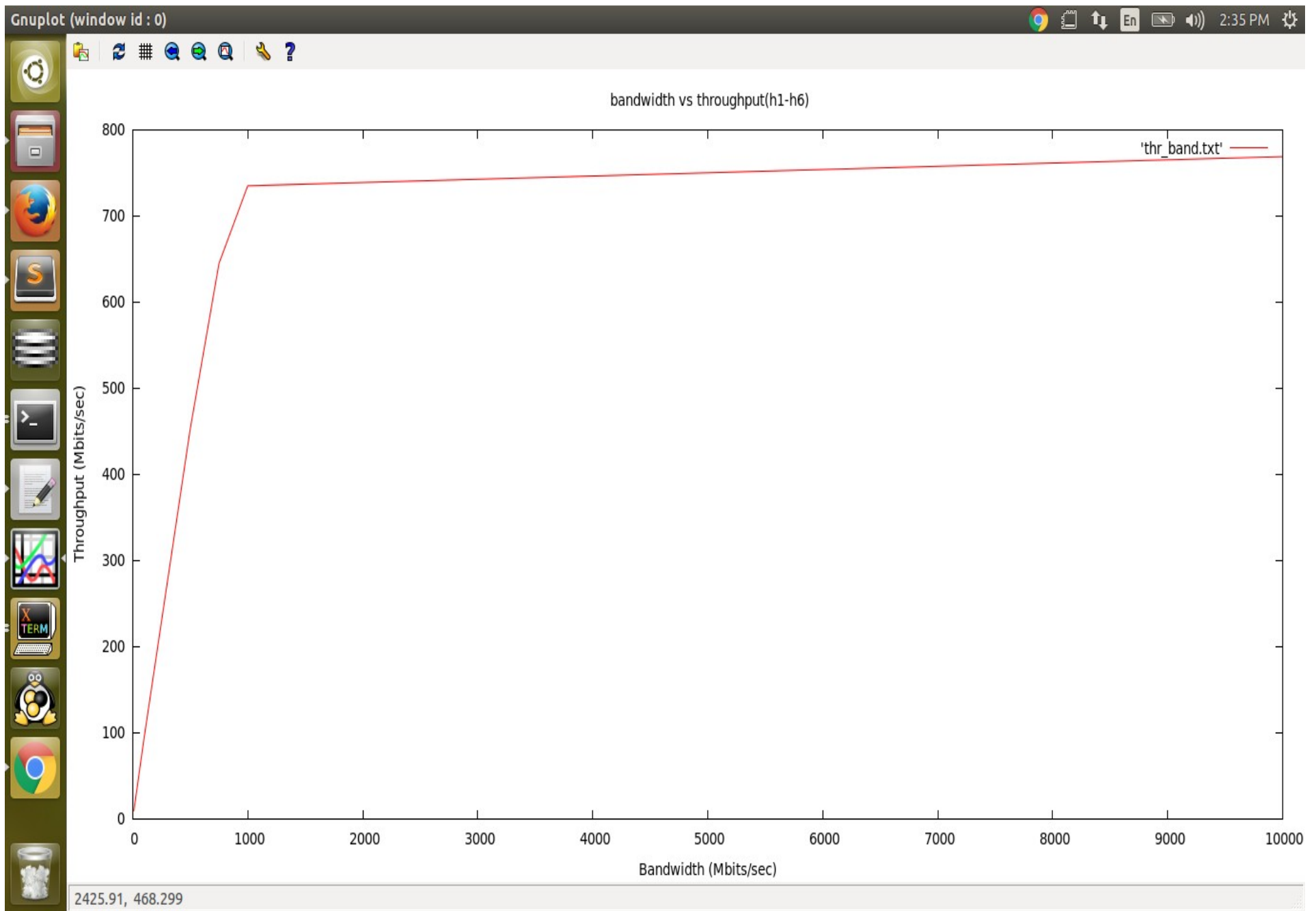


```
mininet> h1 ping h6
PING 10.0.4.3 (10.0.4.3) 56(84) bytes of data.
64 bytes from 10.0.4.3: icmp_seq=1 ttl=61 time=69.1 ms
64 bytes from 10.0.4.3: icmp_seq=2 ttl=61 time=28.7 ms
64 bytes from 10.0.4.3: icmp_seq=3 ttl=61 time=55.6 ms
64 bytes from 10.0.4.3: icmp_seq=4 ttl=61 time=33.4 ms
64 bytes from 10.0.4.3: icmp_seq=5 ttl=61 time=60.9 ms
64 bytes from 10.0.4.3: icmp_seq=6 ttl=61 time=20.8 ms
64 bytes from 10.0.4.3: icmp_seq=7 ttl=61 time=16.4 ms
64 bytes from 10.0.4.3: icmp_seq=8 ttl=61 time=44.2 ms
64 bytes from 10.0.4.3: icmp_seq=9 ttl=61 time=22.1 ms
64 bytes from 10.0.4.3: icmp_seq=10 ttl=61 time=49.3 ms
64 bytes from 10.0.4.3: icmp_seq=11 ttl=61 time=43.1 ms
64 bytes from 10.0.4.3: icmp_seq=12 ttl=61 time=34.8 ms
64 bytes from 10.0.4.3: icmp_seq=13 ttl=61 time=62.2 ms
64 bytes from 10.0.4.3: icmp_seq=14 ttl=61 time=40.4 ms
64 bytes from 10.0.4.3: icmp_seq=15 ttl=61 time=18.6 ms
64 bytes from 10.0.4.3: icmp_seq=16 ttl=61 time=60.6 ms
64 bytes from 10.0.4.3: icmp_seq=17 ttl=61 time=53.1 ms
64 bytes from 10.0.4.3: icmp_seq=18 ttl=61 time=32.1 ms
64 bytes from 10.0.4.3: icmp_seq=19 ttl=61 time=60.5 ms
64 bytes from 10.0.4.3: icmp_seq=20 ttl=61 time=36.9 ms
```

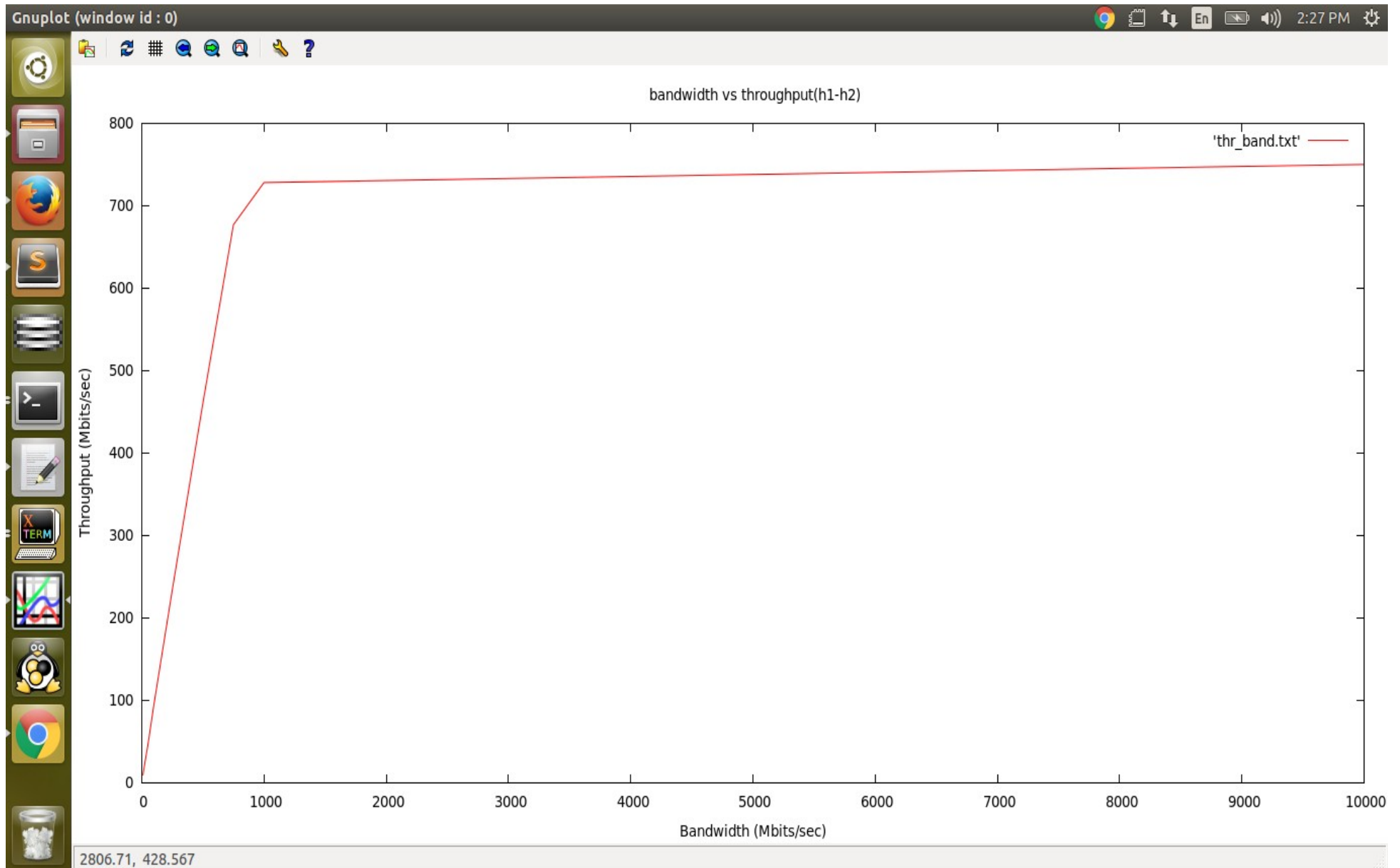
Q 5,6,7,8

- Refer folder wireshark_screenshot
- You can observe network and destination host unreachable behavior
- You can also see trace route behavior in pcap file
- Middle host are sending Time to live exceeded message and final destination is sending Echo Reply message

Plot of Bandwidth vs throughput (h1-h6) for UDP



Plot of bandwidth vs throughput (h1-h2) for UDP



Observations from ping h1-H*

- As you can see the ping screen shots that time taken for ping from h1-h* increases with number for hops between h1-h*.

so ping time for h1-h6 > h1-h2

- For any Ping H1-H* :

First ping taken more time than subsequent pings since in the first ping router does an ARP query to find next hop HW address after that it caches that address.

Observations from ping h2 to unreachable IP

- For this case ICMP reply type to `TYPE_DEST_UNREACH`
- And then we set code for unreachable in two ways
 - Network unreachable : router first checks whether the destination network exists or not. If it doesn't
it sets code to `CODE_UNREACH_NET`
 - Host unreachable : it destination network exists it forwards packet to the next Hop using routing table. Once the packet reaches to that networks gateway router it checks whether host exists or not. If destination Host doesn't exist set
code to `CODE_UNREACH_HOST`

You can see this behavior in the wireshark traces of that ping.

Observations from iperf with UDP

- Since every channel has a maximum data rate which it can support hence throughput does not always increase with bandwidth. After some bandwidth it becomes constant. Initially it increases linearly with bandwidth.
- Max. Throughput for H1-H6 UDP – 768 Mb/sec
- Max. Throughput for H1-H2 UDP – 750 Mb/sec

Contribution Table

- Every one equally contributed to assignment