Simulation of Exponential Backoff in a Wireless Network

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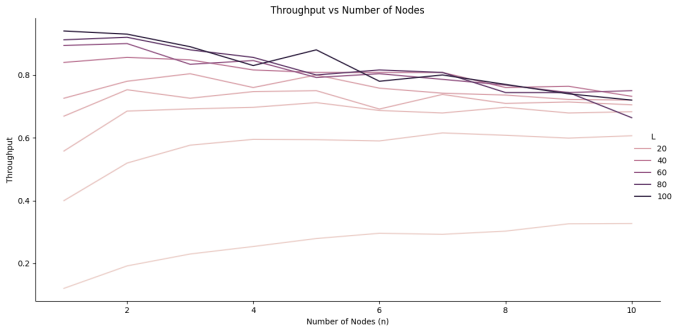
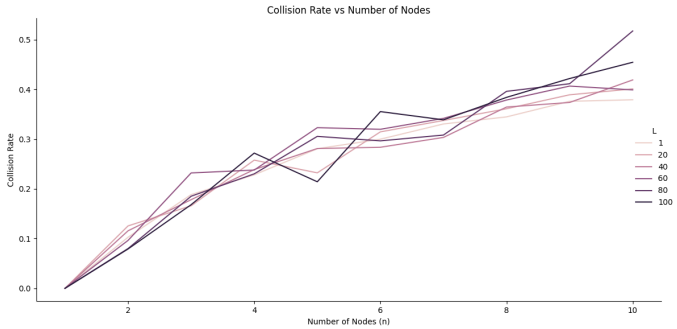
1 Observations



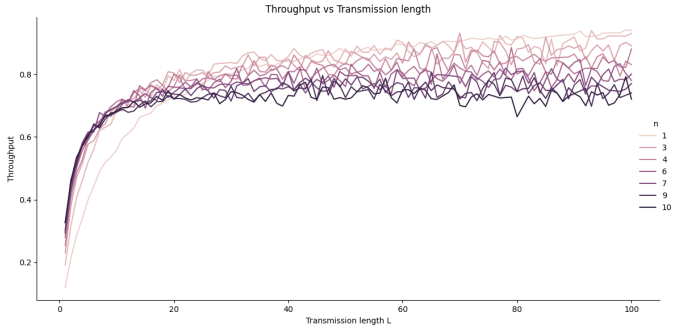
(a) Throughput vs. Number of Nodes



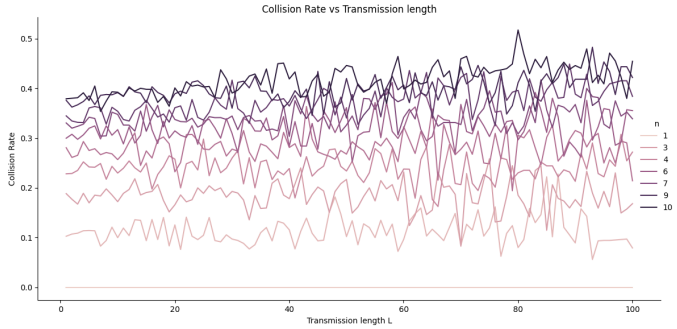
(b) Collision Rate vs. Number of Nodes

Throughput vs. Number of Nodes: As the number of nodes (n) increases, throughput initially increases due to greater channel utilization, but beyond a point decreases due to higher collision probability. For longer transmission lengths (L), this point is reached quicker. In fact for L=100, throughput only decreased with increase in n.

Collision Rate vs. Number of Nodes: Collision rate increases with node count as more stations compete for the channel. No dependency on L is observed due to the definition of collision rate used (when we divide by total tries we ignore the failed attempts to transmit when server is busy).



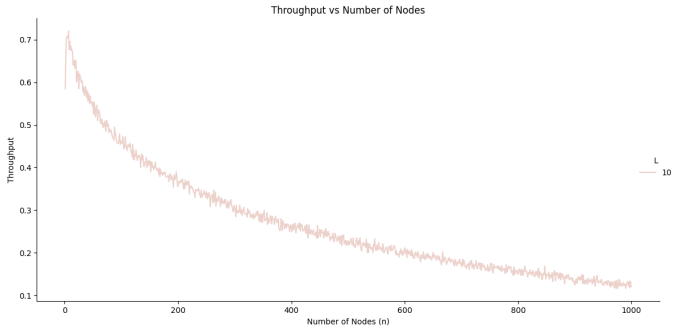
(a) Throughput vs. Transmission Length (L)



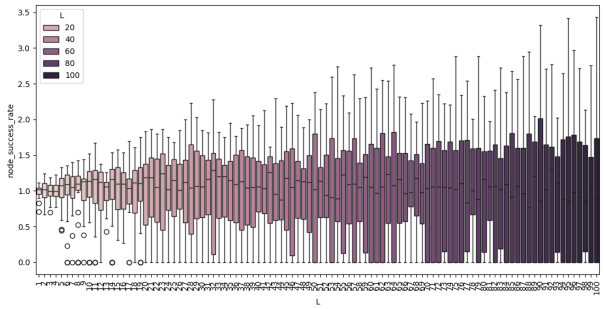
(b) Collision Rate vs. Transmission Length (L)

Throughput vs. Transmission Length: Throughput quickly rises and then saturates with increasing L. Larger n makes the throughput saturate faster and at a lower value.

Collision rate vs. Transmission Length: Same observations as the previous collision rate plot



(a) Throughput vs. Number of Nodes for large n



(b) Spread in Per-Node Success Rate vs. Transmission Length

Throughput vs. Number of nodes for large n: This graph shows how throughput goes to 0 for very large n. This is because of the way throughput is calculated, where even though a single node transmits when a a collision occurs, it is counted as a collision for all nodes and not a success for the transmitting node.

Per-Node Success Rate: Success rates show significant variance between nodes at higher L values, indicating potential fairness issues in the network access protocol. The graph was plotted with n fixed at 30.

2 Conclusion

1. For a fixed n, we must choose L where the throughput just begins to saturate to ensure more fairness among the nodes.
2. For a fixed L, there will be an optimal n beyond which throughput will decay. For L beyond a threshold, (around 50), the optimal n will be 1. Hence we feel that exponential backoff is not ideal for crowded networks.