I am so sorry for the late upload! I uploaded my code before the assignment was officially due, but resubmitted 2 hours and 40 minutes late because I was struggling getting some graphs to populate properly. I hope this is ok. Thank you!

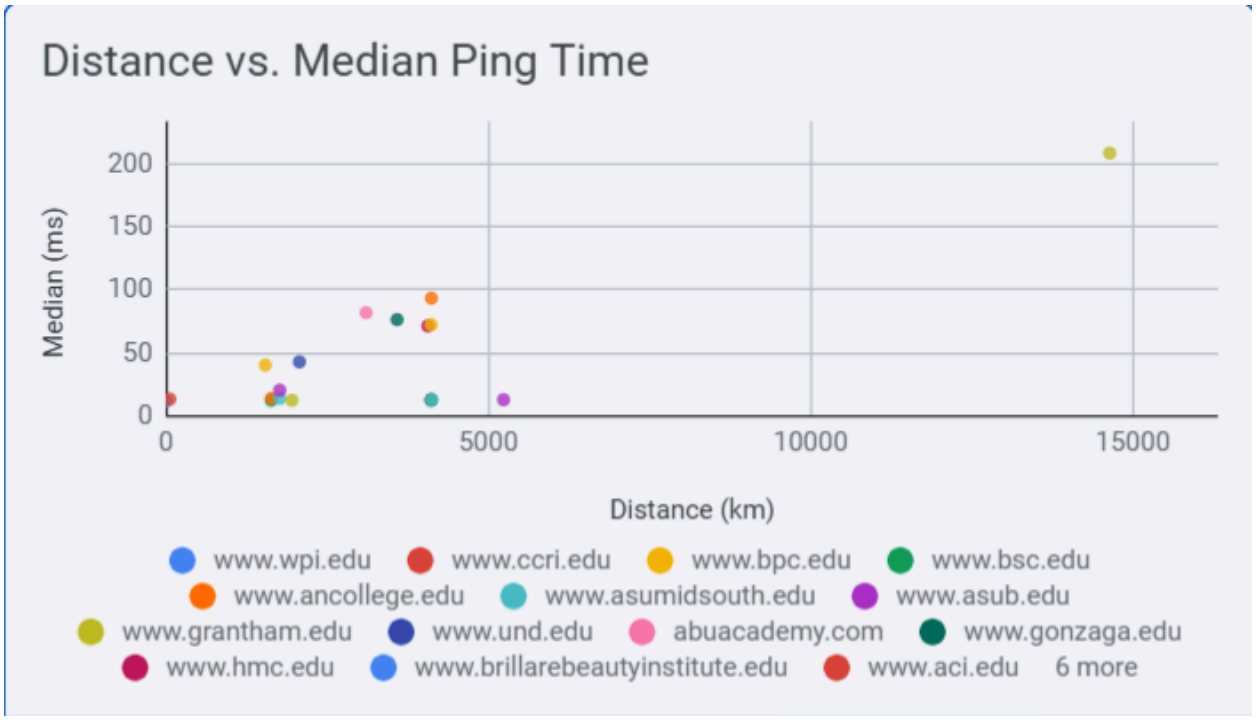
For this project I made a script that makes a connection with a web server.
It can be run using ./webclient [server_url] [option(-ping, -pkt, -info, -f, -nf)] [save_file_name].

If you run it with the -ping option, it returns the time in ms it takes to ping the webservers ip. It does not save the websites return in a save file.
If you run it with -pkt, it prints the time for each read and the number of bytes in each read when getting the website. It also does not save what the website returns in a save file.
If you run it with -info, it returns the rtt and rtt variance, and does not save the return values.
If you run it with -f, you can put in another argument with the file name you wish to save results to.
If you run it with -nf, instead of saving to a file it will print to the terminal.

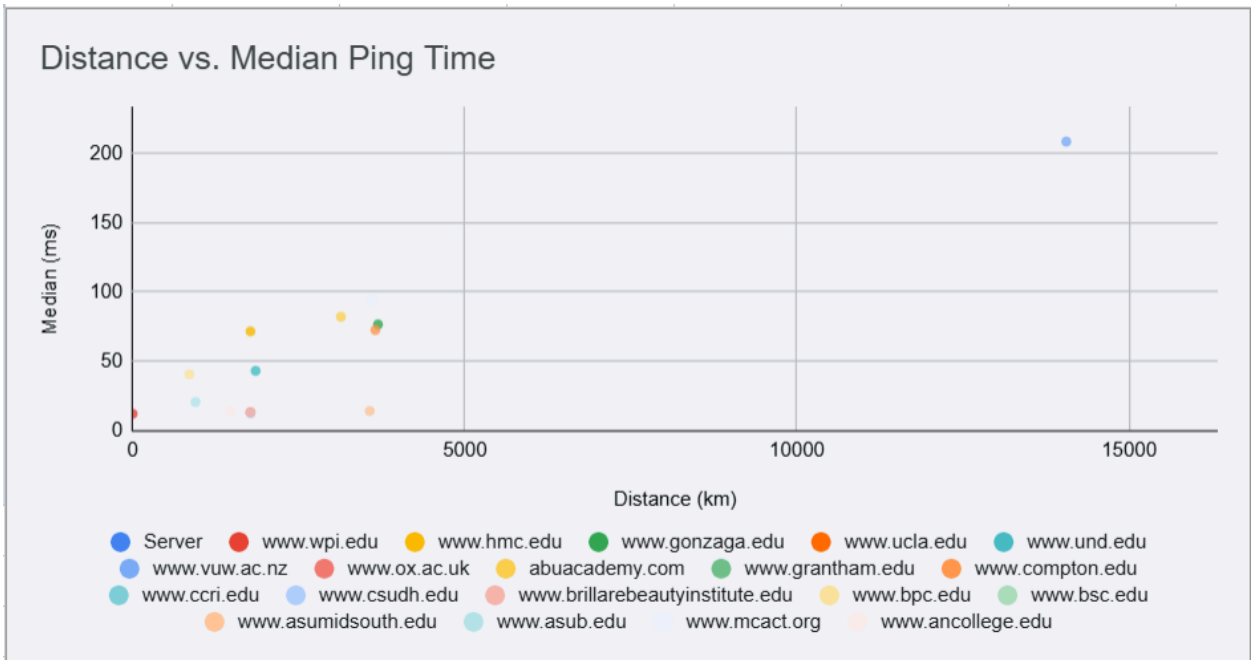
Ping

Server	IP	Min (ms)	Max (ms)	Median (ms)	Distance (km)
www.wpi.edu	184.73.245.212	12	12	12	0.3592317426
www.hmc.edu	66.33.202.112	71	72	71.5	4061.940594
www.gonzaga.edu	20.72.217.90	76	77	76.5	3585.096188
www.ucla.edu	3.171.61.25	12	13	13	4124.286835
www.und.edu	134.129.183.70	39	43	43	2070.132455
www.vuw.ac.nz	130.195.2.29	207	209	208.5	14640.91401
www.ox.ac.uk	104.20.34.13	13	13	13	5236.44691
abuacademy.com	162.241.218.55	74	90	82	3104.747553
www.grantham.edu	162.159.134.42	12	13	12.5	1954.004046
www.compton.edu	198.188.134.24	71	73	72.5	4114.578334
www.ccri.edu	104.18.14.201	13	14	13.5	60.15218449
www.csudh.edu	108.138.85.22	11	13	12.5	4115.904858
www.brillarebeautyinstitute.edu	141.193.213.20	12	13	13	4112.262814
www.bpc.edu	144.202.28.95	36	43	40.5	1540.719584

www.bsc.edu	104.26.0.60	12	13	12.5	1632.455004
www.asumidsouth.edu	192.124.249.158	13	14	14	1765.61542
www.asub.edu	66.42.127.164	19	21	20.5	1765.729374
www.aci.edu	141.193.213.20	12	13	13	4112.262814
www.mcact.org	103.224.182.253	92	94	93.5	4116.974184
www.ancollege.edu	34.149.87.45	13	14	14	1634.286801



There is a clear correlation between distance and ping time. As distance increases, the return time increases as well, with some variation depending on path, buffering, and other various factors. This is clear with Grantham, which is the furthest away and also has the highest median time to return,

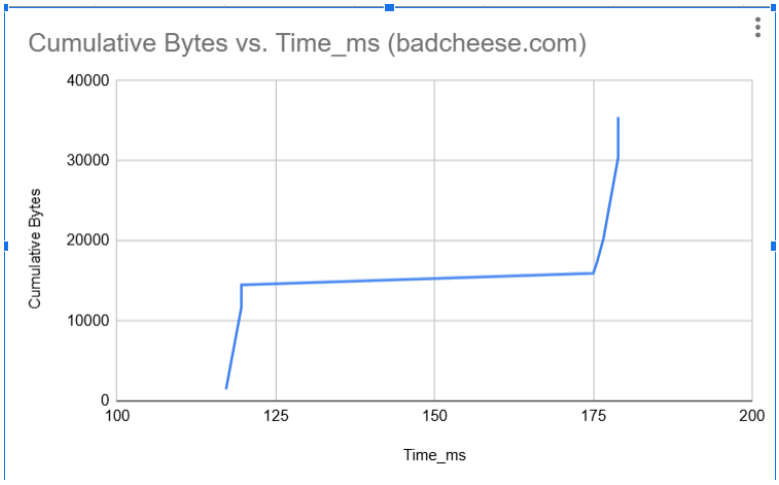


This chart shows the distance between servers. While the chart is similar, one notable difference is that several of the servers are hosted by cloudflare or aws - most of the cloud flare ones simply did not show up using maxmind, and several of the aws ones had the same ip, and therefore the same distance. However, overall, we can see a similar trend.

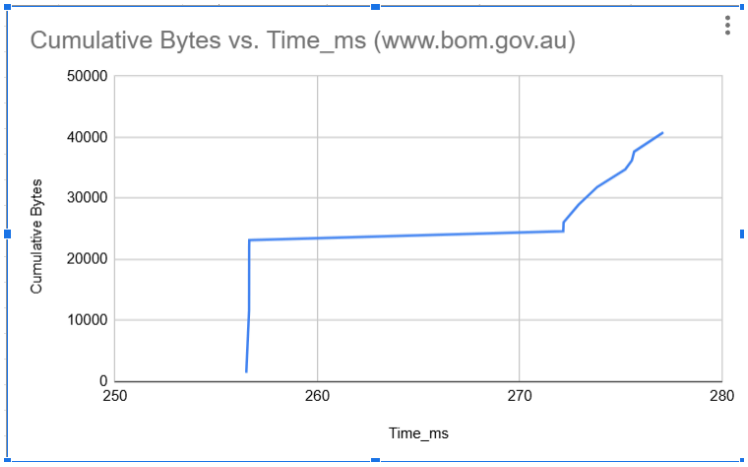
PKT

I used:

http://badcheese.com/: Max: 10240

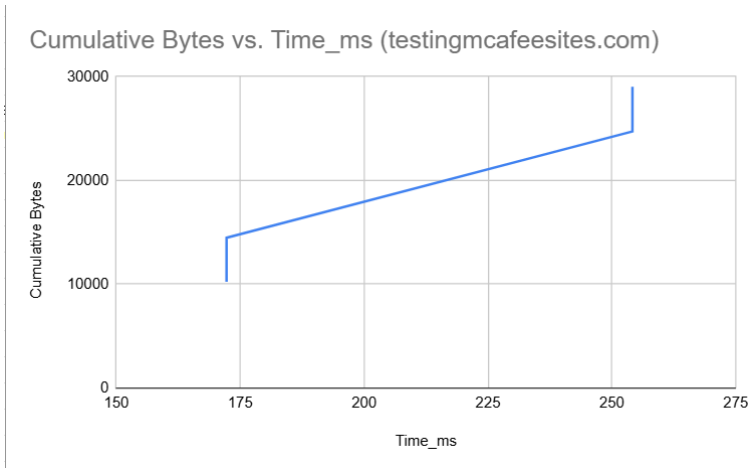


www.bom.gov.au: Max: 10240



http://www.testingmcafeesites.com/: Max: 10240

- Only gave 4 packets, but all the others I could find that returned larger amounts were ISO files that returned hundreds or thousands.



Analysis:

badcheese.com			www.bom.gov.au			www.testingmcafeesites.com		
Time_ms	Bytes	CumulativeBytes	Time_ms	Bytes	CumulativeBytes	Time_ms	Bytes	CumulativeBytes
117.157	1448	1448	256.484	1448	1448	172.241	10240	10240
119.566	10240	11688	256.622	10240	11688	172.247	4240	14480
119.57	2792	14480	256.626	10240	21928	254.152	10240	24720
174.978	1448	15928	256.632	1240	23168	254.157	4308	29028
175.597	1448	17376	272.148	1448	24616			
176.59	2896	20272	272.164	1448	26064			
178.907	10136	30408	272.902	2896	28960			
178.911	5042	35450	273.826	2896	31856			
			275.215	2896	34752			
			275.539	1448	36200			
			275.65	1448	37648			
			276.978	2896	40544			
			277.089	263	40807			

There were not particularly longer wait times between larger packets and smaller packets sending. All of the websites had some packets which sent a full buffer worth. It felt somewhat random how these sent data. These flights are not very well formed, and it was difficult to get a good amount of data as I was just not able to find good http websites to ping.

Info

For this section I got round trip time and the variance.

Server	TCP RTT (ms)	Variance (ms)	Ping (ms)
http://badcheese.com/	55.763	21.133	55
www.bom.gov.au	15.217	6.143	9
http://www.testingmcafesites.com/	83.076	31.448	84
www.wpi.edu	13.500	5.400	13
www.hmc.edu	71.801	27.289	72
www.gonzaga.edu	76.636	29.042	77
www.ucla.edu	13.500	5.460	14
www.und.edu	42.361	16.738	43
www.vuw.ac.nz	209.142	79.219	210
www.ox.ac.uk	13.451	5.552	13

The higher the round trip time became, the higher the variance as well. In comparison to ping, most measurements were extremely close. In fact, every ping measurement except for www.bom.gov.au was within 1ms of the measured tcp rtt. The www.bom.gov.au measurement was right on the edge of the variance.