Simulation Modelling Project Report

Simulation of Router Performance using Arena

Changes from the Proposal:

- Another layer of delay was added after the packet's left the router's output port. The distribution was kept same for simplicity.
- Any source host can send a packet to any destination host. This was determined by using a "DECISION" module with "N-way by chance" option. 3 ways were used with a 33% probability each. A dispose module, named "Packets Dropped", was used to capture the 1% of the packet's.
- In PQ, an attribute was used to determine whether the packet generated at the host was a real time packet (those that carry a live stream's, video call's or voice call's data). This attribute is not being used in FCFS since FCFS doesn't forward based on the urgency of the packet.

Overview:

The simulation project aimed to model and analyze router performance under different traffic conditions and queuing algorithms using Arena simulation software. The project was successfully completed, delivering a comprehensive simulation model, implementation of various queuing behaviors, analysis of performance metrics, and a report summarizing the findings and insights.

Achievements:

1. Simulation Model Development: A detailed simulation model was developed in Arena, accurately representing the behavior of a router. The model included components for packet generation, input and output queues, routing mechanisms, and realistic delay simulations.

2. Queuing Behavior Implementations: First-In-First-Out (FIFO) and Priority Queuing (PQ) algorithms were used within the simulation model. These helped analyze the difference between router implementations under different traffic conditions such as when the network is filled with Real Time data that takes priority over normal data packets.

3. Analysis of Performance Metrics: Key performance metrics such as packet delay, packet loss rates, round-trip time (RTT), and queue lengths were analyzed under different traffic loads and queuing algorithms. Insights were gained into the impact of each factor on router performance.

4. Report Preparation: A detailed report was prepared, documenting the simulation model, algorithm implementations, simulation parameters, and analysis of results. The report provided a comprehensive summary of findings and recommendations for optimizing router performance.

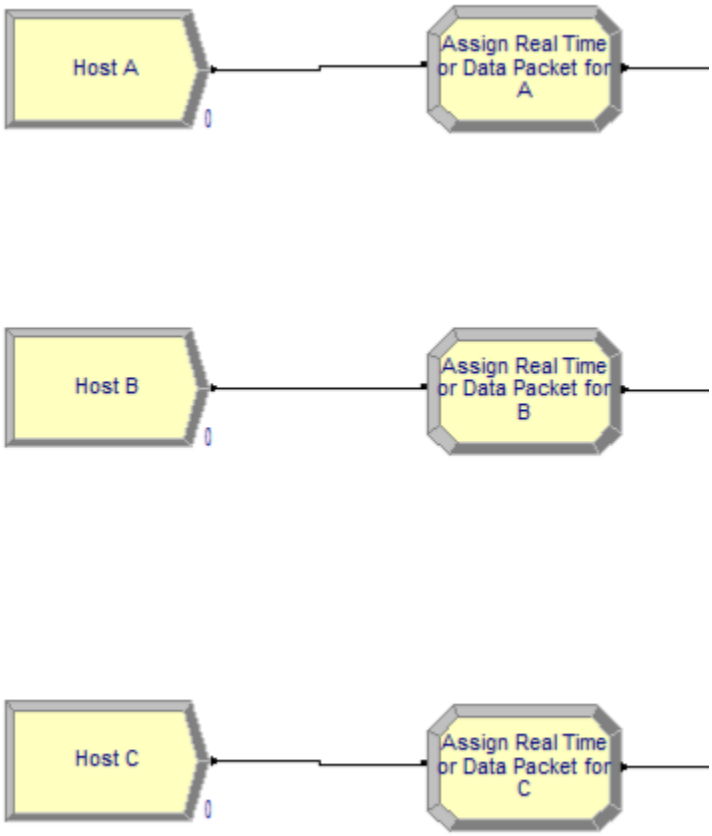

Fig 1. Packets Generating at the hosts and getting assigned whether they are real time or normal packets

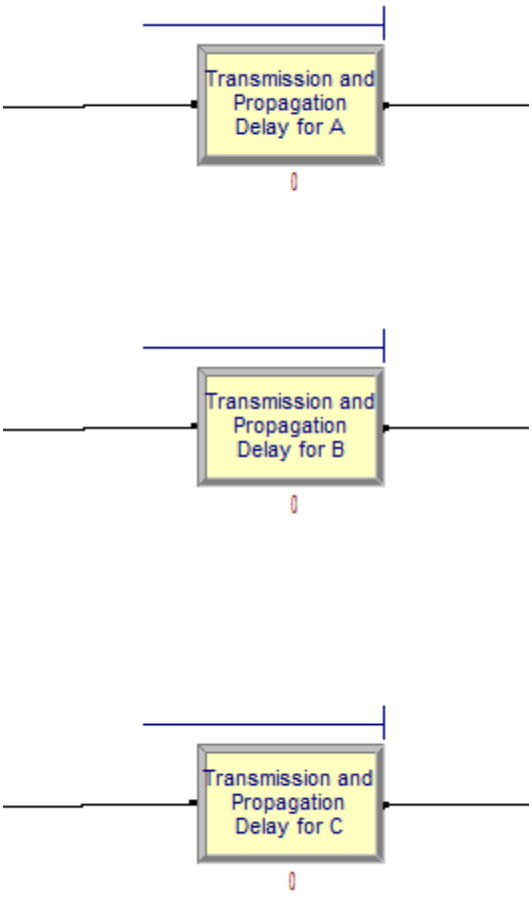

Fig 2. Delay being simulated on the outgoing link from the hosts (input link to the router)

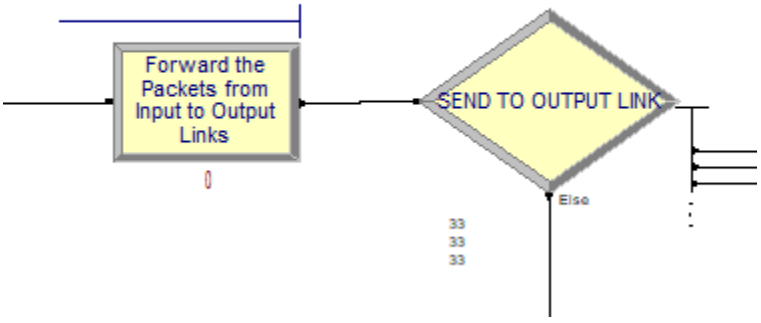

Fig 3. Router's activities (switching and storing at the output port) being simulated

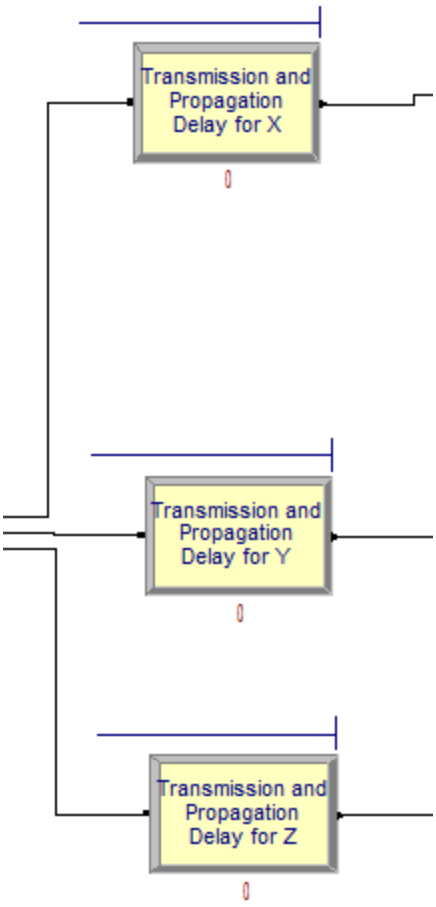

Fig 4. Delay on the output link to the router being simulated

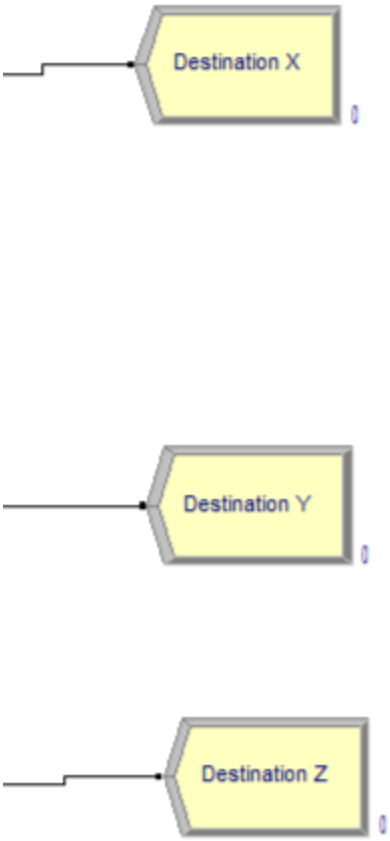

Fig 5. Packets arriving at the Destination

Fig 6. Packets being dropped because 33+33+33 = 99.

Key Findings:

- Queuing Algorithms Impact Performance: The choice of queuing algorithm significantly impacted router performance. FCFS ensured fairness in packet transmission but may lead to higher delays, especially for real-time packets. PQ prioritized critical data transmission, reducing delays for real-time applications but potentially increasing delays for regular packets during congestion.

- Realistic Delay Simulations Enhance Accuracy: The introduction of an additional layer of delay after packets left the router's output port improved the accuracy of the simulation model by simulating real-world network conditions more effectively.

- Optimization Opportunities: Fine-tuning parameters such as queue sizes and delay distributions could further enhance router performance and resource utilization, depending on the specific requirements of the network.

Conclusion:

The completion of the simulation project has provided valuable insights into router performance and network optimization strategies. By accurately modeling router behavior and analyzing key performance metrics, the project has contributed to a better understanding of the factors influencing network performance and resource utilization. Moving forward, the recommendations outlined in this report can guide further research and development efforts to enhance router performance and ensure efficient network operation.

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