Lab 4 - Cpre 489

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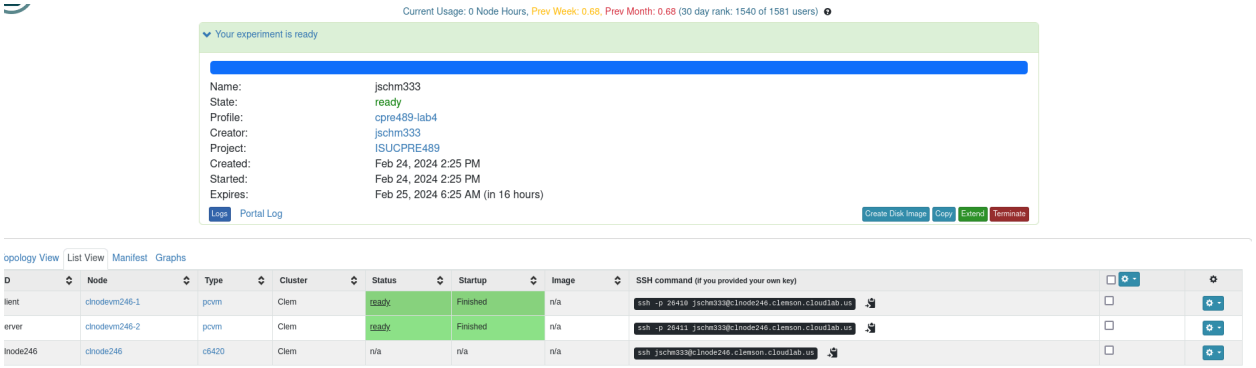
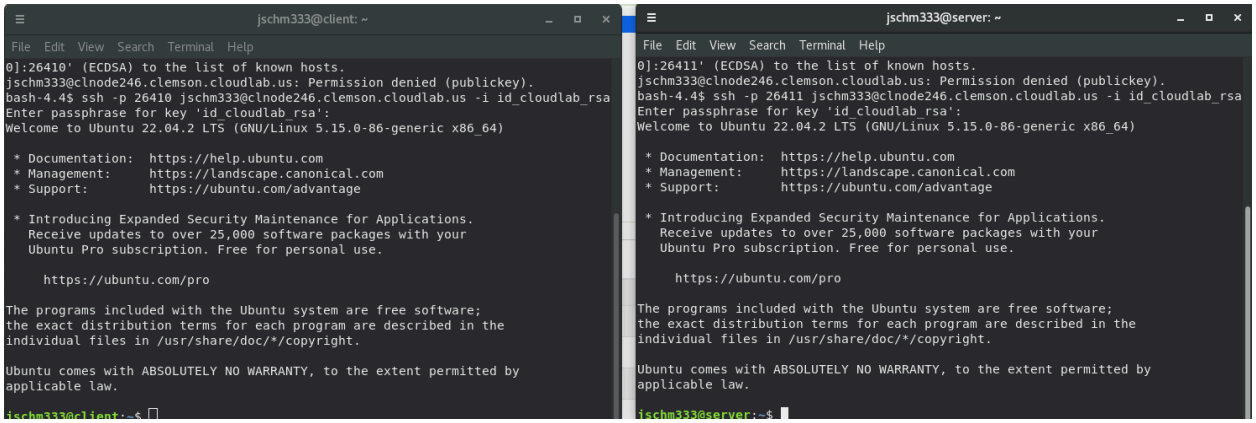
Exercise 1:



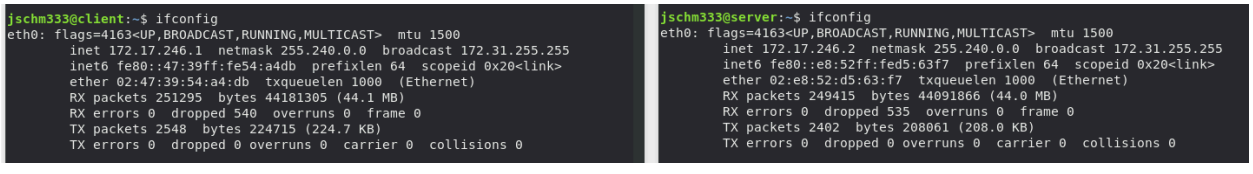
Exercise 2:



Exercise 3:

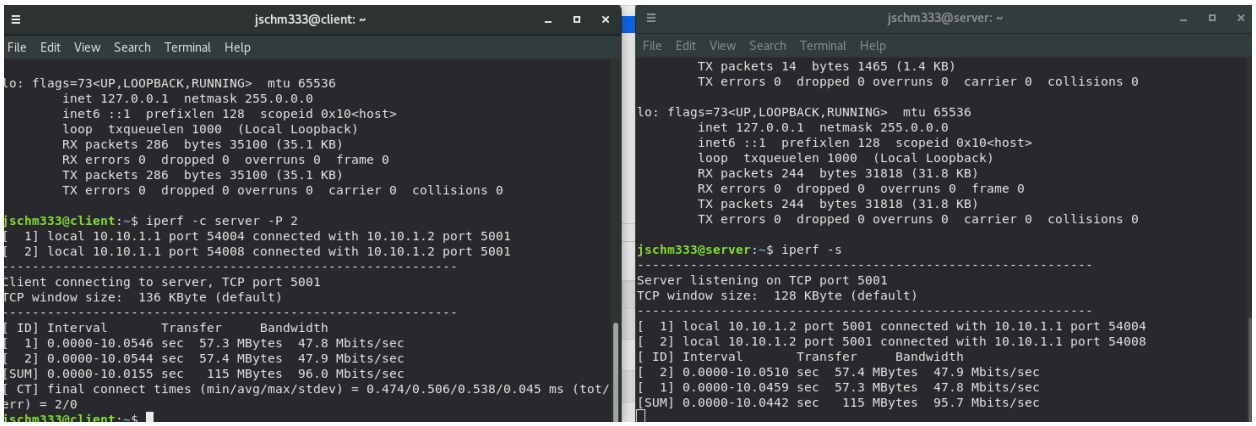
Client: 172.17.246.1

Server: 172.17.246.2



Exercise 4:

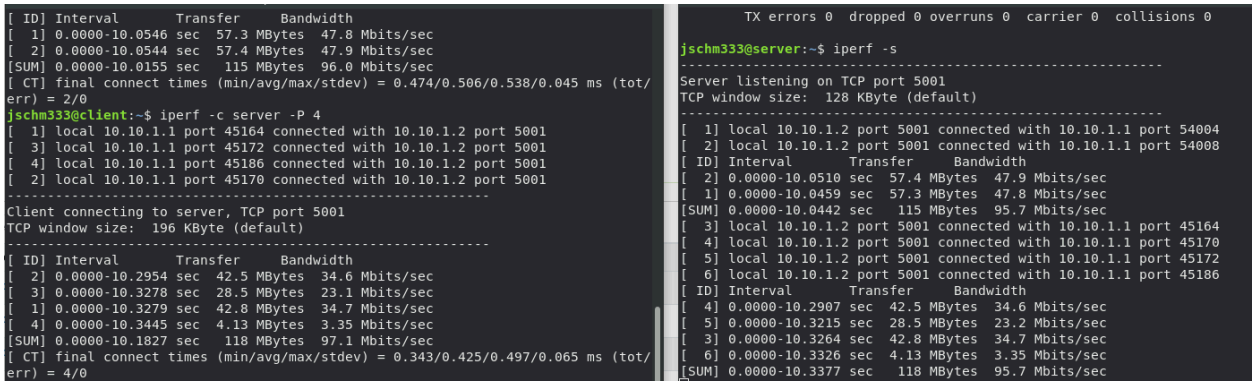
2 Tcp connections:



```
jschm333@client: ~
File  Edit  View  Search  Terminal  Help

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 286  bytes 35100 (35.1 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 286  bytes 35100 (35.1 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

jschm333@client:~$ iperf -c server -P 2
[  1] local 10.10.1.1 port 54004 connected with 10.10.1.2 port 5001
[  2] local 10.10.1.1 port 54008 connected with 10.10.1.2 port 5001
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size:  136 KByte (default)
------------------------------------------------------------
[ ID] Interval       Transfer     Bandwidth
[  1] 0.0000-10.0546 sec  57.3 MBytes  47.8 Mbits/sec
[  2] 0.0000-10.0544 sec  57.4 MBytes  47.9 Mbits/sec
[SUM] 0.0000-10.0155 sec   115 MBytes  96.0 Mbits/sec
[ CT] final connect times (min/avg/max/stdev) = 0.474/0.506/0.538/0.045 ms (tot/
err) = 2/0
jschm333@client:~$
```

```
jschm333@server: ~
File  Edit  View  Search  Terminal  Help
        TX packets 14  bytes 1465 (1.4 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING>  mtu 65536
        inet 127.0.0.1  netmask 255.0.0.0
        inet6 ::1  prefixlen 128  scopeid 0x10<host>
        loop  txqueuelen 1000  (Local Loopback)
        RX packets 244  bytes 31818 (31.8 KB)
        RX errors 0  dropped 0  overruns 0  frame 0
        TX packets 244  bytes 31818 (31.8 KB)
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

jschm333@server:~$ iperf -s
------------------------------------------------------------
Server listening on TCP port 5001
TCP window size:  128 KByte (default)
------------------------------------------------------------
[  1] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 54004
[  2] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 54008
[ ID] Interval       Transfer     Bandwidth
[  2] 0.0000-10.0510 sec  57.4 MBytes  47.9 Mbits/sec
[  1] 0.0000-10.0459 sec  57.3 MBytes  47.8 Mbits/sec
[SUM] 0.0000-10.0442 sec   115 MBytes  95.7 Mbits/sec
```

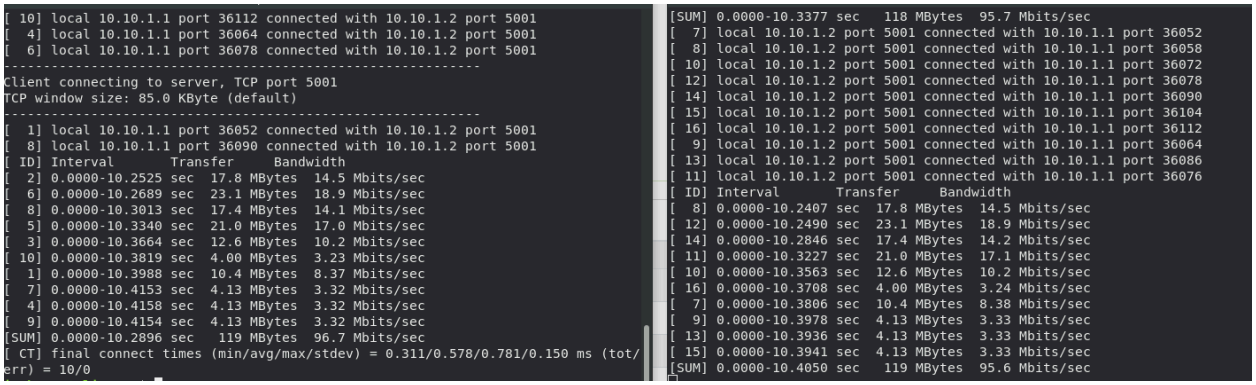
4 Tcp connections:



```
[ ID] Interval       Transfer     Bandwidth
[  1] 0.0000-10.0546 sec  57.3 MBytes  47.8 Mbits/sec
[  2] 0.0000-10.0544 sec  57.4 MBytes  47.9 Mbits/sec
[SUM] 0.0000-10.0155 sec   115 MBytes  96.0 Mbits/sec
[ CT] final connect times (min/avg/max/stdev) = 0.474/0.506/0.538/0.045 ms (tot/
err) = 2/0
jschm333@client:~$ iperf -c server -P 4
[  1] local 10.10.1.1 port 45164 connected with 10.10.1.2 port 5001
[  3] local 10.10.1.1 port 45172 connected with 10.10.1.2 port 5001
[  4] local 10.10.1.1 port 45186 connected with 10.10.1.2 port 5001
[  2] local 10.10.1.1 port 45170 connected with 10.10.1.2 port 5001
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size:  196 KByte (default)
------------------------------------------------------------
[ ID] Interval       Transfer     Bandwidth
[  2] 0.0000-10.2954 sec  42.5 MBytes  34.6 Mbits/sec
[  3] 0.0000-10.3278 sec  28.5 MBytes  23.1 Mbits/sec
[  1] 0.0000-10.3279 sec  42.8 MBytes  34.7 Mbits/sec
[  4] 0.0000-10.3445 sec  4.13 MBytes  3.35 Mbits/sec
[SUM] 0.0000-10.1827 sec   118 MBytes  97.1 Mbits/sec
[ CT] final connect times (min/avg/max/stdev) = 0.343/0.425/0.497/0.065 ms (tot/
err) = 4/0
```

```
        TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0

jschm333@server:~$ iperf -s
------------------------------------------------------------
Server listening on TCP port 5001
TCP window size:  128 KByte (default)
------------------------------------------------------------
[  1] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 54004
[  2] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 54008
[ ID] Interval       Transfer     Bandwidth
[  2] 0.0000-10.0510 sec  57.4 MBytes  47.9 Mbits/sec
[  1] 0.0000-10.0459 sec  57.3 MBytes  47.8 Mbits/sec
[SUM] 0.0000-10.0442 sec   115 MBytes  95.7 Mbits/sec
[  3] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 45164
[  4] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 45170
[  5] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 45172
[  6] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 45186
[ ID] Interval       Transfer     Bandwidth
[  4] 0.0000-10.2907 sec  42.5 MBytes  34.6 Mbits/sec
[  5] 0.0000-10.3215 sec  28.5 MBytes  23.2 Mbits/sec
[  3] 0.0000-10.3264 sec  42.8 MBytes  34.7 Mbits/sec
[  6] 0.0000-10.3326 sec  4.13 MBytes  3.35 Mbits/sec
[SUM] 0.0000-10.3377 sec   118 MBytes  95.7 Mbits/sec
```

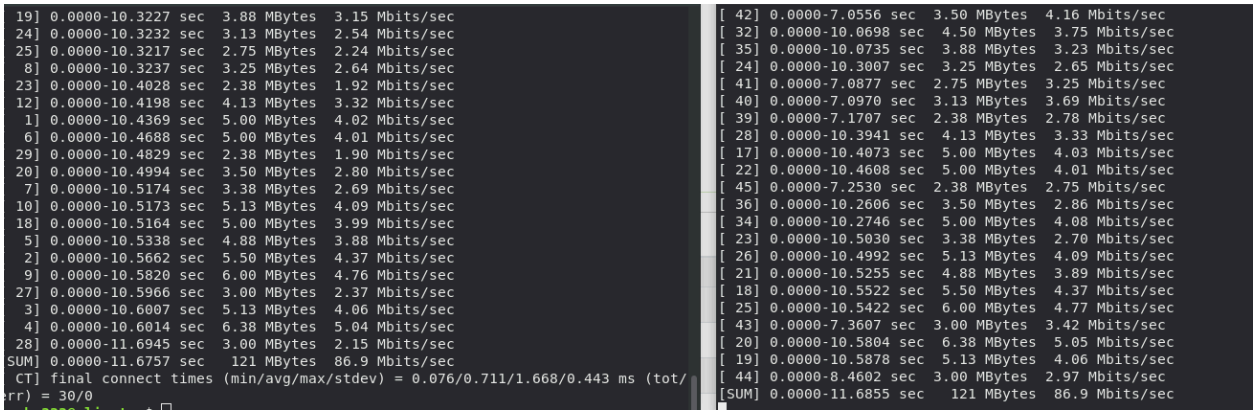
10 Tcp connections:



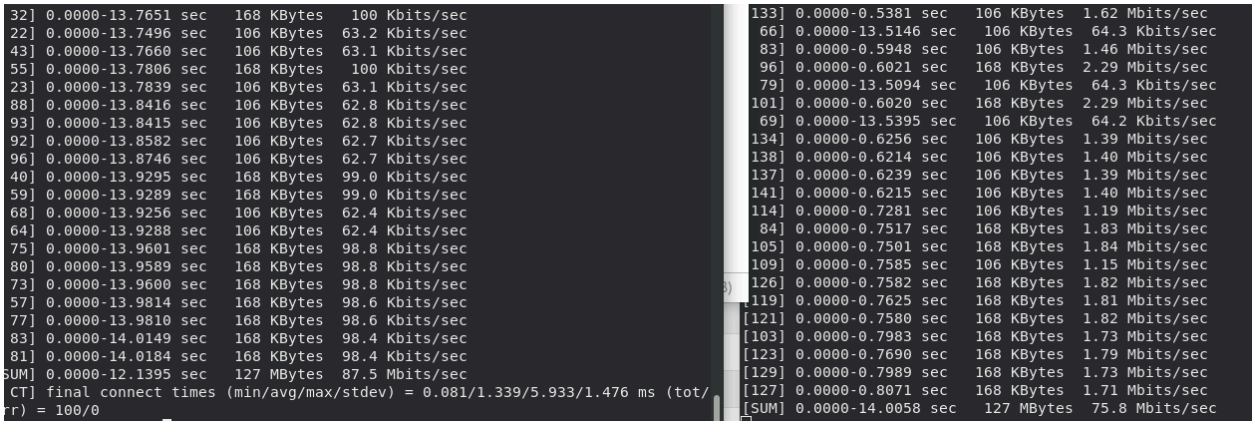
```
[ 10] local 10.10.1.1 port 36112 connected with 10.10.1.2 port 5001
[  4] local 10.10.1.1 port 36064 connected with 10.10.1.2 port 5001
[  6] local 10.10.1.1 port 36078 connected with 10.10.1.2 port 5001
------------------------------------------------------------
Client connecting to server, TCP port 5001
TCP window size: 85.0 KByte (default)
------------------------------------------------------------
[  1] local 10.10.1.1 port 36052 connected with 10.10.1.2 port 5001
[  8] local 10.10.1.1 port 36090 connected with 10.10.1.2 port 5001
[ ID] Interval       Transfer     Bandwidth
[  2] 0.0000-10.2525 sec  17.8 MBytes  14.5 Mbits/sec
[  6] 0.0000-10.2689 sec  23.1 MBytes  18.9 Mbits/sec
[  8] 0.0000-10.3013 sec  17.4 MBytes  14.1 Mbits/sec
[  5] 0.0000-10.3340 sec  21.0 MBytes  17.0 Mbits/sec
[  3] 0.0000-10.3664 sec  12.6 MBytes  10.2 Mbits/sec
[ 10] 0.0000-10.3819 sec  4.00 MBytes  3.23 Mbits/sec
[  1] 0.0000-10.3988 sec  10.4 MBytes  8.37 Mbits/sec
[  7] 0.0000-10.4153 sec  4.13 MBytes  3.32 Mbits/sec
[  4] 0.0000-10.4158 sec  4.13 MBytes  3.32 Mbits/sec
[  9] 0.0000-10.4154 sec  4.13 MBytes  3.32 Mbits/sec
[SUM] 0.0000-10.2896 sec   119 MBytes  96.7 Mbits/sec
[ CT] final connect times (min/avg/max/stdev) = 0.311/0.578/0.781/0.150 ms (tot/
err) = 10/0
```

```
[SUM] 0.0000-10.3377 sec   118 MBytes  95.7 Mbits/sec
[  7] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36052
[  8] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36058
[ 10] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36072
[ 12] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36078
[ 14] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36090
[ 15] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36104
[ 16] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36112
[  9] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36064
[ 13] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36086
[ 11] local 10.10.1.2 port 5001 connected with 10.10.1.1 port 36076
[ ID] Interval       Transfer     Bandwidth
[  8] 0.0000-10.2407 sec  17.8 MBytes  14.5 Mbits/sec
[ 12] 0.0000-10.2490 sec  23.1 MBytes  18.9 Mbits/sec
[ 14] 0.0000-10.2846 sec  17.4 MBytes  14.2 Mbits/sec
[ 11] 0.0000-10.3227 sec  21.0 MBytes  17.1 Mbits/sec
[ 10] 0.0000-10.3563 sec  12.6 MBytes  10.2 Mbits/sec
[ 16] 0.0000-10.3708 sec  4.00 MBytes  3.24 Mbits/sec
[  7] 0.0000-10.3806 sec  10.4 MBytes  8.38 Mbits/sec
[  9] 0.0000-10.3978 sec  4.13 MBytes  3.33 Mbits/sec
[ 13] 0.0000-10.3936 sec  4.13 MBytes  3.33 Mbits/sec
[ 15] 0.0000-10.3941 sec  4.13 MBytes  3.33 Mbits/sec
[SUM] 0.0000-10.4050 sec   119 MBytes  95.6 Mbits/sec
```

30 Tcp connections:

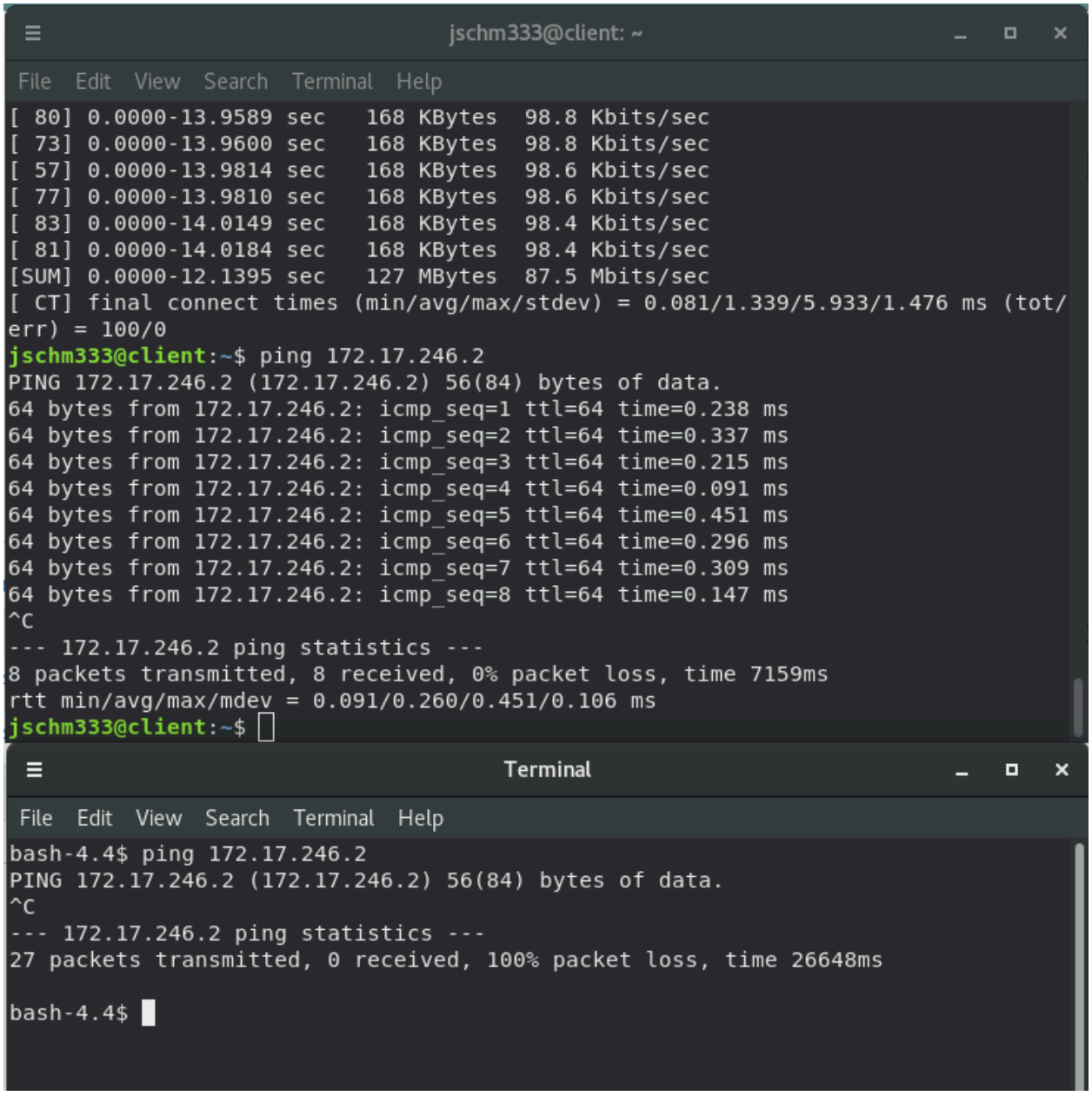


100 Tcp connections:

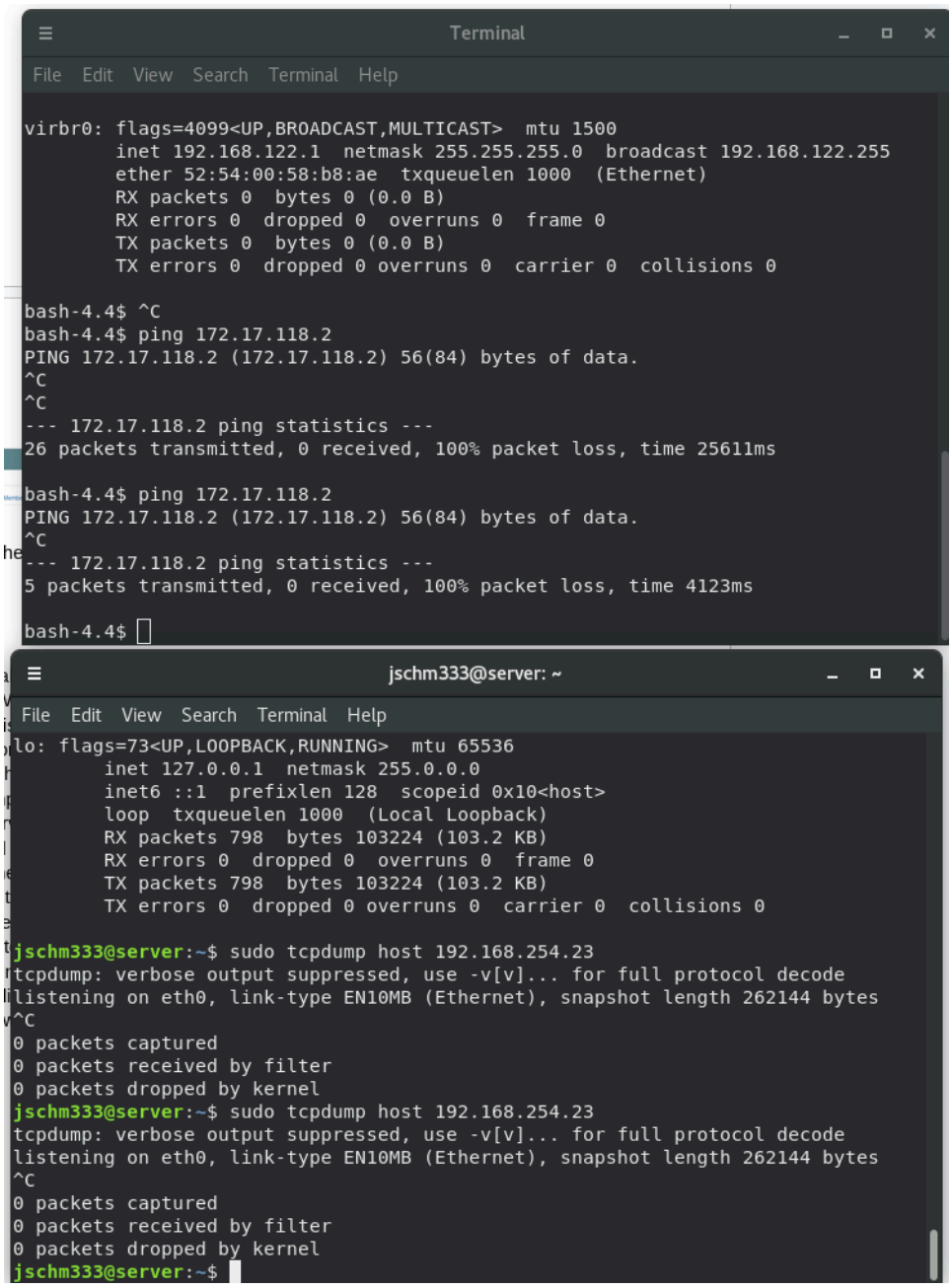


The total Mbits/sec or the sum stays the same throughout. Their individual connection speed goes down though. It basically divides the sum among the amount of the TCP connections but there are some outliers that get more that the others for example in the 100 one you can see some are down to 62 Kbits/sec but there are a couple that are at 100 Kbits/sec. So it divides it among the connections but not perfectly.

Exercise 5:



i.The client can access the server. You can see from the upper terminal, that 8 packets were transmitted and that 8 were received. That means the client and the server are in connection.
ii. The lower terminal shows my local pc trying to ping the server. As you can see 27 packets were transmitted but 0 were received. This means that things over the internet cannot access the server.



This shows the server running tcpdump with the ip of my computer pinging it. It got 0 packets from my computer and my computer received 0 back.

Experiment 6:

Showing I terminated the server.

Conclusion:
In this lab we learned about Cloudlab and how to interact with it. We set up an experiment with a client and a server. We then used ssh to connect to both the server and the client. Using this we were able to establish TCP connections between them. We also were able to call shell commands on them from using ssh. We called ifconfig in order to get the ips of both the client and the server. Using this ip we were able to try to ping the server. We did this with both the client and another computer that was on the internet. The client was able to establish a connection with the server and receive back packets. The computer over the internet was unable to and received no packets back. Another interesting thing we saw was that when we had multiple TCP connections the sum stayed relatively the same no matter the amount of TCP connections. The result though was that the individual connections suffered and they didn't have as big of a transfer rate. Another thing we did was secure ssh where we had to have a certain key to connect to our server and our client. Along with this key we had a passphrase that we had to insert to connect. If you didn't have this key or passphrase you were unable to ssh into the server or the client. Overall, this lab gave us a good intro to cloud lab and to internal networks and working with client server models.