Assignment 2
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CWM ProgNet TT22

1. Ping RasPi from the PC, 10 times, 0.2 seconds.
rtt min/avg/max/mdev = 0.367/0.419/0.481/0.032 ms

2. Ping PC from the RasPi, 10 times, 0.2 seconds.
rtt min/avg/max/mdev = 0.418/0.500/0.603/0.062 ms

Both measurements usually have high variance, but in general pinging the PC takes longer than the RasPi.

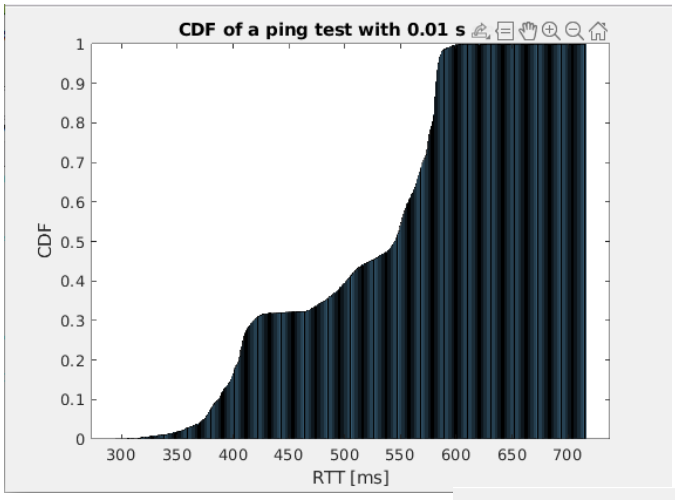
3. Ping PC from the RasPi. 100 times, 0.001 seconds.
rtt min/avg/max/mdev = 0.308/0.352/0.504/0.024 ms

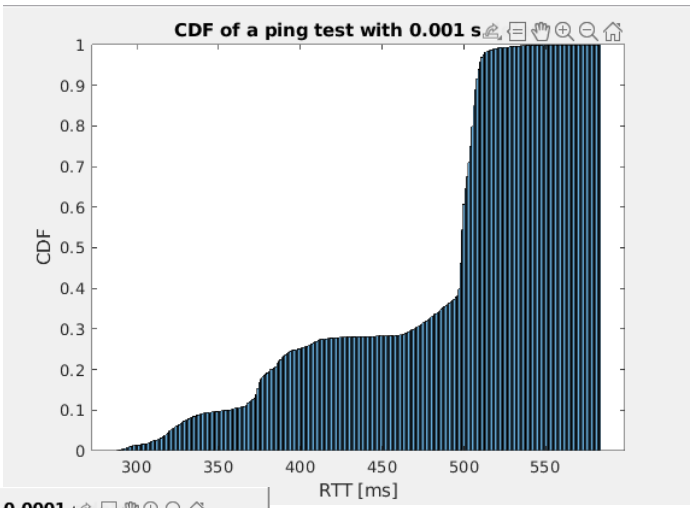
Reducing the interval between pings reduces the average. Most of the measurements are around the average with a number of outliers on both the high and low end.

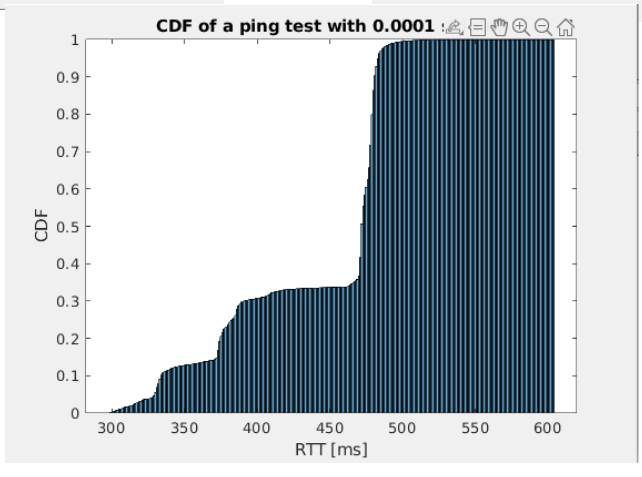
4. Ping PC from the RasPi, 10k times, flood.
rtt min/avg/max/mdev = 0.213/0.307/0.608/0.020 ms
ipg/ewma 0.357/0.325 ms

Continuing on from the previous part, reducing the interval to the minimum minimises the ping average.

5. Ping PC from the RasPi, 5k measurements, 3 different intervals (1E-2 to 1E-4 s)







All distributions have a peak at around 550ms which is most likely due to some underlying temporal process in either the PC or RasPi.

When using shorter intervals the PC is less likely to start other operations in between pings and hence will usually respond quicker.

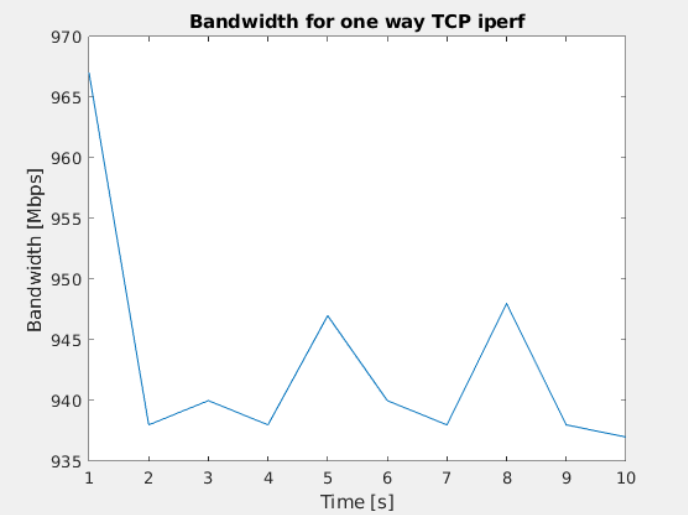
The average is the best estimate of the system delay, as there are two distinct groups of delay (seen by steep gradient of the CDF) and the average lies between them. Any outliers will statistically lie in both the high and low tail and “cancel out”.

6. PC as iperf server, one directional, TCP, 10 seconds

[ID]	Interval	Transfer	Bandwidth
[3]	0.0000-10.0040 sec	1.10 GBytes	941 Mbits/sec

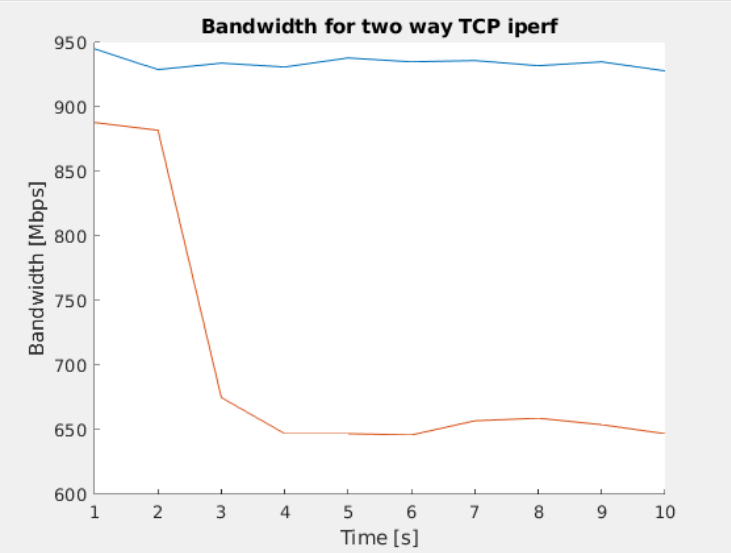
Bandwidth close to advertised (94% of 1Gbps)

7. RasPi as iperf server, one directional, TCP, 10 seconds, 1sec intervals



Overall bandwidth 941 Mbits/sec

8. RasPi as iperf server, bidirectional, TCP, 10 seconds, 1sec intervals



Transfer from PC to RasPi (blue line) has a much higher sustained bandwidth compared to the reverse.

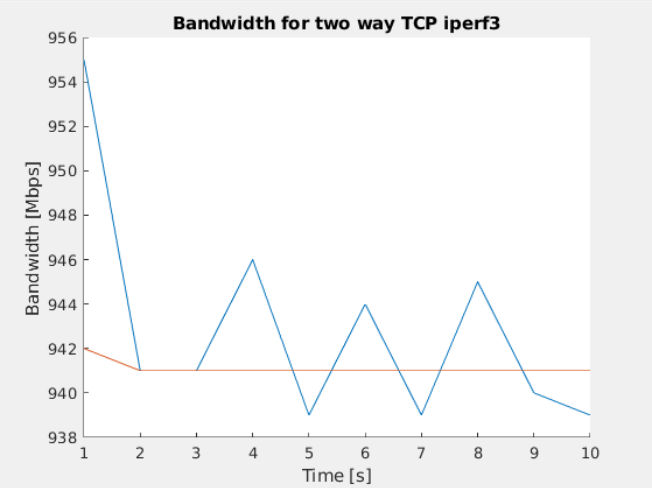
Overall bandwidth 943 Mbits/sec to RasPi and 700 Mbits/sec from RasPi

9. RasPi as iperf server, one directional, UDP, 5 seconds, varying bandwidth (100k, 1m, 100mb)

[ID]	Interval	Transfer	Bitrate	Jitter	Lost/Total Datagrams
[3]	0.0- 5.1 sec	61.7 KBytes	100 Kbits/sec	62.508 ms	0/ 43 (0%)
[3]	0.0- 5.0 sec	612 KBytes	1.00 Mbits/sec	0.008 ms	0/ 426 (0%)
[3]	0.0- 5.0 sec	59.6 MBytes	100 Mbits/sec	0.000 ms	0/42518 (0%)

High jitter at low bandwidth, but no packet loss at any of the bandwidths used.

10. RasPi as iperf3 server, bidirectional (not supported so using one normal and one reverse test), TCP, 10 seconds, 1sec intervals



Overall 941 Mbits/sec to RasPi and 941 Mbits/sec to PC.

RasPi is transmitting at the same speed as PC in iperf3, but might be the consequence of using two seperate tests instead of one bidirectional. Otherwise average speed is almost identical, but it is a lot more stable (especially for RasPi)

11. RasPi as iperf3 server, one directional, UDP, 5 seconds, varying bandwidth (100k, 1m, 100mb)

[ID]	Interval	Transfer	Bitrate	Jitter	Lost/Total Datagrams	
[5]	0.00-5.00 sec	62.2 KBytes	102 Kbits/sec	0.000 ms	0/44 (0%)	sender
[5]	0.00-5.00 sec	62.2 KBytes	102 Kbits/sec	0.006 ms	0/44 (0%)	receiver
[5]	0.00-5.00 sec	611 KBytes	1.00 Mbits/sec	0.000 ms	0/432 (0%)	sender
[5]	0.00-5.00 sec	611 KBytes	1.00 Mbits/sec	0.001 ms	0/432 (0%)	receiver

[5] 0.00-5.00 sec 59.6 MBytes 100 Mbits/sec 0.000 ms 0/43157 (0%) sender
[5] 0.00-5.00 sec 59.6 MBytes 100 Mbits/sec 0.010 ms 0/43157 (0%) receiver

No packet loss at any bandwidth and slight jitter at reception.
Experimentally, packet loss starts appearing at around 500Mbps (~0.1%) and quickly increases after that point.