EECS 428 Episode 4

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1 Exponential Flows

Trace file analysis has yielded an average on time of $\mu = 80.2846$ seconds, and an average off time of $w = 147.7159$ seconds. The total duration of the simulation $S = 2000$ seconds, and the number of browser flows was $n = 60$. The total number of bytes transmitted by the exponential flows was measured to be $T = 222283500$ bytes, or approximately 212 MB.

Theoretically, the total number of bytes transmitted is given by the equation $T = \dfrac{Sn\mu r}{\mu + w}$, where r is the average on-time rate in bytes per second.

Solving for r, we get $r = 5260.53$ B/s, or about 0.04 Mbps.

2 Pareto Flows

For the Pareto flows, trace file analysis yields an average on time $\mu = 0.411519$ seconds, and an average off time of $w = 24.7697$ seconds. The total number of pareto bytes was $T = 16812900$ bytes, or approximately 16 MB.

Solving the same equation for r, this time we get $r = 8573.3$ B/s, or about 0.07 Mbps.

3 Elephant Prediction

Given the bandwidth taken up by the Pareto and Exponential flows, the Elephants are left with $10 - r_{exp} - r_{pareto} = 9.8945$ Mbps of bandwidth through the central link. Given that each Elephant must transmit a 400MB file, the Elephant is expected to finish at about 970s on average, given one-third of the remaining bandwidth.

The measured Elephant finish times were 704s, 885s, and 1441s. This is in keeping with the expected average finish time.

4 Delayed Acknowledgements

After altering the analysis script to take into account only the endpoint, I have accurately measured all DelACK timeouts to be 50ms as intended. There were 10905 DelACK timeouts, and 432445 immediate ACKs triggered by data packets. The TCP packet to ACK ratio is still 2.

5 Bytes ACKed Over Time

As shown in Figure 1, the data ACKed over time does not change as the first Elephant finishes at 704s. This can be interpreted to mean that the link is at full utilization all the way until the second Elephant finishes. There are distinct slope changes when the second and third Elephants finish. Furthermore, the total number of bytes ACKed at the conclusion of the trace is 1.21 GB, which is equal to the sum of the three 400 MB files and the 16 MB of total data in the pareto flows.

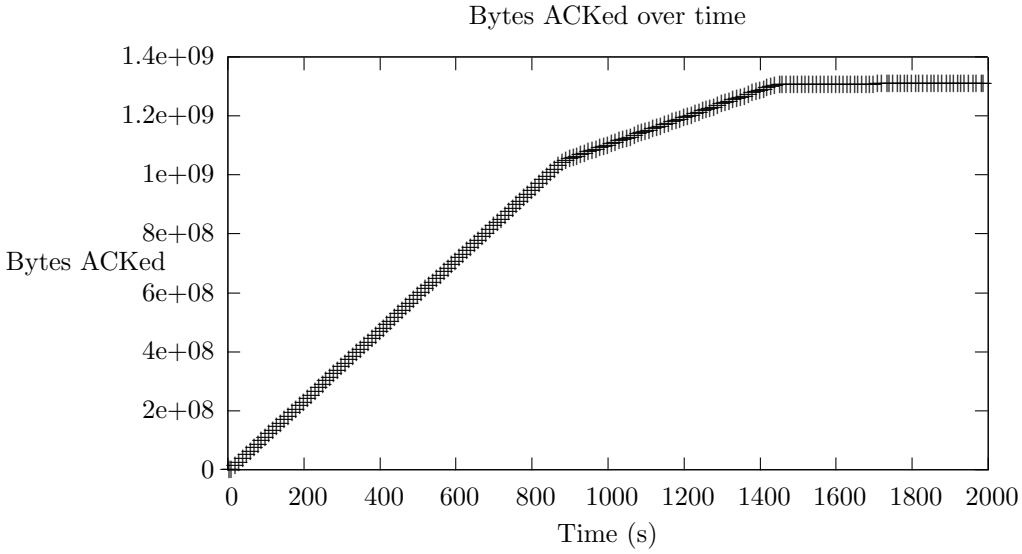

Figure 1: Plot of the number of bytes ACKed at the source, taken every 10 seconds.