

Bonus problem [20 pts]

Instruction

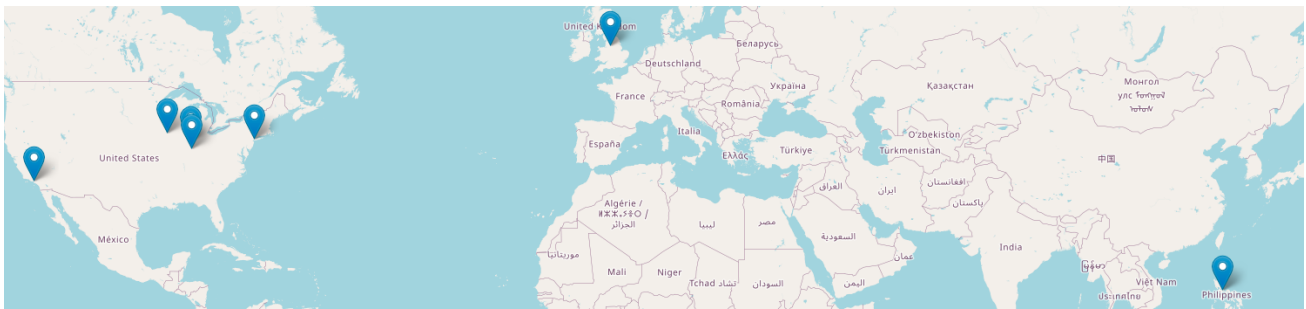
Use the ping application from one of our lab machines to measure the time it takes for a packet to reach the destination and receive a response, called the round-trip time (RTT). Do so for CS's web server www.cs.purdue.edu and IUPUI's web server www.iupui.edu in Indianapolis. Select five additional destinations: midwest, east coast, west coast, across the Atlantic, and across the Pacific. Some web servers of universities may be configured to ignore ping messages but it is not difficult to find many that will respond. For the 7 destinations, use a map to roughly estimate their physical distance from Purdue. Use SOL to calculate lower bounds of RTT for these destinations. Compare the lower bounds against the estimates obtained through ping. For each of the destinations, give your thoughts on what may be the main factors that result in the discrepancy. For example, if your distance estimate from Purdue is based on straight line distance, then the fact that communication lines follow indirect routes through major communication hubs might be one such factor. Whether this is a major factor you may determine by overestimating the physical distance from Purdue and checking if SOL latency is significantly impacted. Submit your answer in a pdf file, `lab1.pdf`, under `lab1/`.

The Bonus Problem is completely optional. It serves to provide additional exercises to understand the material. Bonus problems help more readily reach the 45% contributed by lab component to the course grade.

Answer

Selected Destinations

Destination	URL	IP Address	Estimated Physical Distance (km)	RTT Lower Bound (ms)	Estimated RTT (ms)
Purdue	www.cs.purdue.edu	128.10.19.120	1	0.007	0.397
IUPUI	www.iupui.edu	129.79.123.148	140	0.933	5.906
Midwest	bulletin.case.edu	12.2.169.179	409	2.727	13.511
East Coast	cs.nyu.edu	216.165.22.203	1090	7.267	25.779
West Coast	www.cs.ucla.edu	164.67.100.182	2861	19.073	50.741
Cross the Atlantic	www.manchester.ac.uk	130.88.101.57	6203	41.353	100.777
Cross the Pacific	upd.edu.ph	202.92.128.226	13267	88.447	240.461



Discrepancy Explanation

Destination	[Estimated RTT / RTT Lower Bound] Ratio
Purdue	56.71428571
IUPUI	6.330117899
Midwest	4.954528786
East Coast	3.547406082
West Coast	2.660357574
Cross the Atlantic	2.436993688
Cross the Pacific	2.718701595

From the ratio table, most of the discrepancy between the estimated RTT with ping command and the lower bound of RTT will reduce if the physical distance between two places increases. It is possible that when the physical distance is relatively short, the RTT is mainly subject to the overhead of the devices I/O and routing. Conversely, if the physical distance is relatively long, the speed of transmission would affect the RTT more.

Overall, the lower bound of the RTT is always much smaller than the estimated RTT. That is because, usually, the route between the source and destination would not be a straight line. Also, the route will not be directly connected generally. More routing means more overhead, possible queueing and package losses, which greatly increases the RTT.

For the connection oversea, another factor of the impact on the RTT could be the limited resource of international internet connectivity and the undersea cables.

To sum up, the estimated RTT will get closer to the lower bound if the length of the route is longer. The factor includes the indirect routing, queueing and device overhead.