Ceng519 Term Project Phase 1 Report

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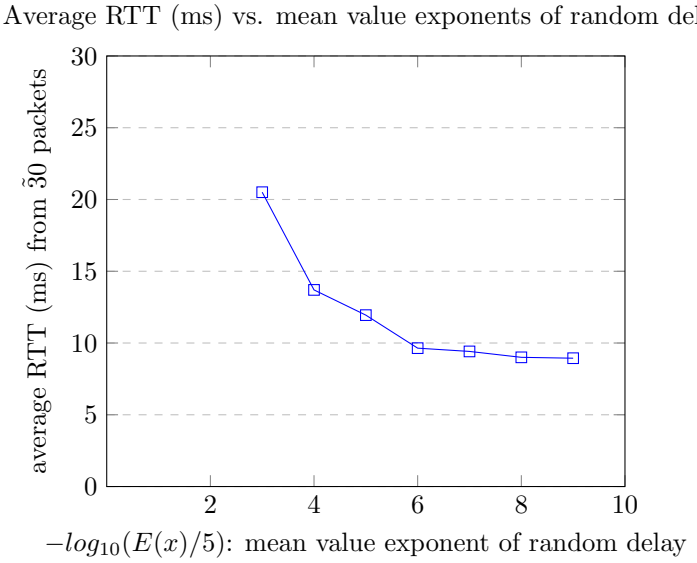
Experiment Data

In my experiments I've changed the mean of the random delay exponentially. To make the plot x axis linear, I've elected to plot average RTT versus exponent of the mean of random delay. I've used $-log_{10}(E(x)/5)$ so that I can simplify means like "5e-6" into "6". Data point at (2, 120.727) is shown only on the graph at the end of the report.

E(x)	Average RTT
5e-2	120.727
5e-3	20.508
5e-4	13.700
5e-5	11.943
5e-6	9.642
5e-7	9.414
5e-8	9.003
5e-9	8.942



Comments

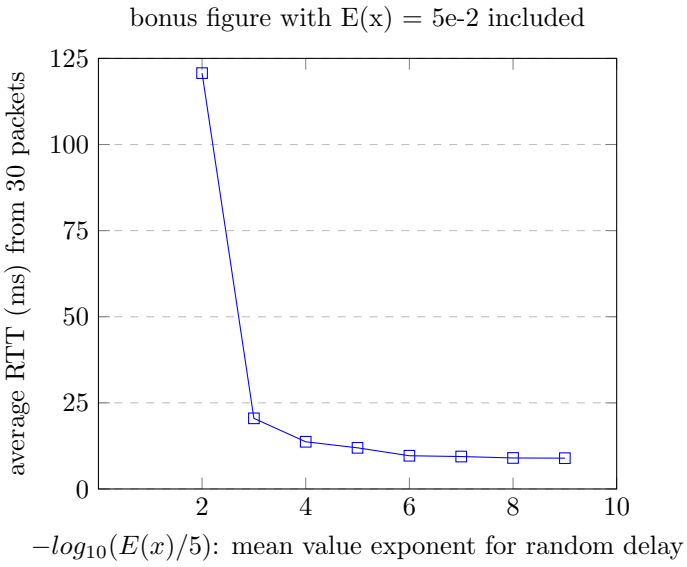
I noticed for small values of mean random delays, the RTT between runs is not much different. For example, on points 6, 7, 8, and 9 in the above plot we have RTTs within the same order of magnitude. I believe the reason for this is because even if we added no delays at all, there would be some variance in RTT due to randomness of the environment (for example, what other jobs are running on my machine at the same time as the experiments), and no matter how small our delay is, we cannot go below some baseline RTT which is the time it would take the ping to travel naturally.

As we move towards larger delays, the change is much more noticeable between each step. At datapoints 4 and below, we are adding exponentially larger delays to our pings and as a result we observe an exponentially growing difference between each individual runs average RTT. This is simply because the average RTT is equal to the sum of natural average RTT and the mean random delay we are adding to it.

A random delay with mean 5e-3 will on average add 5 miliseconds to our RTT. With mean 5e-4 we will on average add 0.5 miliseconds to our RTT. So I would expect to see a difference of 4.5 miliseconds or so in the average RTT for these two datapoints. From the table we can observe that this value is 20.508 - 13.700 = 6.808 ms. This is within an order of magnitude of our expected result, and I believe the slight difference is due to other random delays caused by the limitations of my device. We can make similar comparisons between other data points and the observed values are within an order of magnitude of expected values.

Bonus Plot

Data point at (2, 120.727) is omitted on the plot above for the sake of granularity. We can see the exponential magnification of RTT even clearer in this extra plot. 50 ms - 5 ms = 45 ms is the theoretical expected difference, and the observed difference is about 100 ms, again within an order of magnitude.


bonus figure with E(x) = 5e-2 included
average RTT (ms) from 30 packets
125
100
75
50
25
0
2
4
6
8
10
$-log_{10}(E(x)/5)$: mean value exponent for random delay