CS3200: Computer Networks

Lecture 22

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25 Sep, 2019

Packet Scheduling

- Algorithms that allocate router resources among the packets of a flow and between competing flows are called **packet scheduling** algorithms.

- Each router buffers packets in a queue for each output line until they can be sent, and they are sent in the same order that they arrived. This algorithm is known as **FIFO (First-In First-Out)**, or equivalently **FCFS (First-Come First-Serve)**.

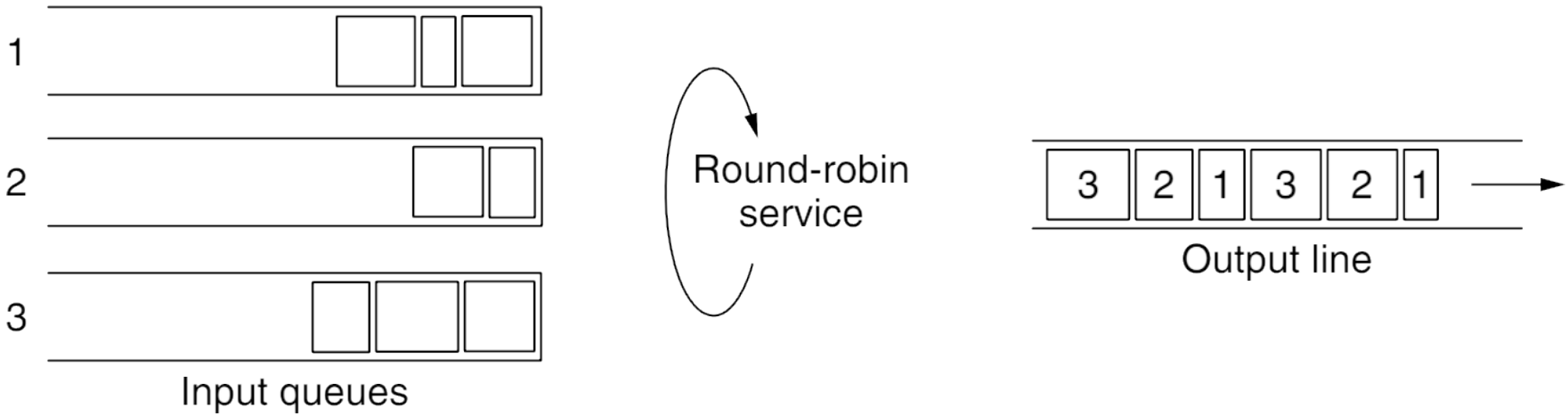
- FIFO routers usually drop newly arriving packets when the queue is full. Since the newly arrived packet would have been placed at the end of the queue, this behavior is called **tail drop**.

- Any drawbacks to FIFO when there are multiple flows?

cannot ensure fairness as one source could be aggresive

Round Robin Scheduling

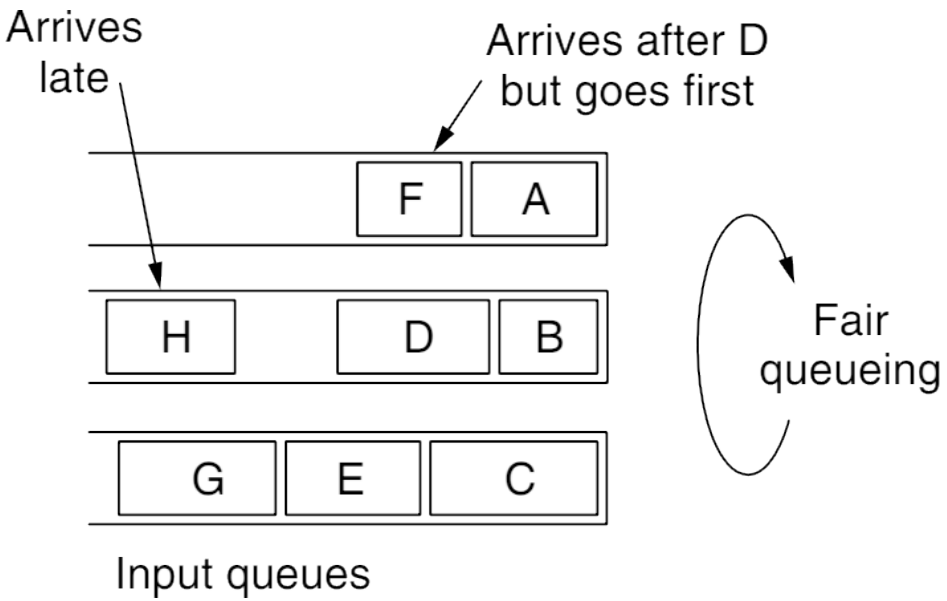
- Many packet scheduling algorithms have been devised that provide stronger isolation between flows and thwart attempts at interference.
- One of the first ones was the **fair queueing** algorithm devised by Nagle (1987).
- Routers have separate queues, one for each flow for a given output line.
- When the line becomes idle, the router scans the queues round-robin and takes the first packet on the next queue.



Byte-by-Byte Round Robin

- It gives more bandwidth to hosts that use large packets than to hosts that use small packets.
- Demers et al. (1990) suggested an improvement in which the round-robin is done in such a way as to simulate a byte-by-byte round-robin, instead of a packet-by-packet round-robin.
- The trick is to compute a virtual time that is the number of the round at which each packet would finish being sent.
- Each round drains a byte from all of the queues that have data to send.
- The packets are then sorted in order of their finishing times and sent in that order.

Byte-by-Byte Round Robin



Arrival details: A - 0 - 8; B - 5 - 6; C - 5 - 10; D - 8 - 9; E - 8 - 8; F - 10 - 6; G - 11 - 10; H - 20 - 8

see diagram in copy (see that complete page).

Byte-by-Byte Round Robin

- One shortcoming of the previous algorithm in practice is that it gives all hosts the same priority.
- In many situations, it is desirable to give, for example, video servers more bandwidth than, say, file servers.
- This is easily possible by giving the more bytes per round. This modified algorithm is called **WFQ (Weighted Fair Queueing)**. Letting the number of bytes per round be the weight of a flow W, we can now give the formula for computing the finish time:

$$F_i = \max\{A_i, F_{i-1}\} + L_i/W$$

where A_i is the arrival time, F_i is the finish time, and L_i is the length of packet i.