

CS342: Computer Networks Laboratory

Deadline: 11:59 pm, 6 October 2024

Instructions:

- This assignment is to be done in groups. Continue with the same group partner you had for the last assignment.
- The programs can be written in C/C++.
- Your code should have a readme file, a makefile, and it should be well commented. These will carry separate marks for each question.
- No extensions in submission are allowed. Delay in submission will lead to penalty in marks.
- Assignments submitted before the deadline will only be considered for evaluation. Please do not email your assignments separately to the TAs, it will not be considered for evaluation.
- Your code will be checked for plagiarism. Any kind of academic dishonesty, plagiarism, etc. will lead to penalties.
- No sharing of code between students is allowed.
- The first instance of code copying will result in ZERO marks for the assignment. The second instance of code copying will result in a 'F' grade. Students may also be reported to the Students Disciplinary Committee, which can impose additional penalties.
- **TOTAL MARKS = 80 (4 Algorithms: WFQ(10), iSLIP(10), RR(5), Priority(5); Report: 10; Metrics: 20 (5*4); Viva: 15; README, Makefile, Comments: 5)**

Q1) You are tasked with designing a network router switch fabric that handles high-throughput traffic. The switch fabric has multiple input and output ports, and the job of the scheduling algorithm is to determine which output port a packet should be sent to from an input queue. The goal of this assignment is to explore and compare the performance of different scheduling algorithms used in the output queuing of router switch fabrics. You are required to implement and analyze four scheduling algorithms: Priority Scheduling, Weighted Fair Queuing (WFQ), Round Robin (RR), and iSLIP. The iSLIP algorithm should be based on the reference provided. Your simulation environment should consist of the following:

- **Number of Input Ports:** 8
- **Number of Output Ports:** 8
- **Packet Arrival Rate:** Variable packet arrival rate, where some input ports receive high-priority traffic (e.g., video streams), and others receive best-effort or low-priority traffic (e.g., web browsing data).
- **Traffic Pattern:** Mixed traffic including bursty and constant traffic for different queues.
- **Buffer Size:** All ports have finite buffer sizes (you can assume a buffer size of 64 packets for each input/output).

Write code in C/C++ to simulate the router switch fabric for each scheduling algorithm. Compare and contrast the performance of each scheduling algorithm using the specified metrics.

Metrics for Comparison:

1. **Queue Throughput:** The number of packets processed per unit time.
2. **Turnaround Time:** The total time taken from when a packet or job enters the system (i.e., arrives in the queue) until it is completely processed and exits the system.
3. **Waiting Time:** The total time a packet spends waiting in the queue before being serviced (i.e., before it begins processing).
4. **Buffer Occupancy:** Track the buffer occupancy for input and output queues.
5. **Packet Drop Rate:** The percentage of packets that are dropped due to queue overflow.

Run the simulation under the following conditions:

- **Uniform Traffic:** All input ports receive equal traffic with random packet generation.
- **Non-Uniform Traffic:** Some input ports receive higher priority traffic (e.g., real-time applications), while others receive low-priority traffic.
- **Bursty Traffic:** Randomly generate bursty traffic for certain input ports to simulate peak loads.

Write a detailed report comparing the performance of each scheduling algorithm under the different traffic scenarios. Specifically, address the following:

- Which algorithm achieves the lowest packet delay and why?
- How does each algorithm handle high-priority traffic versus low-priority traffic?
- Which algorithm provides the highest fairness and how does the iSLIP algorithm improve performance over traditional round-robin methods?

Based on the results, recommend the best scheduling algorithm for use in high-throughput router switch fabrics. Submit your source code along with simulation results and also include logs of performance metrics collected from your simulations.
