Scribe Questions 4-6: System Modelling and Analysis

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Scribe Question 4: Model-Implementation Alignment

Probabilistic Model

- The system is modelled as an $M/M/1$ queue, representing a single router.
- Packet arrivals are assumed to be Markovian (Poisson) and independent.
- Router service time is assumed to be Markovian (exponential).
- The router processes one packet at a time, matching the single-server assumption.

Implementation / Experimental Setup

- The simulation generates packets at random times and inserts them into a queue.
- The queue represents the router buffer, and packets are served sequentially.
- Packet delay is measured as the total time spent waiting and being processed.
- Random number generation is used to implement the Markovian assumptions.

Assumptions Influencing Design Choices

- An infinite buffer is assumed, so packet loss is not modelled.
- This allows the implementation to focus purely on queueing delay behaviour.
- Independence of arrivals simplifies both simulation and evaluation.

Scribe Question 5: Cross-Milestone Consistency and Change

Currently Well-Defined Components

- Single-router network model.
- $M/M/1$ queueing structure.
- Packet delay as the primary performance metric.
- Random arrivals and random service behaviour.

Components Expected to Evolve

- Formal definition and analysis of arrival and service rates.
- Mathematical expressions for average delay and queue length.
- Comparison between analytical results and simulation outcomes.

Reason for Planned Refinements

- These aspects require deeper probabilistic analysis and are better addressed after the base model is fixed.
- Gradual refinement ensures consistency while increasing analytical depth in later milestones.

Scribe Question 6: Open Issues and Responsibility Attribution

Open Probabilistic Issues

- Exact analytical delay expressions are not yet derived.
- Delay behaviour under high traffic conditions needs further study.
- The realism of Markovian assumptions needs to be evaluated.
- Validation of theory using simulation results is pending.

Planned Responsibilities

- **Modelling/Theory Team:** Derive and refine probabilistic relationships.
- **Simulation/Coding Team:** Improve simulation and validate results.
- **Documentation/Coordination Team:** Prepare PPTs, scribes, and manage GitHub.