ECS 252 Ethernet Simulation Project

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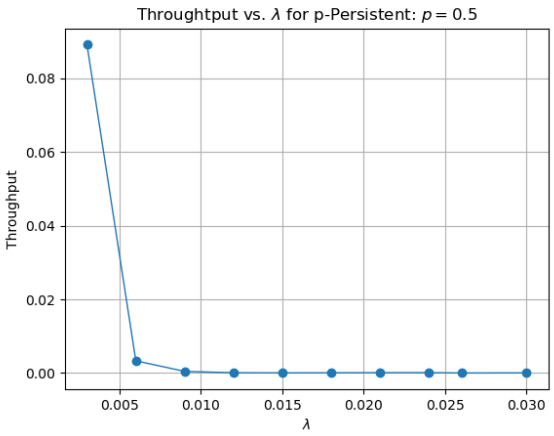
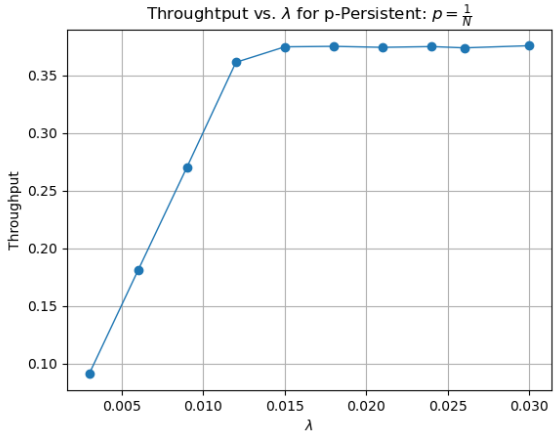
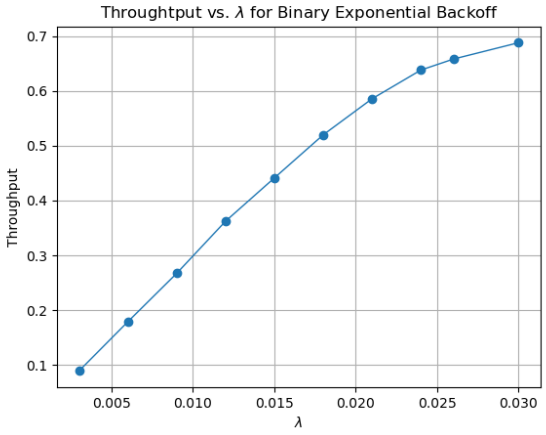
1 Simulation Analysis



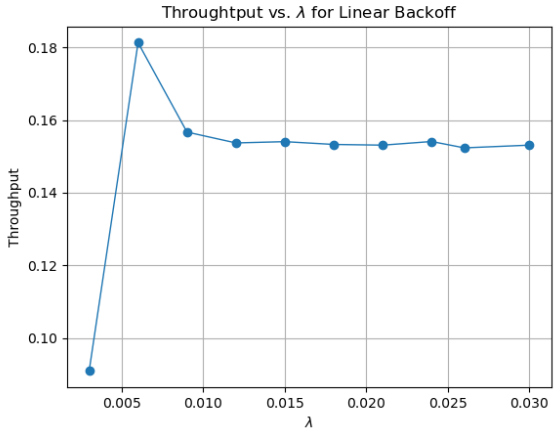
(a) p-Persistent: $p = 0.5$



(b) p-Persistent: $p = \frac{1}{N}$



(c) Binary Exponential Backoff



(d) Linear Backoff

Figure 1: Plots of all four algorithms' Throughput vs. Arrival Rate

The ten arrival rates we chose were: [0.003, 0.006, 0.009, 0.012, 0.015, 0.018, 0.021, 0.024, 0.026, 0.03]. In Figure 1 you can see the plots of throughput vs. the arrival rate λ for each of the algorithms. The p-Persistent algorithm with $p = 0.5$, seen in Figure 1a, is by far the worst with the throughput falling to zero rapidly and remaining there for any arrival rate greater than 0.01 packets per second. We believe this is because each of the nodes have a 50% chance to attempt re-transmission at a slot thus, when the arrival

rate is larger and more nodes have packets they must transmit, there is a very high chance (basically 100% when all 30 nodes have packets in their buffer) that there will be a collision. The same logic applies to the p-Persistent algorithm with $p = \frac{1}{N}$ seen in Figure 1b: when all thirty nodes have packets waiting to be transmit, there is an upper limit to the server's throughput around 0.375 in our case.

Our findings show that the Binary Exponential Backoff algorithm was best in terms of throughput. Seen in Figure 1c, the throughput climbs steadily as the arrival rate increases. This is due to the fact that nodes are being dynamically scheduled for re-transmission depending on how many times they have already been denied, allowing for previously empty nodes that acquire a packet during the time to have the possibility of transmission during the time that these other nodes are awaiting their scheduled re-transmission attempt. This decreases the chance that these nodes with newly arrived packets collide with previously scheduled re-transmissions of other nodes with many re-transmission attempts. Because the range of scheduling is between zero and a power of two, nodes that continuously get collisions quickly have possible scheduled re-transmissions far in the future decreasing the likelihood of another collision quite rapidly. Comparatively the Linear Backoff algorithm (seen in Figure 1d) where the range of scheduled re-transmission increases linearly with the amount of failed attempts, does not quickly give nodes with constant failed attempts far out scheduled slots clogging up the potential slots that could be used for other node transmissions, thus decreasing the throughput.