Homework 1: Packet Delay + Measurement

Question 1 -

500 Byte ms	1000 Byte ms
10	11
2.8	10
2.4	2.8
4	3
5.5	5.5

Propogation + Transmission 500 Byte
2.4

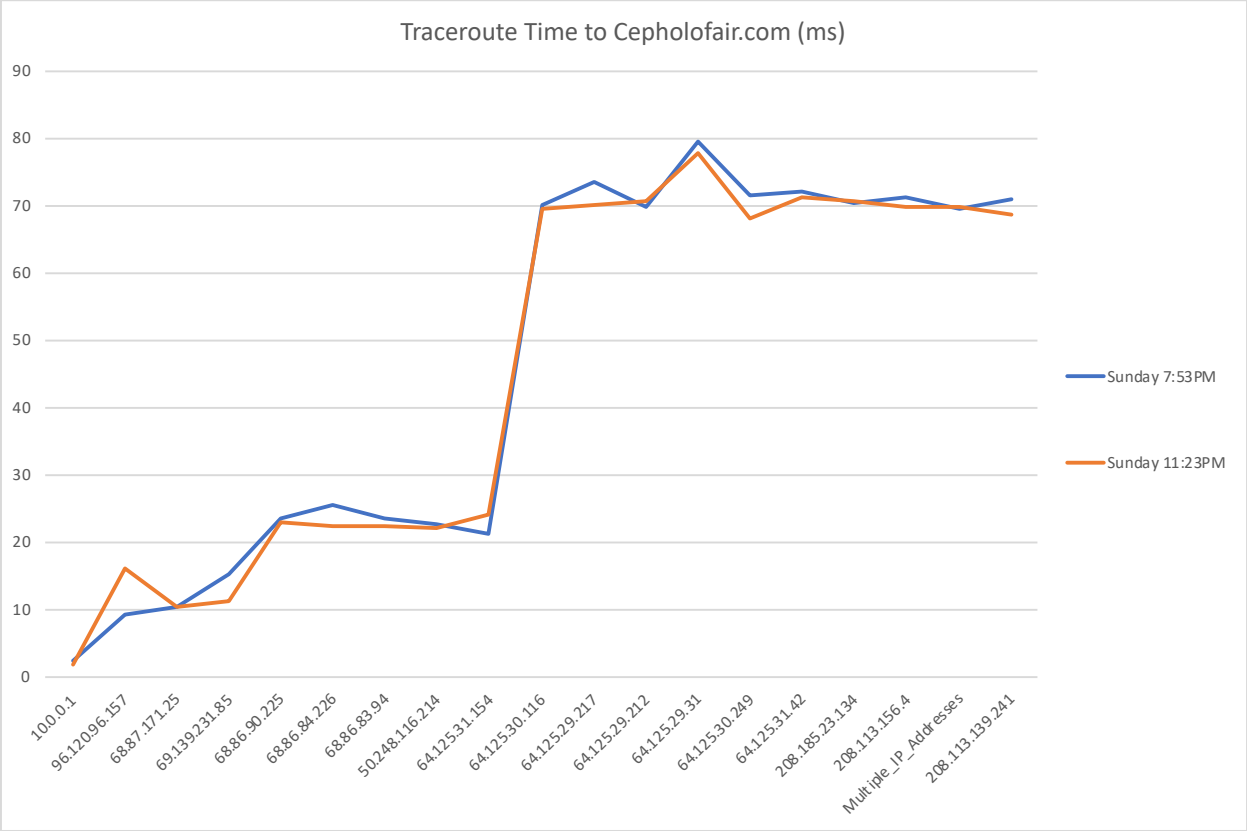
Propogation + Transmission 1000 Byte
2.8

	Average ms	Average Queuing Delay	Queuing	Propagation	Transmission
500 Bytes	4.94	2.54		0.4	2
1000 Bytes	6.46	3.66		0.8	2
		ms Delay/Byte -		0.0008	
600 Bytes				0.48	2

Given that the processing delay is negligible and the propagation and transmission delays are roughly constant for a given node with a given packet size, you can expect any variation in times to be caused by variation in queue delays. If we assume that our third sample (2.8ms - the smallest) has a queuing time of zero we can determine the average queuing time from there. We subtract 2.8ms from each sample and then take the average, which gives us an average queuing time of 3.66ms for a 1000 byte packet.

Since we have assumed that at 2.8ms the processing delay and queuing delay for a 1000 byte packet is zero we know that the combination of the Propagation and Transmission Delays should combine to 2.8. Using similar logic we can conclude that the Propagation and Transmission Delays combine to 2.4 for a 500 byte packet. Transmission should still be constant though, so any change in minimum time can be attributed to propagation delay and packet size. If we assume that propagation delay scales linearly with packet size we can assume that the propagation delay for a 1000 byte packet will be twice that of a 500 byte packet. That leads us to a transmission rate of 2ms and a propagation delay of .48ms for a 600 byte packet.

Question 1b -



Question 2b -

One reason for a delay in an individual traceroute value is that your packet transmission may have coincided with another large burst from another location and the queuing delay may have dramatically increased as a result. Another is that it's possible that your sent packet was corrupted somewhere along the way to the router and had to be resent.