University of Sydney
School of Information Technologies

Simulation of Networks

Simulation Task Set 1

Task 1

Take the single server queue simulation, and modify it so that packet lengths are constant, rather than negative exponential. Compare results with those for negative exponentially distributed packet lengths.

Task 2.1

Take the single server queue simulation and modify it to model the following case:

- *N* circuits
- Calls arrive according to a Poisson process (i.e. negative exponential inter-arrival times)
  - If a circuit is free it is held by the call for a random period of time, assumed to be random with a negative exponential distribution
  - If no circuit is free, the call is lost and does not reattempt.

Find the fraction of calls that are lost.

Task 2.2

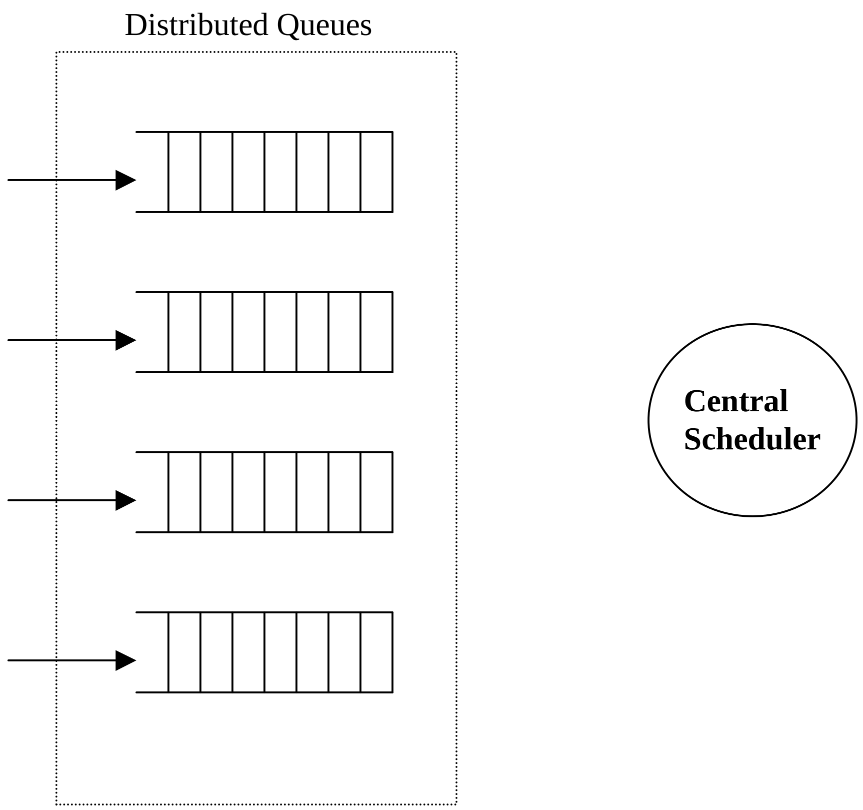
Take the simulation from Task 2.1 and modify it so that a call will hold a circuit for a constant period of time, rather than negative exponential. Compare results with those for negative exponential distributed call holding times.

Task 3

Take the single server queue simulation, and modify it so that the simulation measures the average time spent in the system by packets, i.e. the average time between a packet arriving, and completion of its service. Assume that the service discipline in first-in-first-out (FIFO).

Task 4

This is a simple polling model, e.g. scheduling in an IEEE 802.11 WLAN.

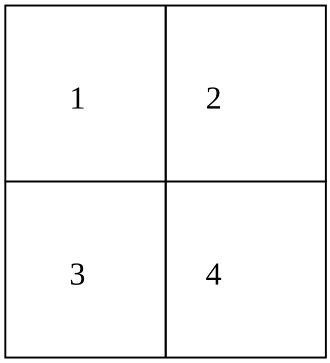


Assume a number *N* of distributed queues, served by a central scheduler.
Packets arrive at the distributed queues independently, according to a Poisson process at each queue (i.e. negative exponential interarrival times).
Packets cannot begin service until the central scheduler polls the queue. If a queue has one or more packets in it when it is polled, only the first packet in the queue is served, following which the next queue in the sequence is polled, after some polling delay. If the queue is empty, then the next queue in the sequence is polled, after some polling delay. Assume that the polling delay is constant.

Find the mean queue length of each of the queues, and the average system time of packets, both overall, and for each of the queues individually.

Task 5

This is a simple model of a cellular mobile communication network.



Assume 4 cells in a rectangular grid, as in the diagram above. Assume that each cell has *c* channels available to it.

Model A: No mobility. Assume that calls arrive at cells according to a Poisson process, and have negative exponential holding times. Find the probability of a new call being blocked. Assume no mobility and therefore no handover. (Hint: This is the same as task 2.1, except that there are 4 independent queues rather than 1.)

Model B: Simple mobility model. Assume that an accepted call will attempt a handover to one of the three adjacent cells after some period of time, assumed to be negative exponentially distributed with a specified mean time. If this handover time is greater than the call holding time, the call terminates before handover, so no handover takes place.

However, if the handover takes place before the call terminates, then we try to find a channel for it in the new cell. If a channel is available, it is assigned to the handover call; otherwise the call is dropped.

Assume equal probability of handover to each of the 3 adjacent cells.

A call that has been successfully handed over is assumed to be subject to further handovers, according to the same process as described above.

Find the probability that a new call will be blocked, and also find the probability that an accepted call will subsequently be dropped.

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19 July 2002