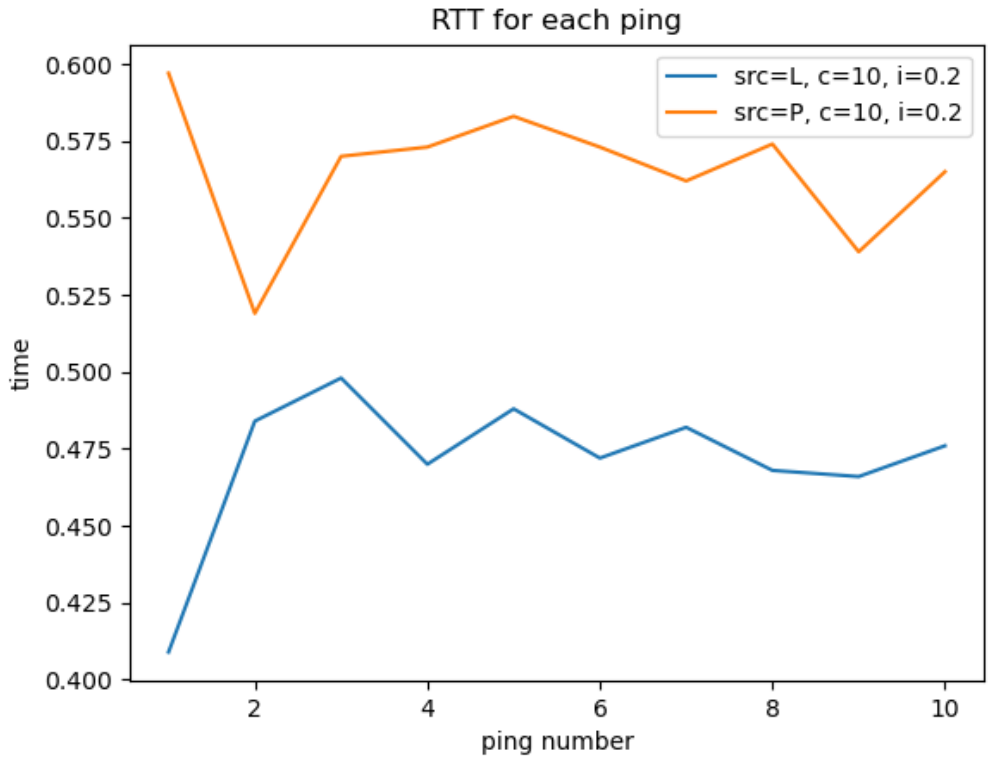
Exercise 2

Ping tests

1. Ping from the lab machine to the Raspberry Pi, 10 times, interval 0.2 seconds. *rtt min/avg/max/mdev = 0.409/0.471/0.498/0.022 ms*

2. Ping from the Raspberry Pi to the lab machine, 10 times, interval 0.2 seconds. *rtt min/avg/max/mdev = 0.519/0.565/0.597/0.020 ms*

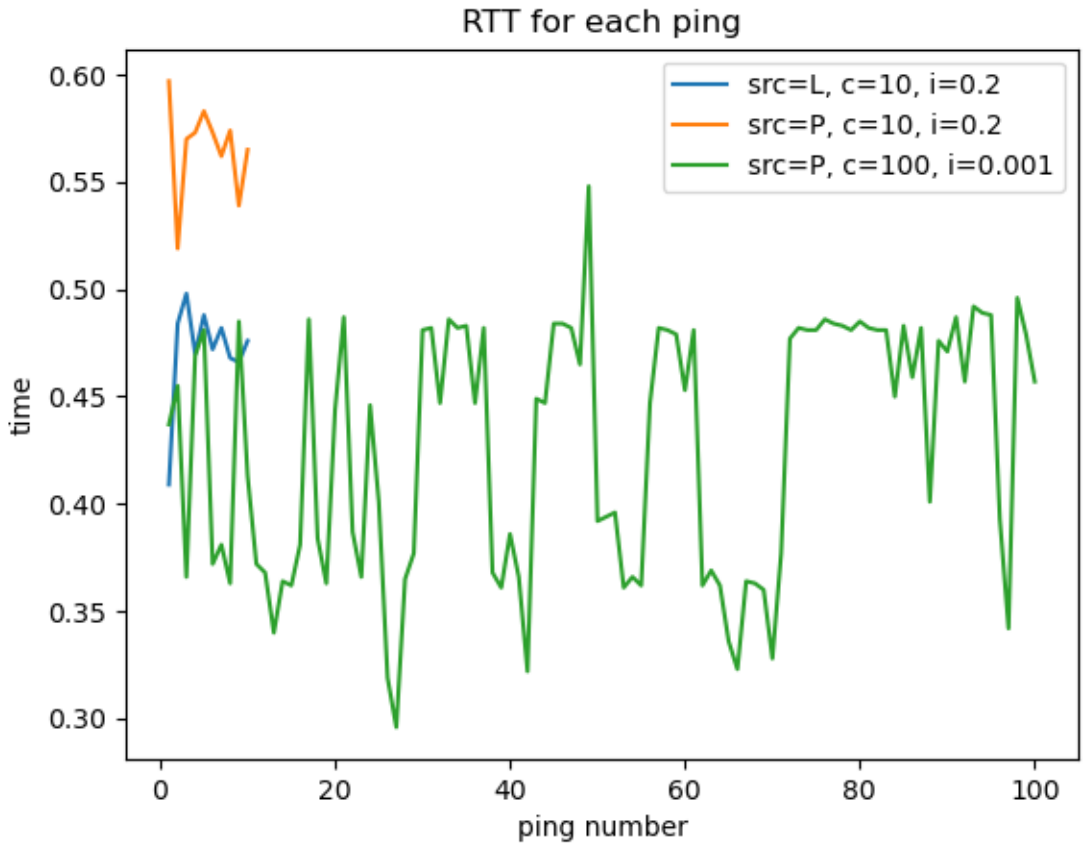
Quick graph:



Here, we see that the pings from the Raspberry Pi (P) take longer than the pings from the Linux workstation (L) when the raspberry pi is controlled by SSH.

3. Ping from the Raspberry Pi to the lab machine, 100 times, interval 0.001 seconds (use sudo). *rtt min/avg/max/mdev = 0.296/0.427/0.548/0.058 ms*

Another (very terrible) graph for a quick visual analysis:



What are the differences between minimum, mean and maximum results?

The numerical results are as follows:

All values in ms	Test 1	Test 2	Test 3
Minimum	0.409	0.519	0.296
Mean	0.471	0.565	0.427
Maximum	0.498	0.597	0.548

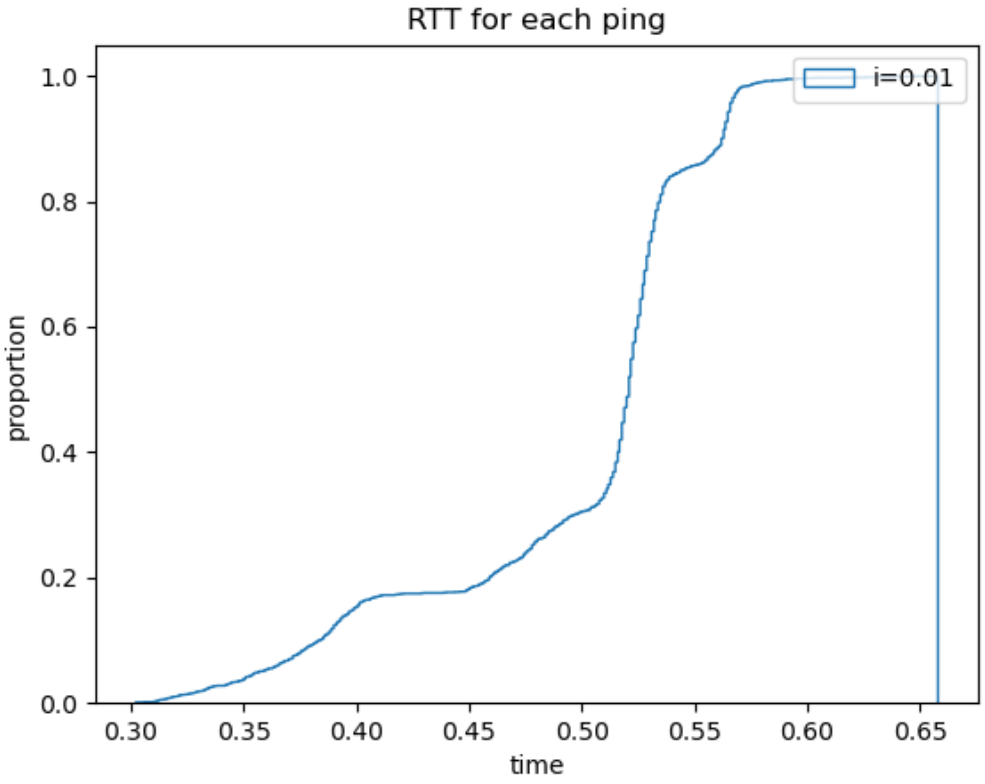
Visually from the graph, we can see that test 3 (the rapid pings from the Raspberry Pi) is the fastest. However, the spread of the data is much larger than the other tests; we can see that the minimum and the maximum are separated by a much greater time. But whether this is the result of the larger number of pings, or an inherent higher variance in the faster pings, is unclear from this data.

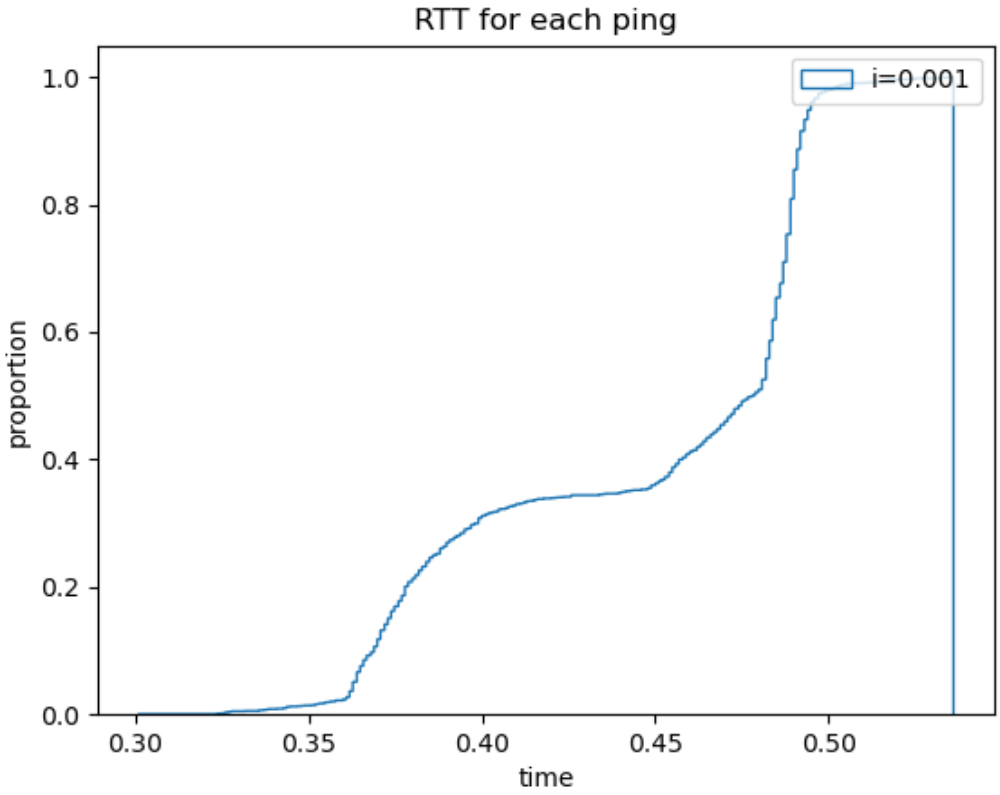
4. Ping from the Raspberry Pi to the lab machine, 10000 times using flooding (use

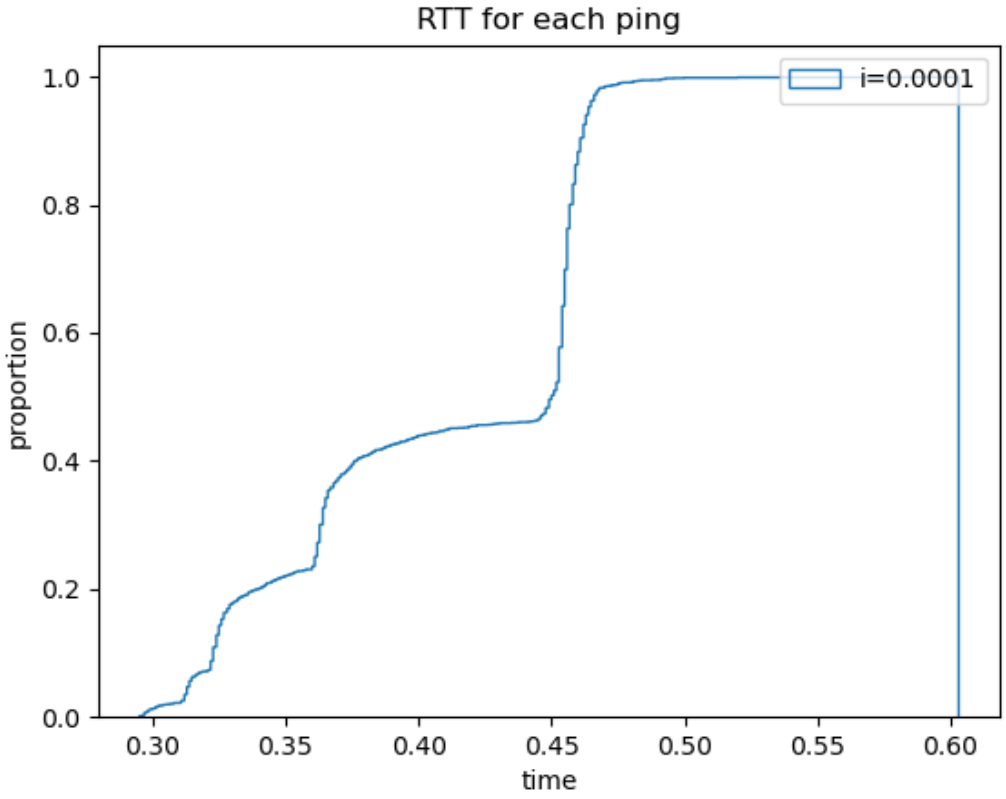
sudo). *rtt min/avg/max/mdev = 0.281/0.317/0.586/0.049 ms*
This took 3.5 seconds in total.

5. Ping from the Raspberry Pi to the lab machine. Run measurements with 3 different intervals (0.01, 0.001, 0.0001) and at least 1000 measurements, and draw a cdf of your measurements results (one graph per interval).

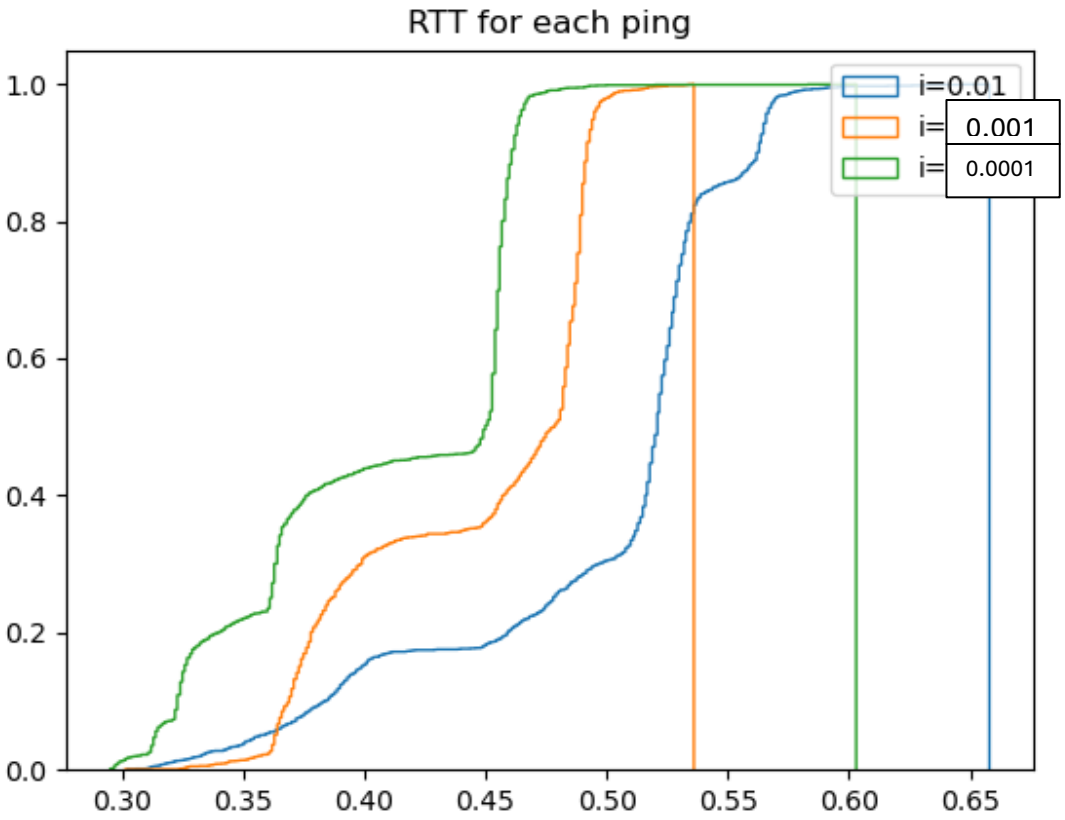
Unfortunately, there is an artifact (the vertical line on the right) due to the way the CDF plotting is implemented.


RTT for each ping
i=0.01
proportion
time
0.0
0.2
0.4
0.6
0.8
1.0
0.30
0.35
0.40
0.45
0.50
0.55
0.60
0.65


RTT for each ping
i=0.001
proportion
time
0.0
0.2
0.4
0.6
0.8
1.0
0.30
0.35
0.40
0.45
0.50



Bonus graph with all three together (again with erroneous vertical lines):



6. Can you speculate why different intervals lead to different round trip results? What do you estimate is the most accurate measured parameter (e.g., min, max, mean) that can be used to estimate propagation time between the two machines?

The different intervals might take different RTTs since the packets might arrive at times that are not in line with the clock.

The minimum measured time is the most accurate estimate for the actual propagation time, since any extra time is due to processing and not the packet travelling time.

iperf

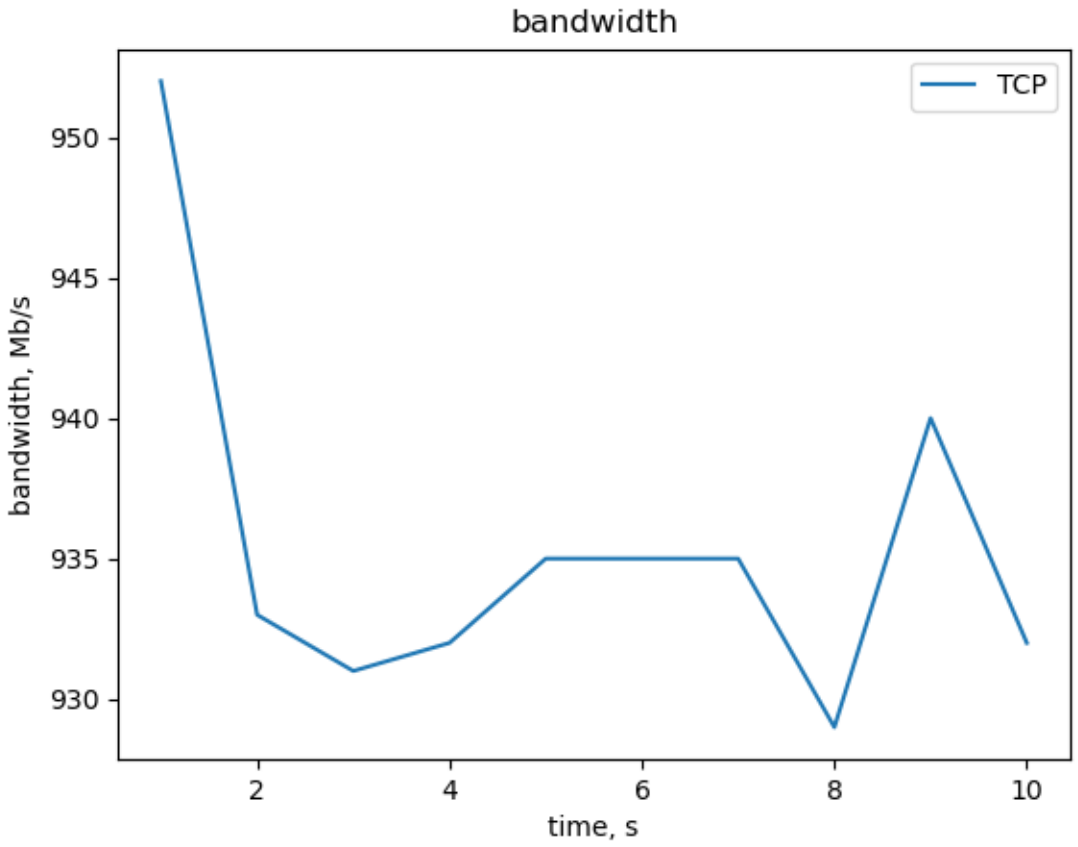
1. Set the lab machine as iperf server, and the Raspberry Pi as the client, and use iperf to measure the effective bandwidth between the two, using TCP and a 10 seconds long experiment.
Report the results.

Using *iperf -s –B 192.168.10.1* on the Linux workstation, and *iperf -c 192.168.10.1 -i 1 -t 10* directly on the RasPi, we get an average rate of about 112 MB/s with a bandwidth around ~950 Mb/s.

2. Set the Raspberry Pi as iperf server, and the lab machine as the client, and use iperf to measure the effective bandwidth between the two, using TCP, a 10 seconds long experiment, and 1 second interval.

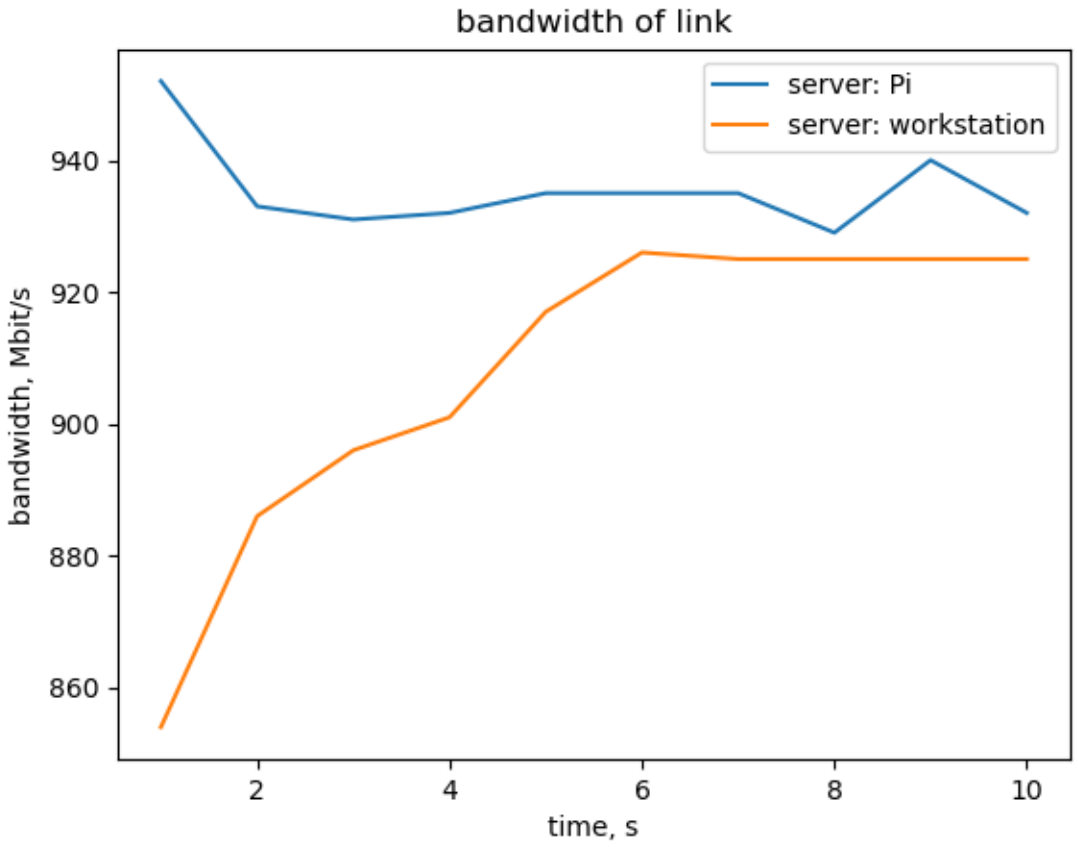
Swapping the two, we get a similar result of ~112 MB/s and ~950 Mb/s

We use *cat iperftest2.txt | grep 'MBytes' | awk '{print $5}'* to grab the lines with *MBytes* and choose the 5th space-delineated column.



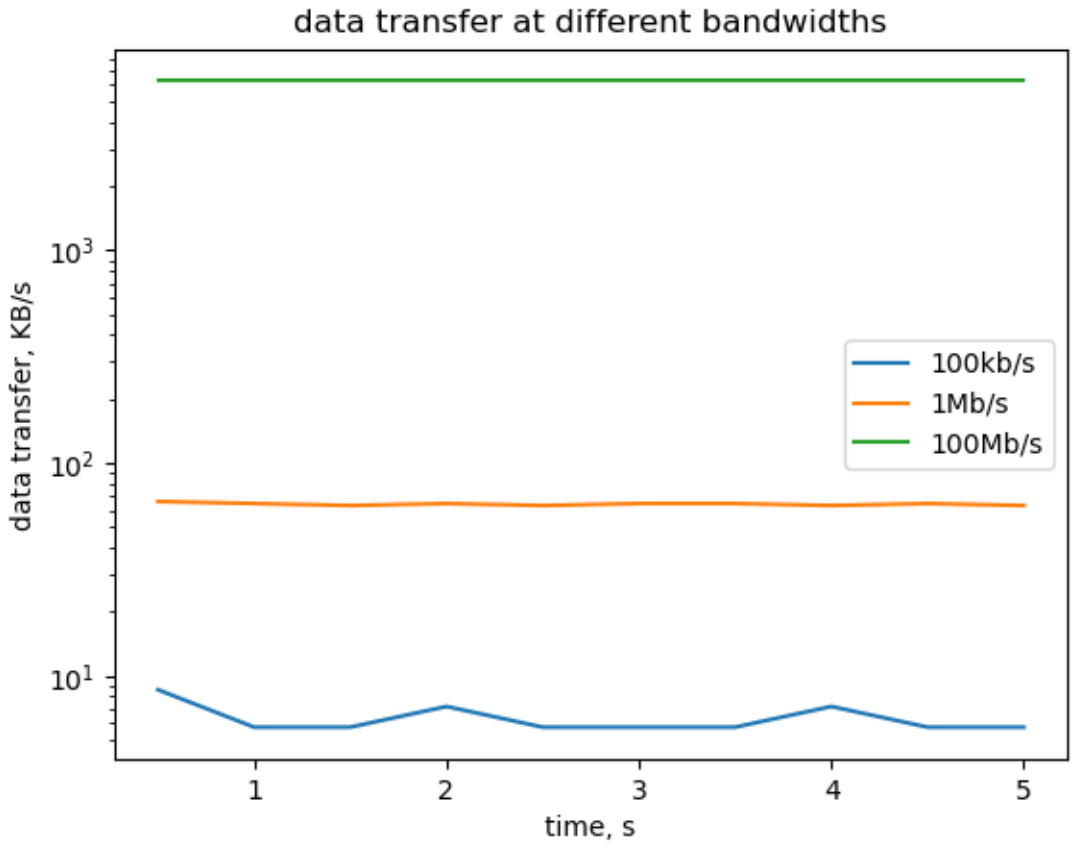
3. Set the Raspberry Pi as iperf server, and the lab machine as the client, and use bi-directional iperf to measure the effective bandwidth between the two, using TCP, a 10 seconds long
experiment, and 1 second interval.
Plot the measured bandwidth in each direction.

cat iperftest2_d.txt | grep 'MBytes' | grep '1]' | awk '{print $7}' > p1.txt



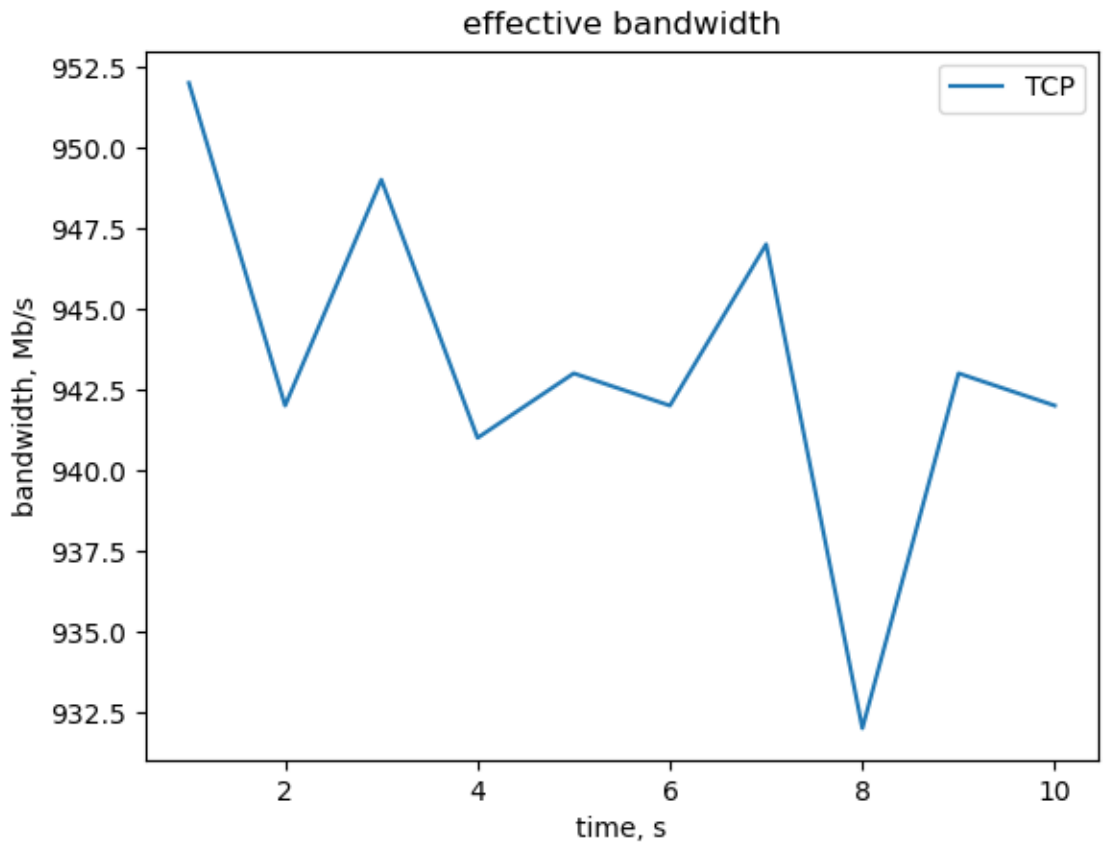
4. Run one way iperf using UDP, from the lab machine to the Raspberry Pi, 5 sec long, with varying bandwidth (100Kb/s, 1Mb/s, 100Mb/s).
None of the packets were dropped, so the graph of percentage packets lost wouldbe a flat line at 0%.

The results for data transfer are shown below:


data transfer at different bandwidths
data transfer, KB/s
10^3
10^2
10^1
1
2
3
4
5
time, s
100kb/s
1Mb/s
100Mb/s

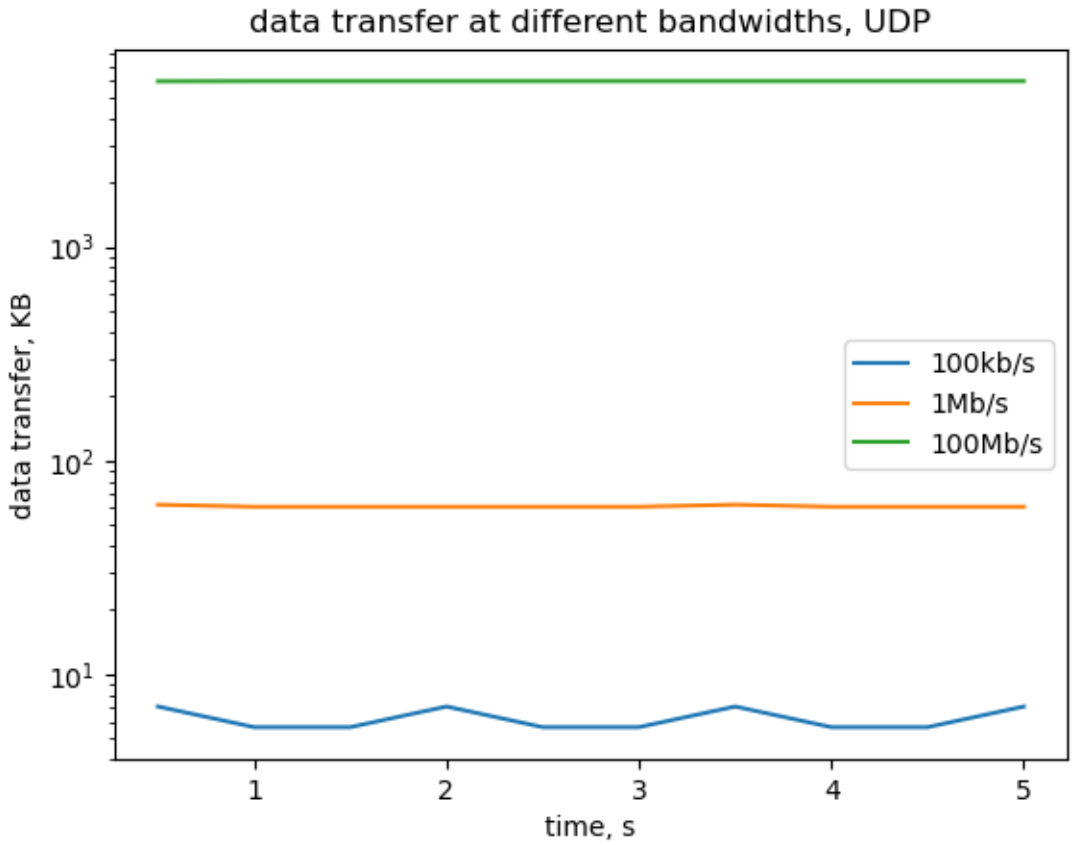
iperf3

1. Set the Raspberry Pi as iperf3 server, and the lab machine as the client, and use iperf3 to measure the effective bandwidth between the two, using TCP, a 10 seconds long experiment, and 1 second interval.



2. Run one way iperf3 using UDP, from the lab machine to the Raspberry Pi, 5 sec long, with varying bandwidth (100Kb/s, 1Mb/s, 100Mb/s).

The packet loss is still zero.



3. Discuss any observed differences between iperf and iperf3 results.
The data rate is approximately the same, but the variation is much lower for iperf3 compared to iperf.