Purpose

The experiment is for observing the effect that limiting the number of accessible CPUs/cores has on the parallel ping program. Because parallel computing utilizes the cores of a CPU in order to optimize runtime and overall performance, the progressive limitation of usable cores should, in theory, likely yield less pings per second.

System Requirements

Because the test utilizes up to eight cores, to exactly replicate the test, one must have at least 8 CPU cores available.

Instructions

Run the following code: `pping [-o output_file] [-p max_procs] {destinations...}` Output file is not necessary. The experiment tests the effects of CPU core limitation when the program pings to one (Google.com), two (Google.com, Facebook.com), and four addresses (Google.com, Facebook.com, Amazon.com, Twitter.com). For each set of addresses, the experimenter observes performance differences as the program utilizes from one to eight cores. Thus, max_procs spans from 1 to 8. The experimenter manually commands the program to stop collecting pings as soon as the program indicates that it has collected 2000 pings per address. From there, the overall pings/second and average ping per address are collected.
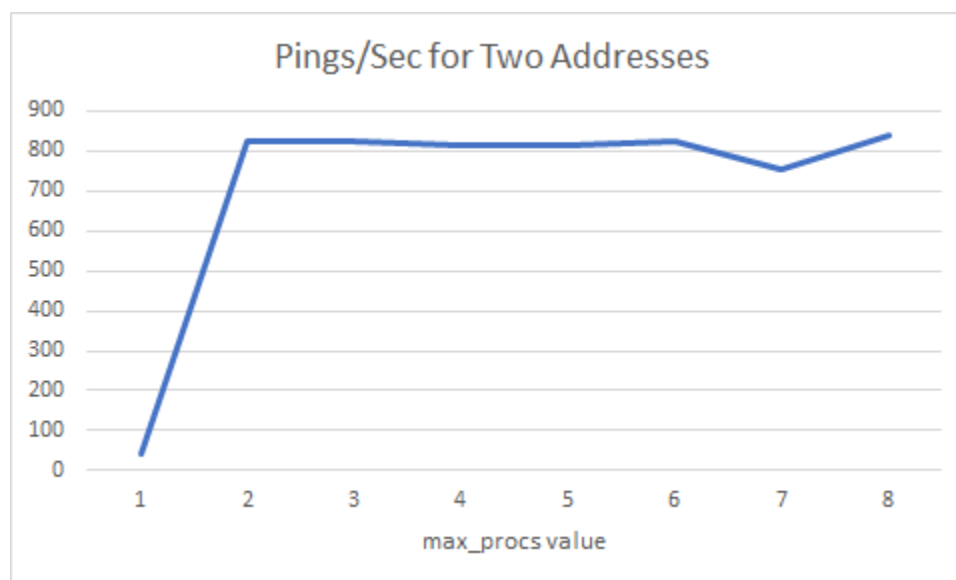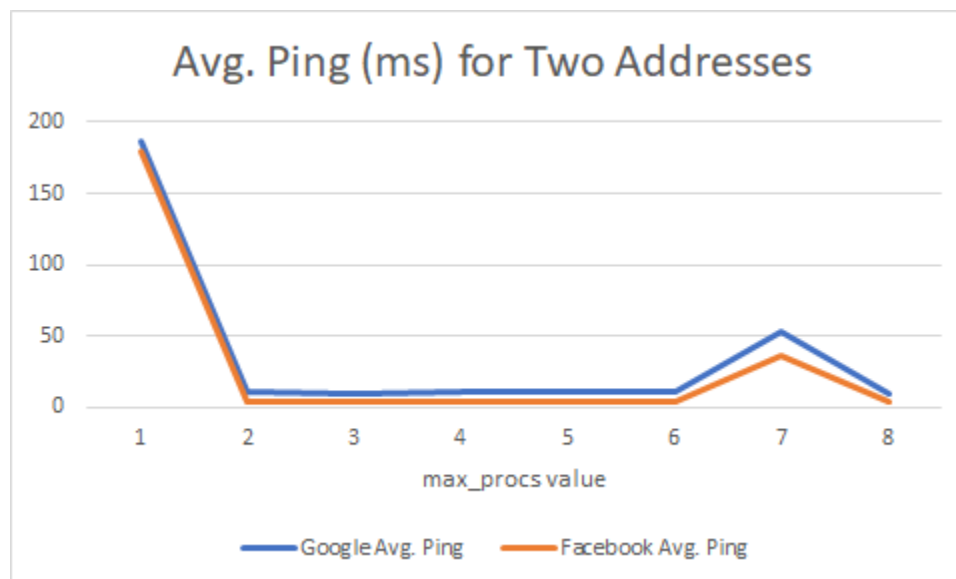
For the second experiment, we want to analyze how distance to the destination affects the ping time. Using the IP addresses listed in the table, we pinged all of them at the same time using a single execution of the command, and retrieved the average pings after 600 for each destination. We entered the distances by using Wolfram Alpha, querying "distance between boston and [destination]". The approximate time for light to travel through fiber was also provided by Wolfram Alpha, and seems to be approximately distance in miles / 132.

Results

GOMAXPROCESSES	Google Avg. Ping	Pings/Sec
1	76.07	40.8
2	8.4	841.05
3	8.34	846.85
4	8.33	846.51
5	8.44	844.75
6	8.37	843.66
7	8.4	843.04
8	8.32	846.1

Avg. Ping (ms) for One Address

Pings/Sec for Single Address
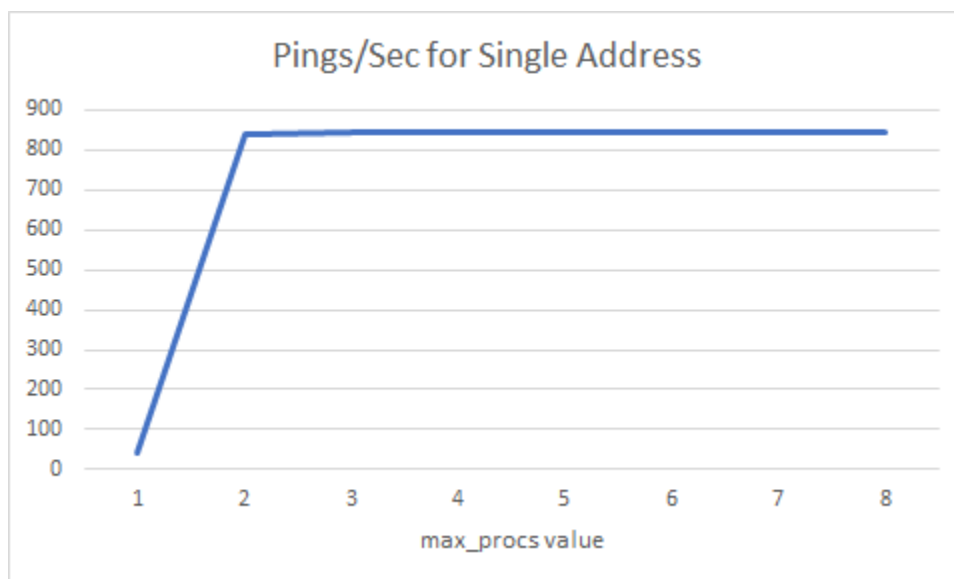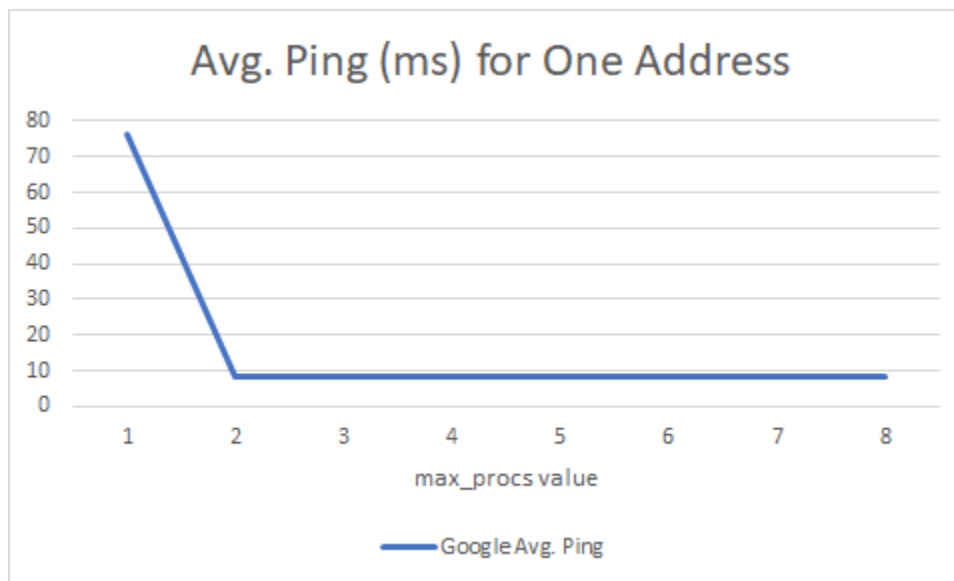
GOMAXPROCESSES	Google Avg. Ping	Facebook Avg. Ping	Pings/Sec
1	187.22	179.84	40.99
2	11.01	4.06	826.77
3	10.05	3.32	826.22
4	11.12	4.05	814.45
5	10.76	3.92	816.48
6	11.08	3.95	822.45
7	53.03	36.09	754.06
8	8.92	4.04	838.3

Avg. Ping (ms) for Two Addresses

Legend: Google Avg. Ping — Facebook Avg. Ping
x-axis: max_procs value

Pings/Sec for Two Addresses

x-axis: max_procs value

GOMAXPROCESSES	Google Avg. Ping	Facebook Avg. Ping	Amazon Avg. Ping	Twitter Avg. Ping	Pings/Sec
1	71.67	74.89	86.64	157.25	42.22
2	9.5	3.41	15.39	82.81	833.33
3	10.63	3.53	15.41	83.38	814.22
4	10.01	3.1	14.83	82.54	816.59
5	11.75	4.34	16.37	84.5	807.47
6	10.88	3.66	15.57	83.44	812.65
7	10.81	3.62	15.57	83.54	811.7
8	10.46	3.51	15.23	82.89	819.02

Avg. Ping (ms) for Four Addresses

Pings/Sec for Four Addresses
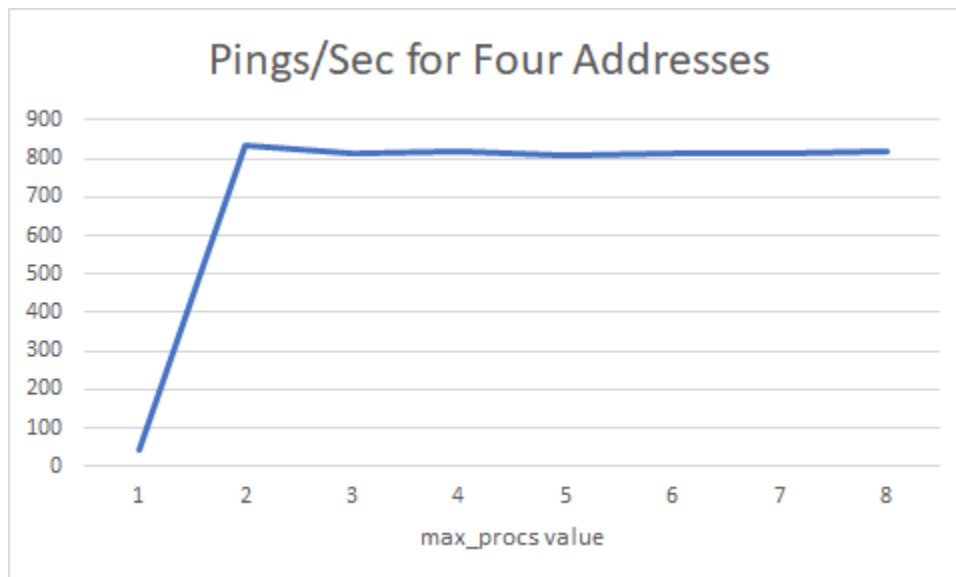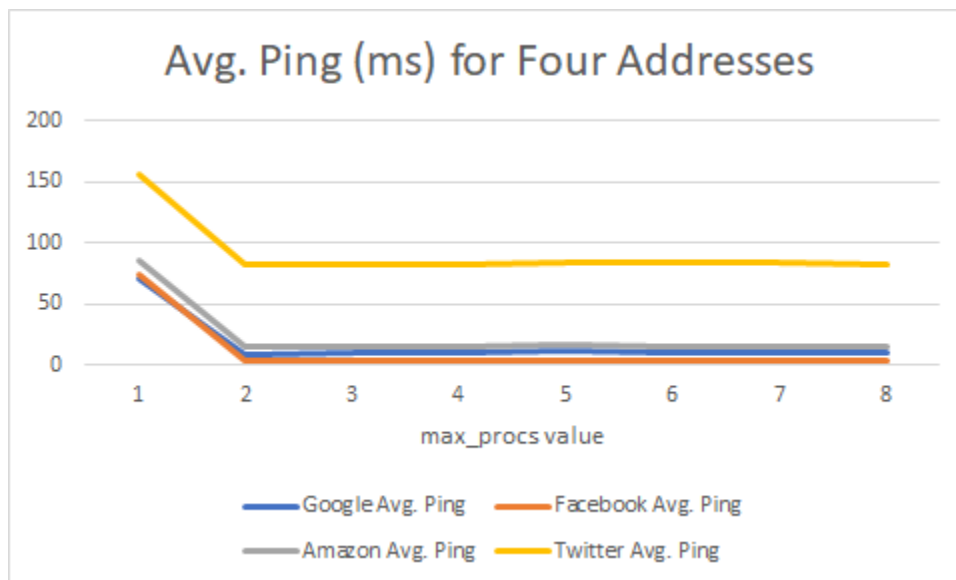
IP Address	Location	Distance (mi)	Approx time for light in fiber (ms)	Average Ping (of 600, in ms)
45.121.209.165	Melbourne	10523	80	214.3
45.127.134.94	Jakarta	9938	75	224.55
103.62.48.238	Singapore	9405	71	233.44
202.129.16.155	Bangkok	8536	65	264.52
103.9.79.189	Hanoi	8066	61	250.44
27.122.12.8	Hong Kong	7973	60	198.21
27.255.77.242	Seoul	6818	52	203.78
143.244.40.227	Tokyo	6723	51	169.85
146.70.37.214	Dubai	6662	50	197.53
79.98.131.46	Istanbul	4833	37	118.97
78.108.38.156	Athens	4746	36	190.55
185.104.187.117	Budapest	4177	32	138.78
185.246.210.17	Prague	3904	30	87.73
185.130.184.202	Frankfurt	3674	28	79.14
185.206.224.209	Copenhagen	3668	28	92.89
84.17.46.6	Amsterdam	3462	26	72.02
82.102.18.44	Paris	3445	26	90.44
212.102.63.108	London	3280	25	128.96
23.92.127.42	Dublin	2997	23	75.12
172.255.125.173	San Francisco	2703	20	77
104.129.56.81	Seattle	2496	19	75.53
190.103.179.217	Mexico City	2278	17	59.03
172.241.131.136	Dallas	1551	12	45.91
104.223.93.144	Atlanta	938	7	25.04
68.235.38.244	Chicago	856	6	24.74
104.244.210.55	Detroit	618	5	21.31
38.101.74.85	Cleveland	552	4	17.54
173.208.45.45	New York	190	1	9.59
199.217.105.241	Cambridge	4	0	3.15

Ping Time by Distance
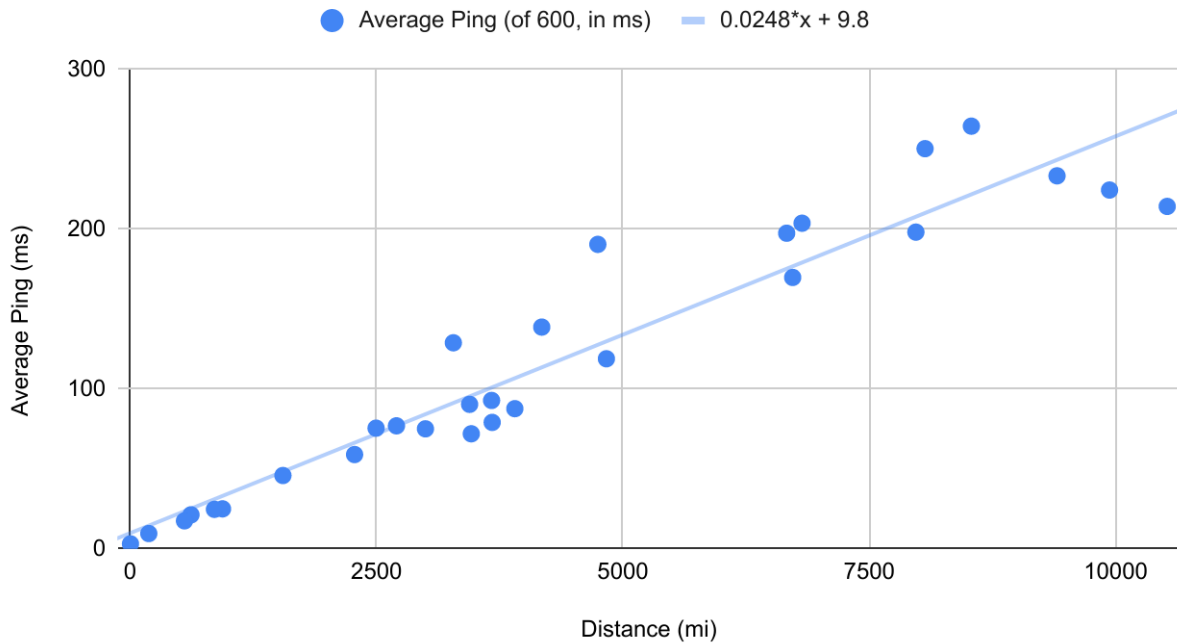
Conclusion

Despite the changes in max_procs value, the difference in performance is, save max_procs = 1, negligible. We believe this may be due to a bottleneck elsewhere in the system, whether with the number of requests the network card can send/receive, or with the icmp package. The sharp contrast in performance between max_procs = 1 and all other values is notable, however. Further, the drastic change in ping was predicted to remain roughly the same, but there is a noticeable difference in average ping when max_procs = 1.

When comparing the ping round trip time to the distance to the datacenter, we observed a linear relationship, as we would've expected. The average ping times were also consistently around 3 or 4 times the estimated times.