PSIT
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CONGESTION CONTROL

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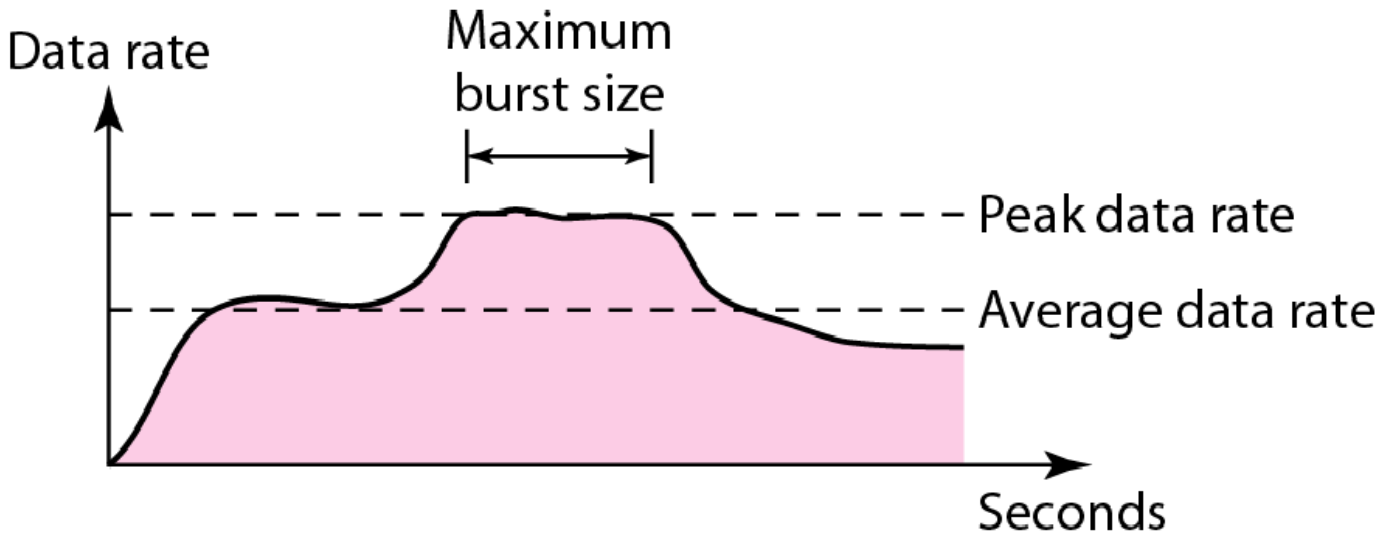
DATA TRAFFIC

The main focus of congestion control and quality of service is data traffic. In congestion control we try to avoid traffic congestion. In quality of service, we try to create an appropriate environment for the traffic. So, before talking about congestion control and quality of service, we discuss the data traffic itself.

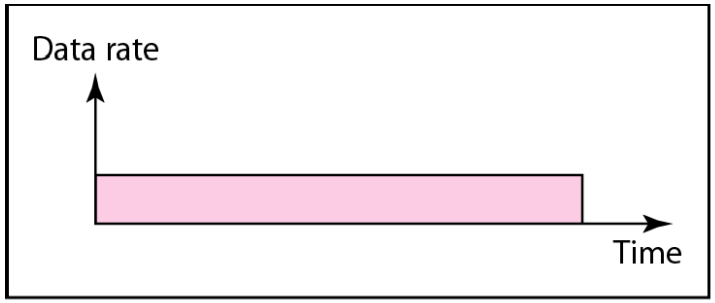
Topics discussed in this section:

Traffic Descriptor
Traffic Profiles

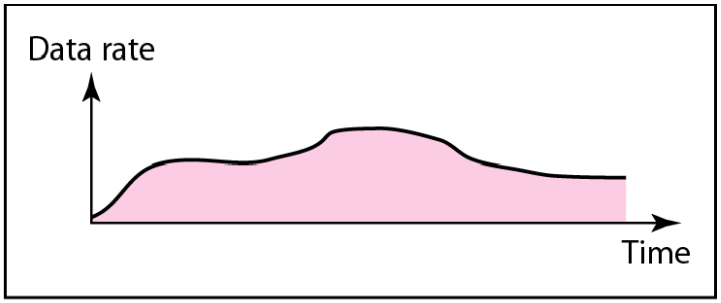
Traffic descriptors



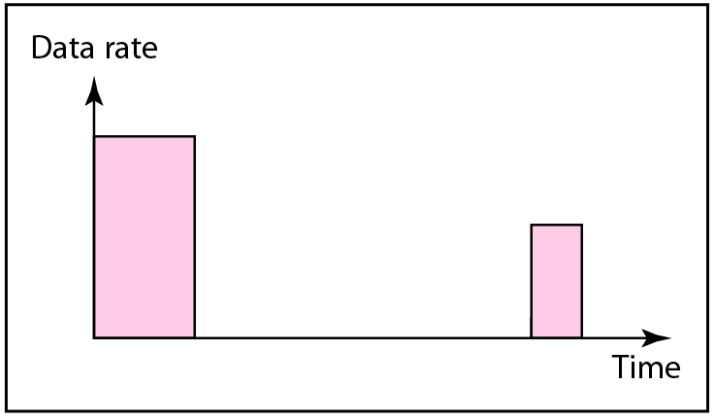
Three traffic profiles



a. Constant bit rate



b. Variable bit rate



c. Bursty

CONGESTION

Congestion in a network may occur if the load on the network—the number of packets sent to the network—is greater than the capacity of the network—the number of packets a network can handle. Congestion control refers to the mechanisms and techniques to control the congestion and keep the load below the capacity..

Topics discussed in this section:

Network Performance

Queues in a router

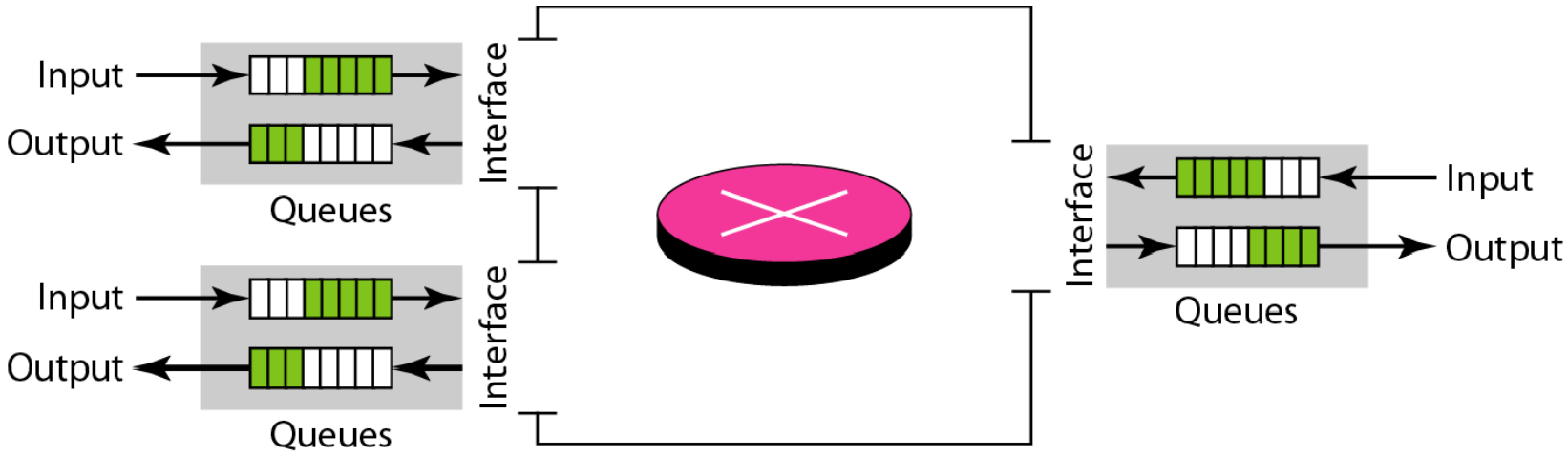
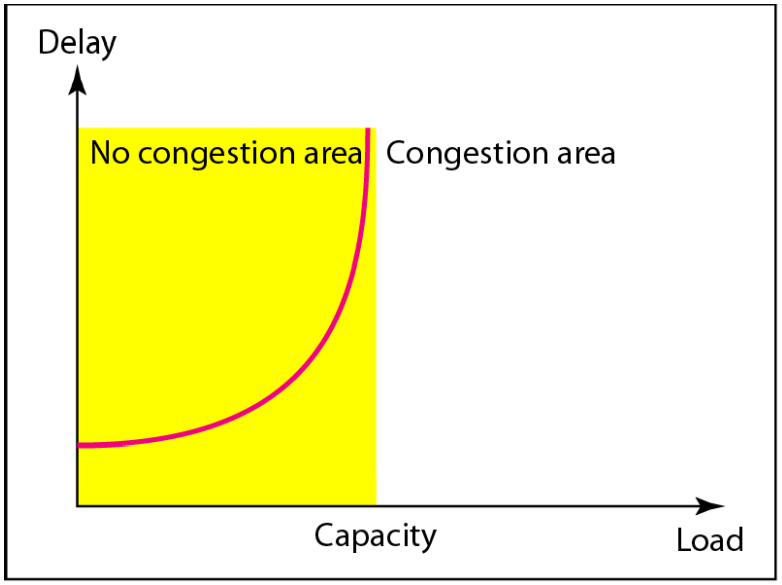
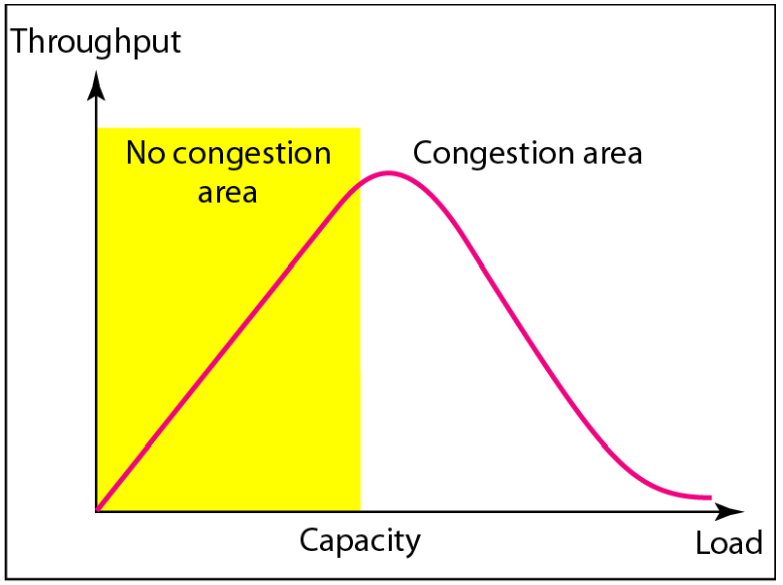


Figure *Packet delay and throughput as functions of load*



a. Delay as a function of load



b. Throughput as a function of load

CONGESTION CONTROL

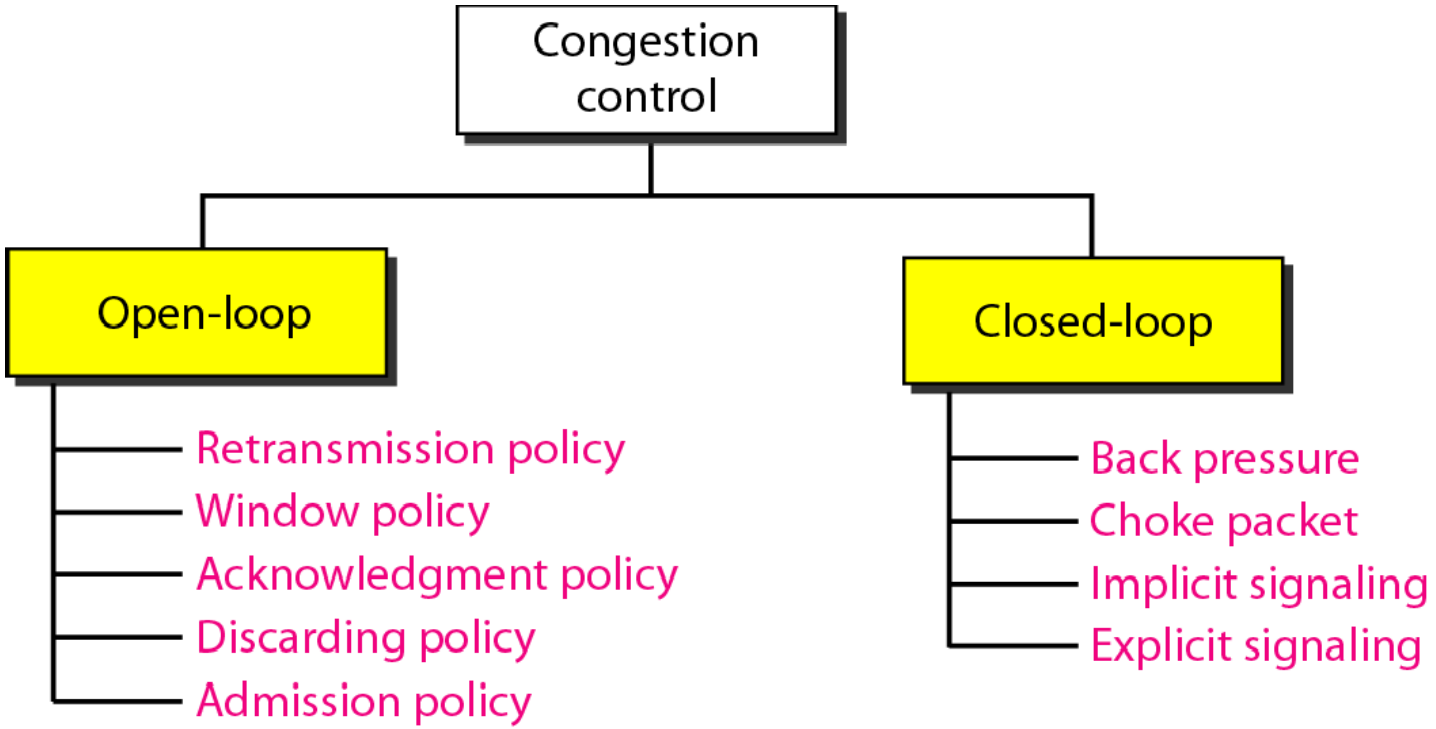
Congestion control refers to techniques and mechanisms that can either prevent congestion, before it happens, or remove congestion, after it has happened. In general, we can divide congestion control mechanisms into two broad categories: open-loop congestion control (prevention) and closed-loop congestion control (removal)....

Topics discussed in this section:

Open-Loop Congestion Control

Closed-Loop Congestion Control

Congestion control categories



Open Loop

a. Retransmission Policy

Retransmission in general may increase congestion in the network. However, a good retransmission policy can prevent congestion. The retransmission policy and the retransmission timers must be designed to optimize efficiency and at the same time prevent congestion. For example, the retransmission policy used by TCP.

b. Window Policy

The type of window at the sender may also affect congestion. The Selective Repeat window is better than the Go-Back-N window for congestion control.

c. Acknowledgment Policy

The acknowledgment policy imposed by the receiver may also affect congestion. If the receiver does not acknowledge every packet it receives, it may slow down the sender and help prevent congestion.

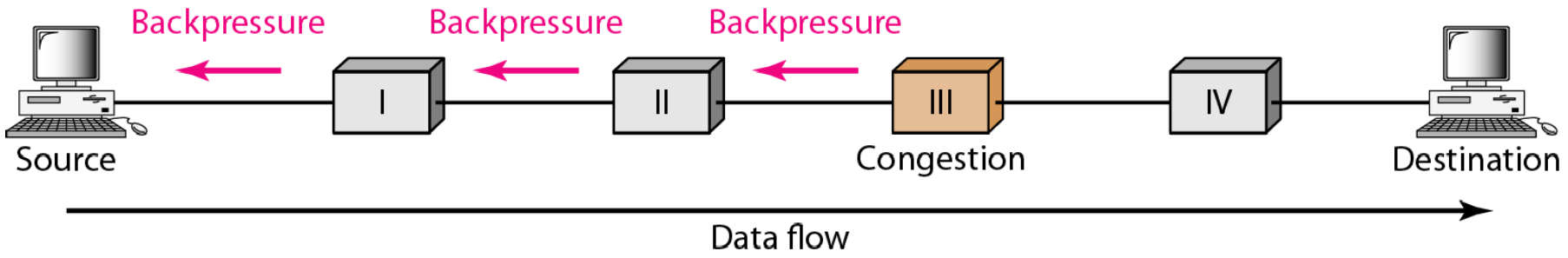
d. Discarding Policy

A good discarding policy by the routers may prevent congestion and at the same time may not harm the integrity of the transmission. For example, in audio transmission, if the policy is to discard less sensitive packets when congestion is likely to happen, the quality of sound is still preserved and congestion is prevented or alleviated.

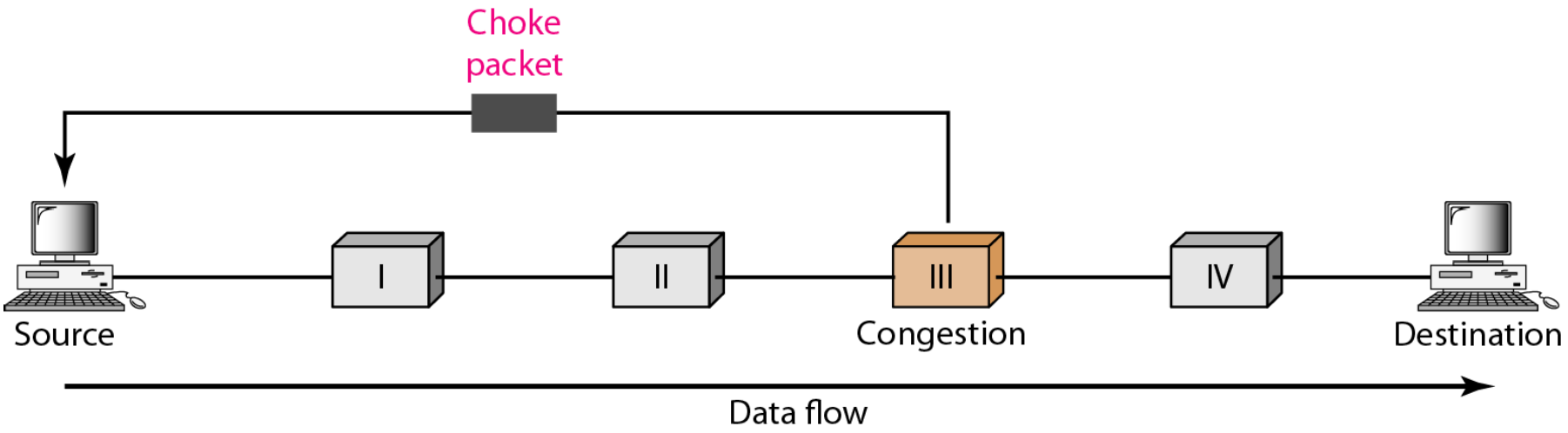
e. Admission Policy

An admission policy, which is a quality-of-service mechanism, can also prevent congestion in virtual-circuit networks. Switches in a flow, first check the resource requirement of a flow before admitting it to the network. A router can deny establishing a virtual circuit connection if there is congestion in the network or if there is a possibility of future congestion.

Backpressure method for alleviating congestion



Choke packet



TWO EXAMPLES

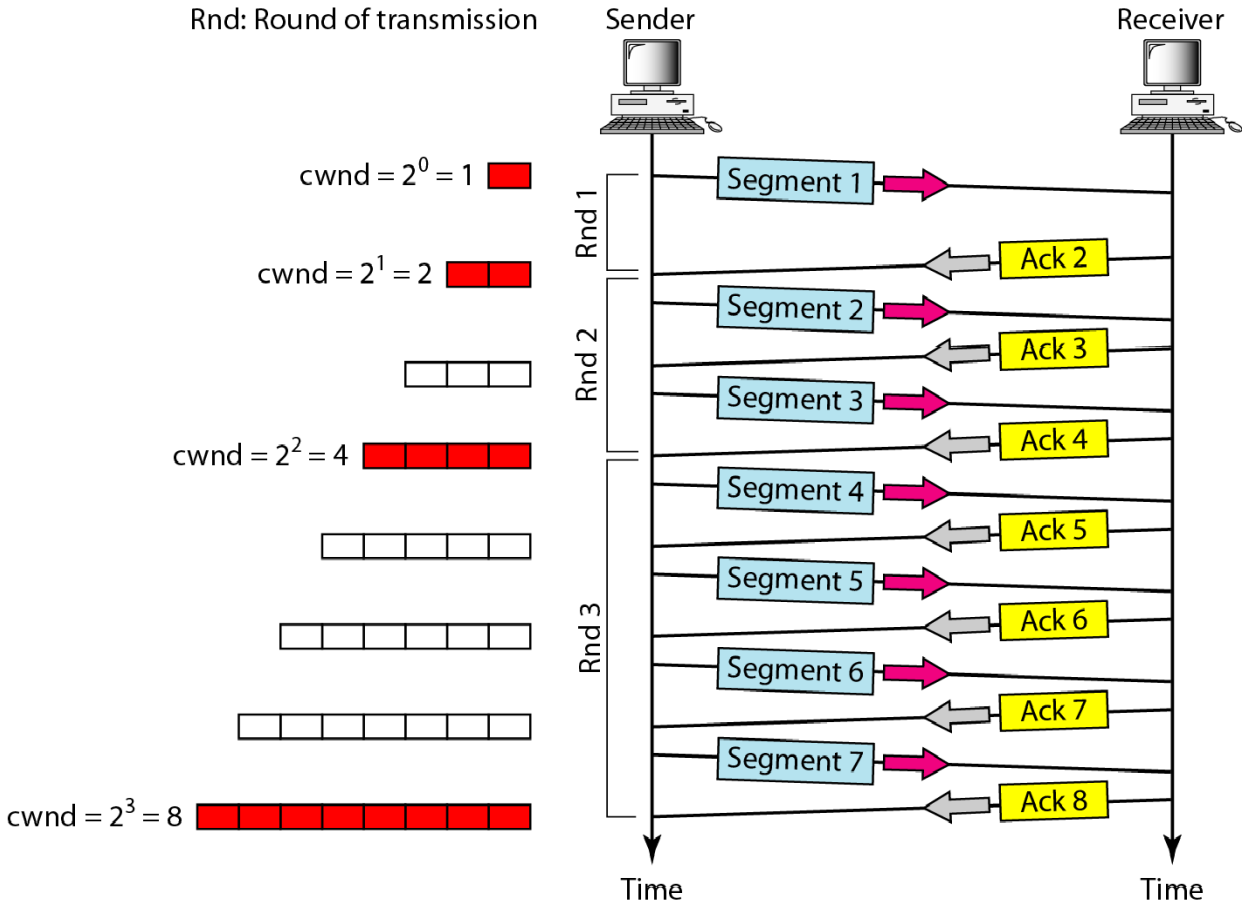
To better understand the concept of congestion control, let us give two examples: one in TCP and the other in Frame Relay..

Topics discussed in this section:

Congestion Control in TCP

Congestion Control in Frame Relay

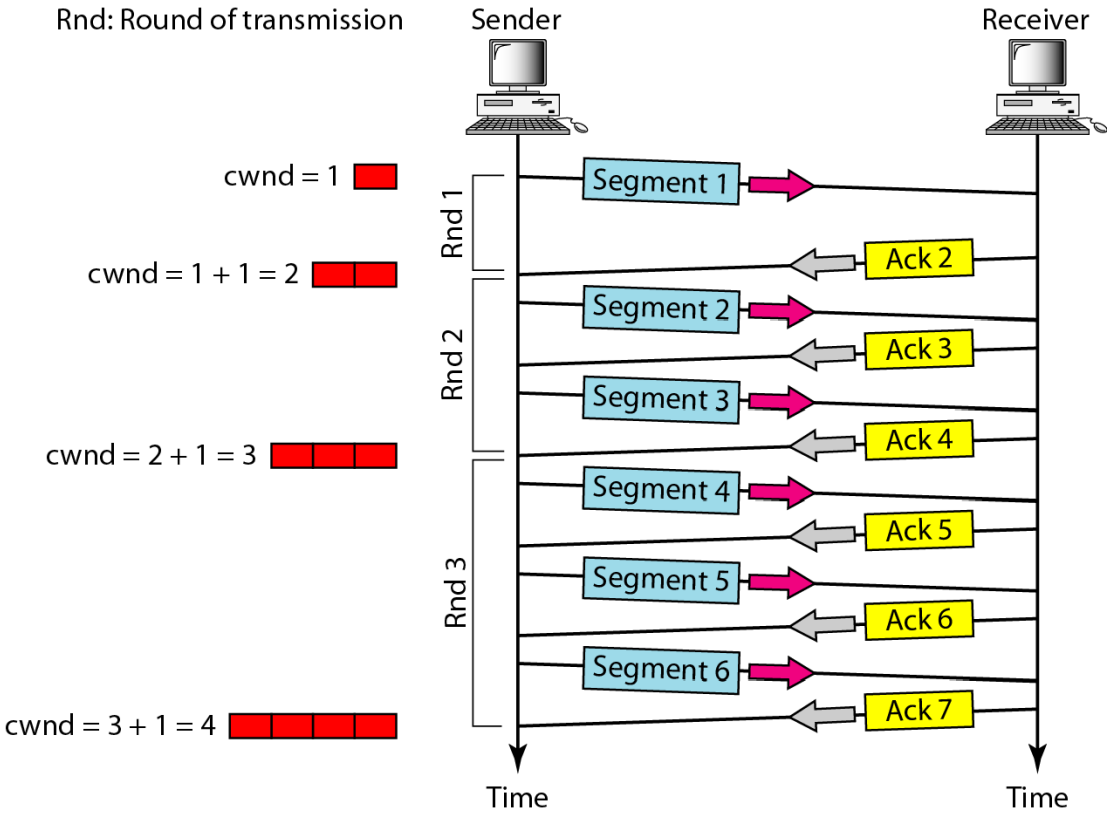
Slow start, exponential increase



Note

In the slow-start algorithm, the size of the congestion window increases exponentially until it reaches a threshold.

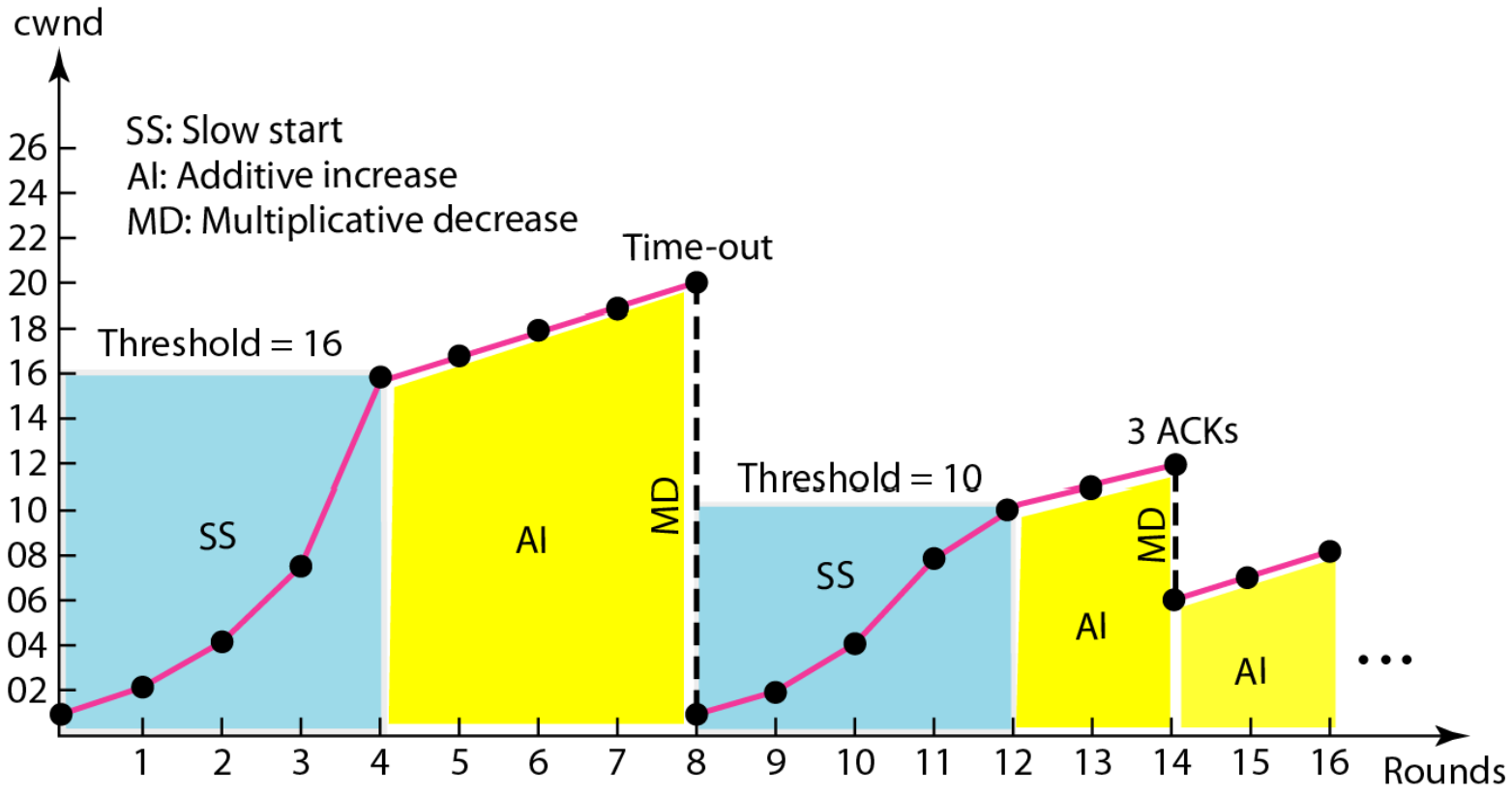
Congestion avoidance, additive increase



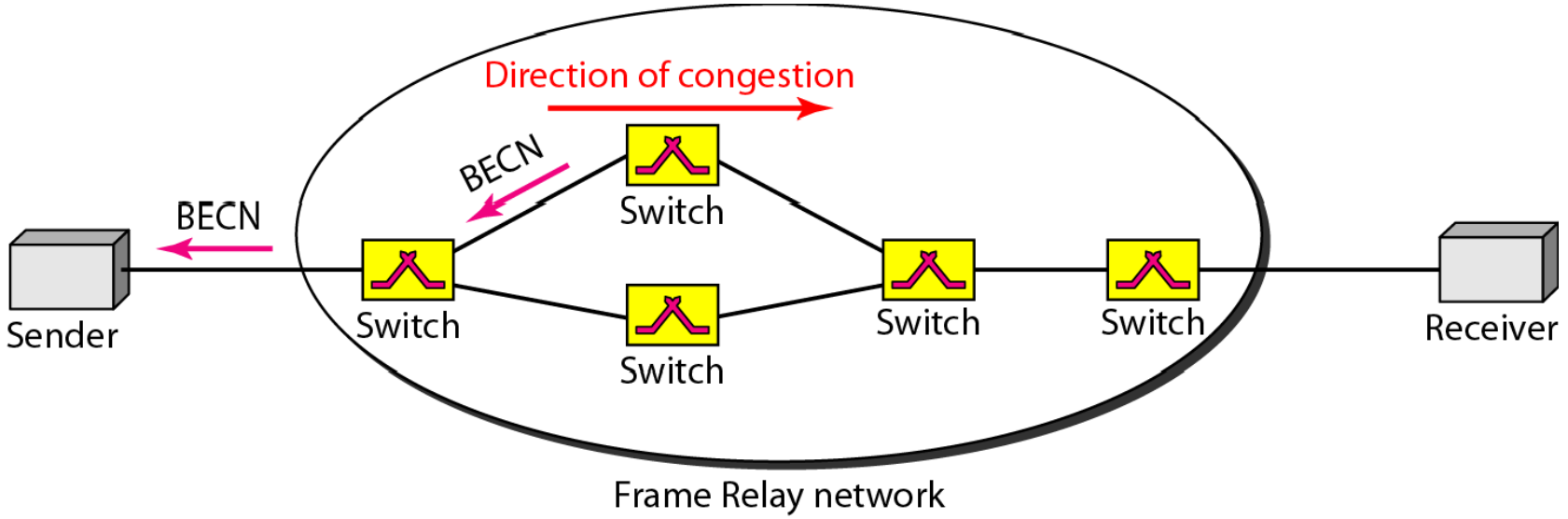
Note

In the congestion avoidance algorithm, the size of the congestion window increases additively until congestion is detected.

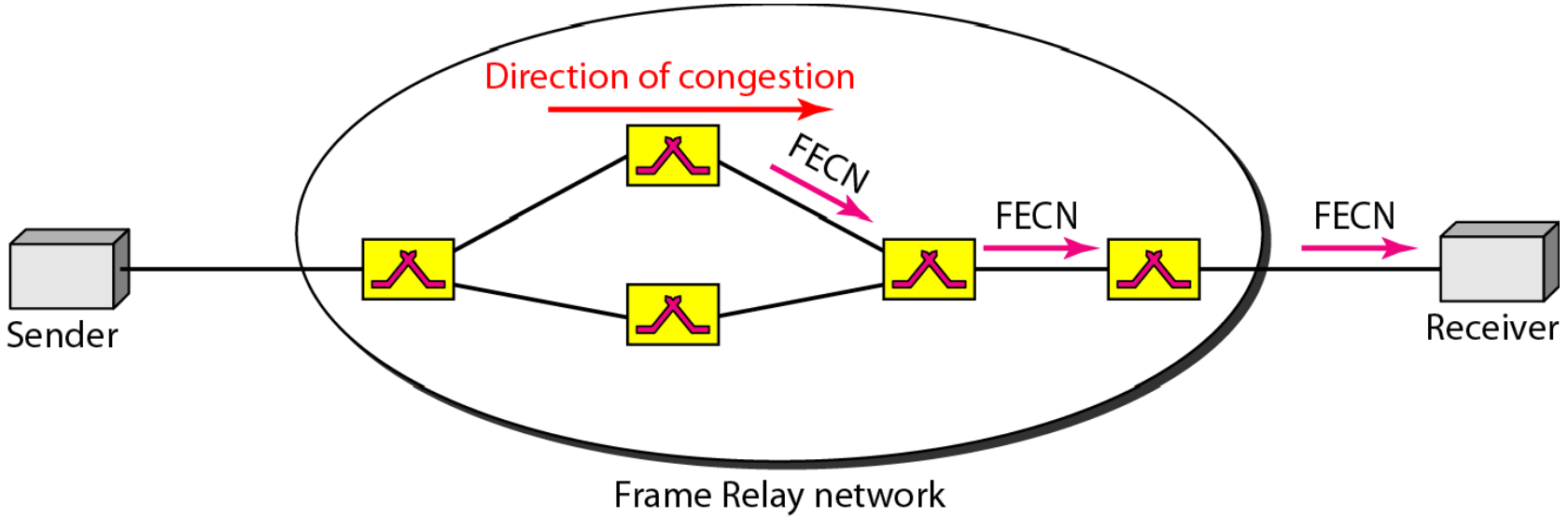
Congestion example



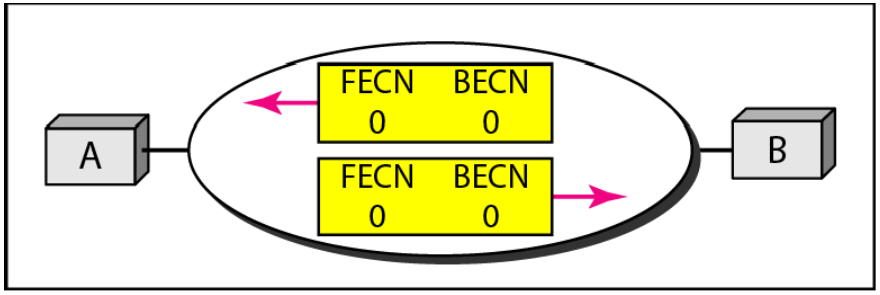
BECN


Direction of congestion
BECN
BECN
Switch
Switch
Switch
Switch
Switch
Sender
Receiver
Frame Relay network

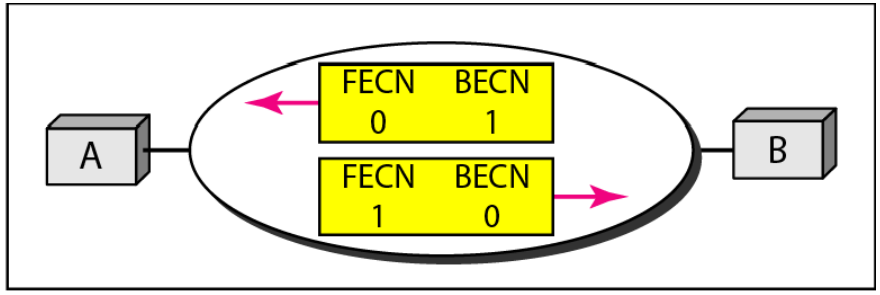
FECN


Direction of congestion
FECN
FECN
FECN
Sender
Receiver
Frame Relay network

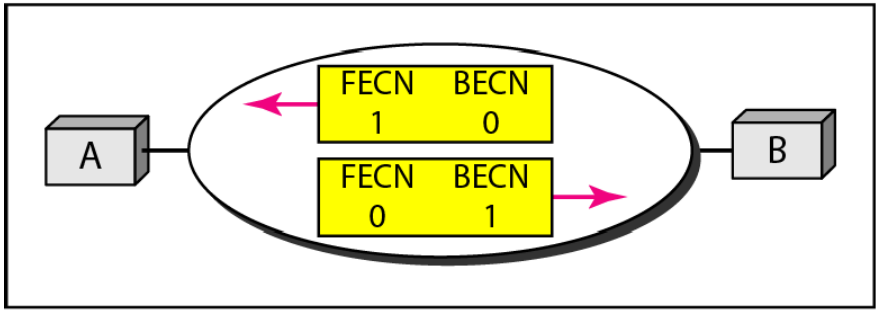
Four cases of congestion



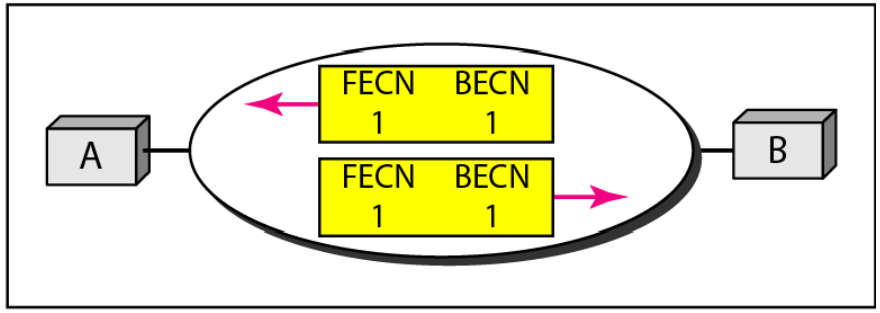
a. No congestion



b. Congestion in the direction A–B



c. Congestion in the direction B–A



d. Congestion in both directions

Quality of Service (QoS)

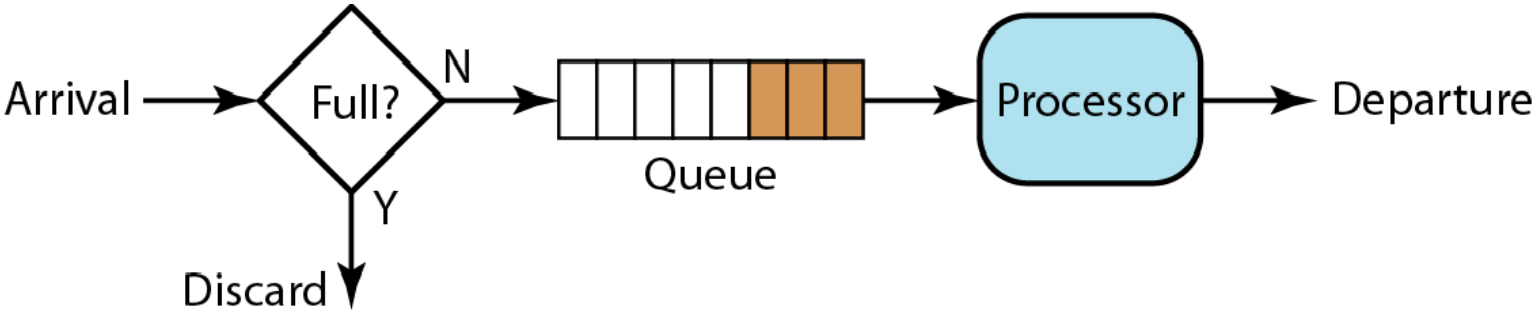
Quality of service (QoS) is an internetworking issue that has been discussed more than defined. We can informally define quality of service as something a flow seeks to attain.

we discuss some techniques that can be used to improve the quality of service.

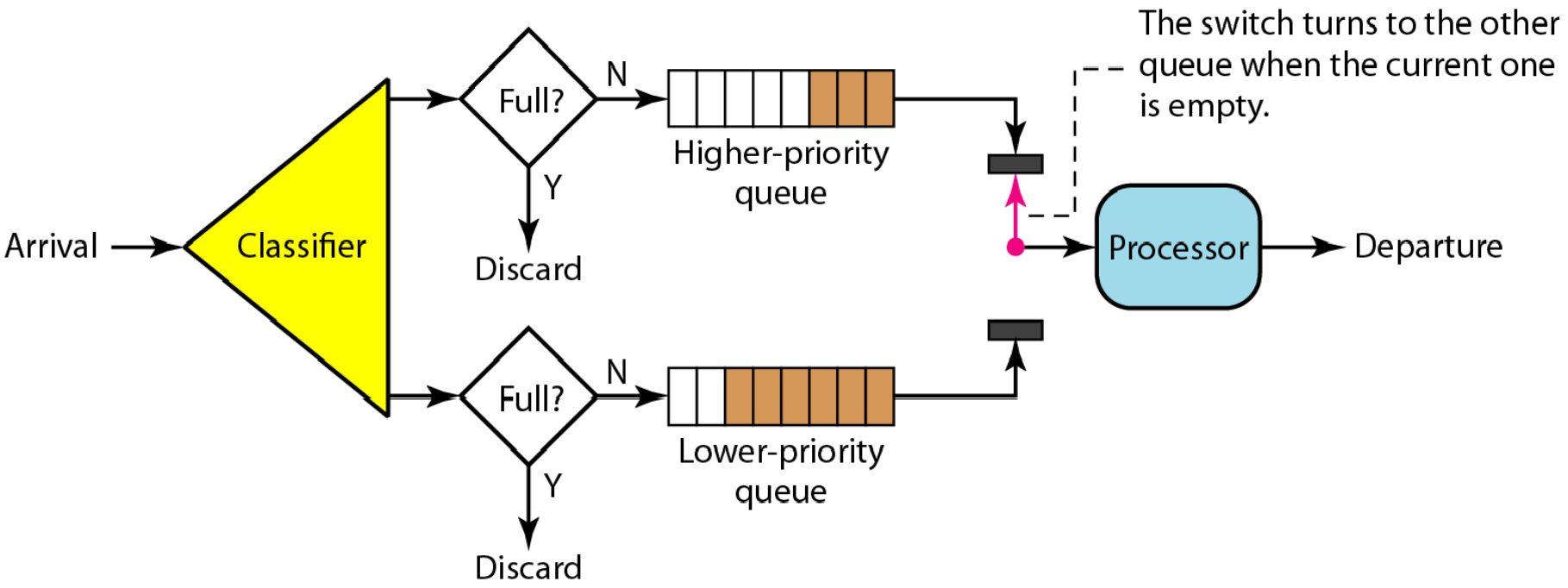
1. ***Scheduling***
2. ***Traffic Shaping***

Scheduling

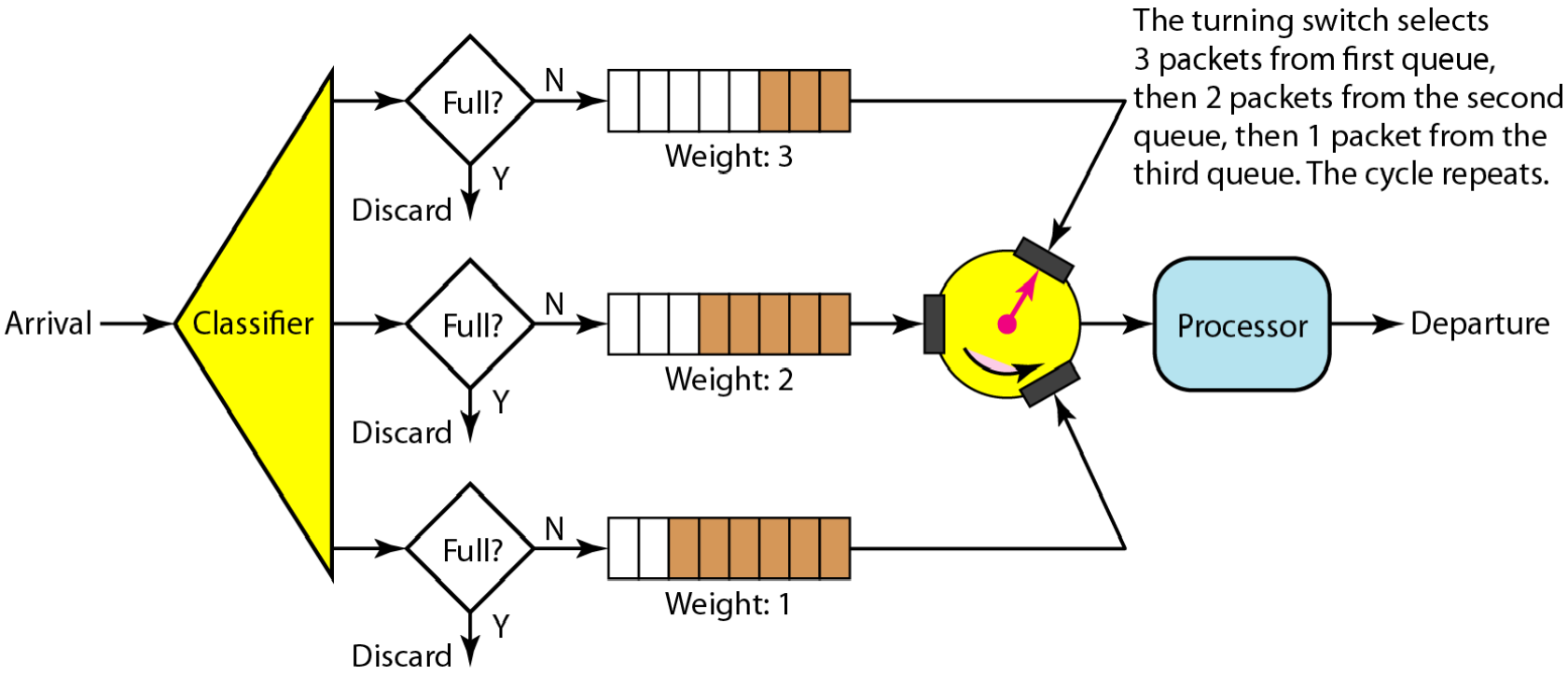
FIFO queue



Priority queuing

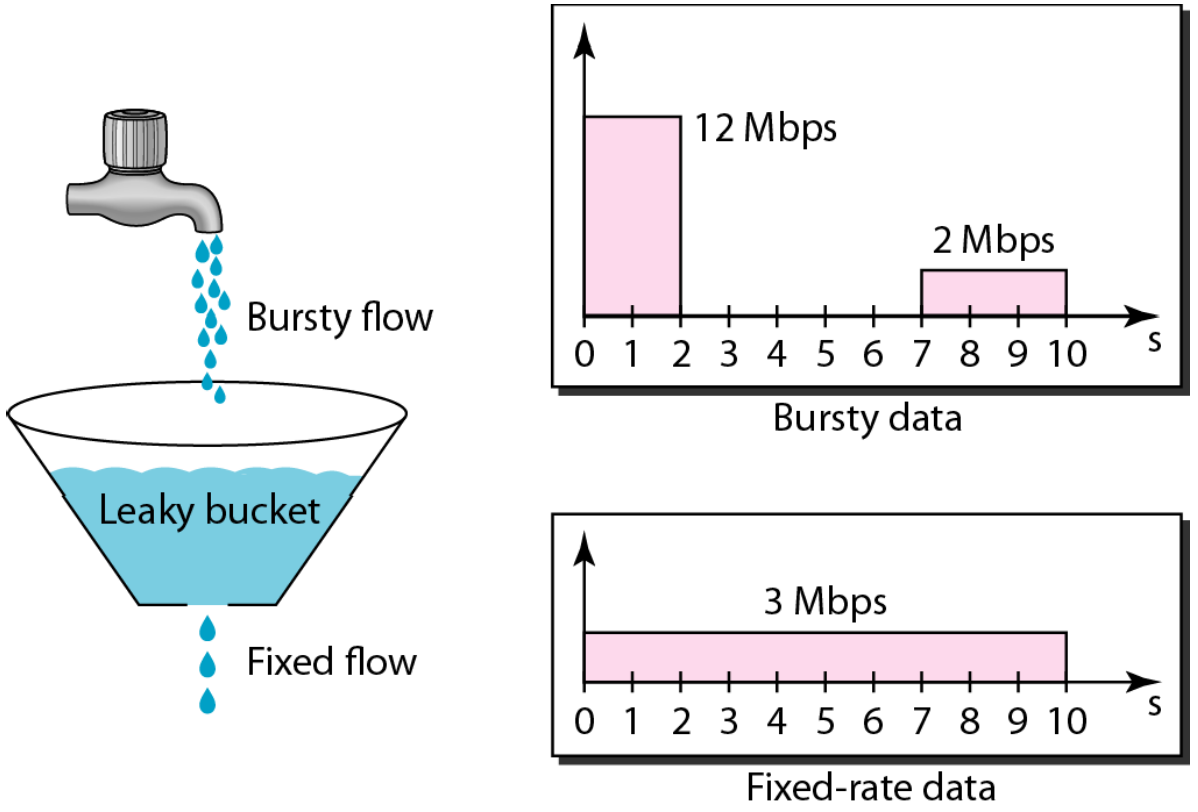


Weighted fair queuing

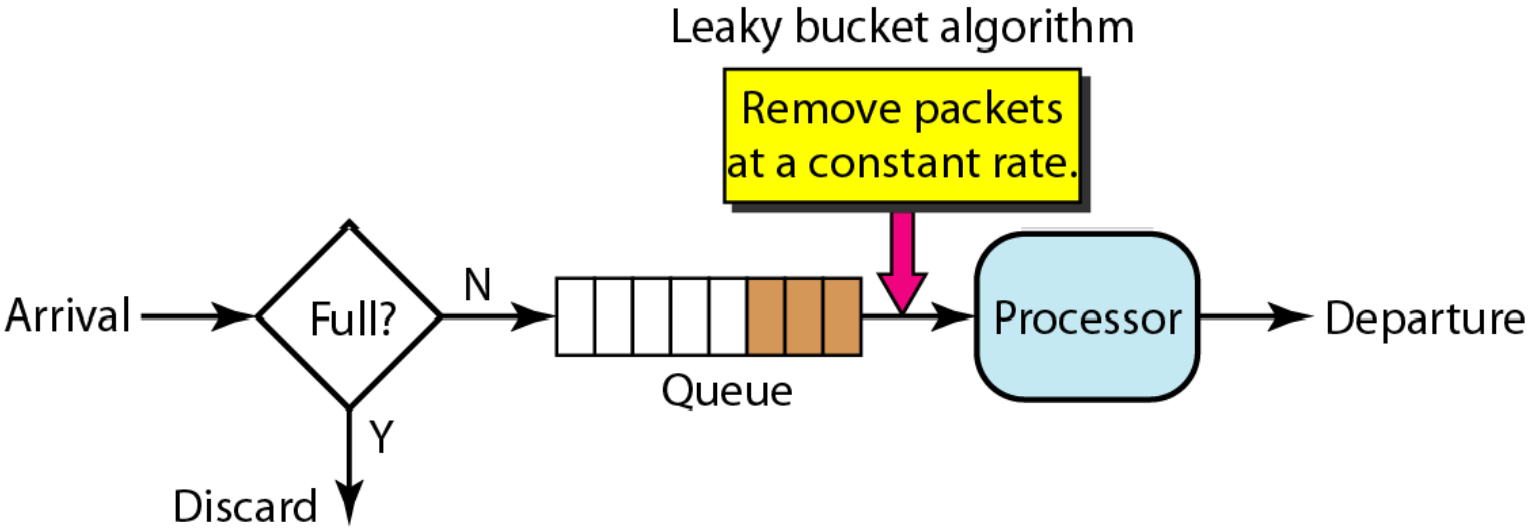


Traffic Shaping

Leaky bucket



Leaky bucket implementation



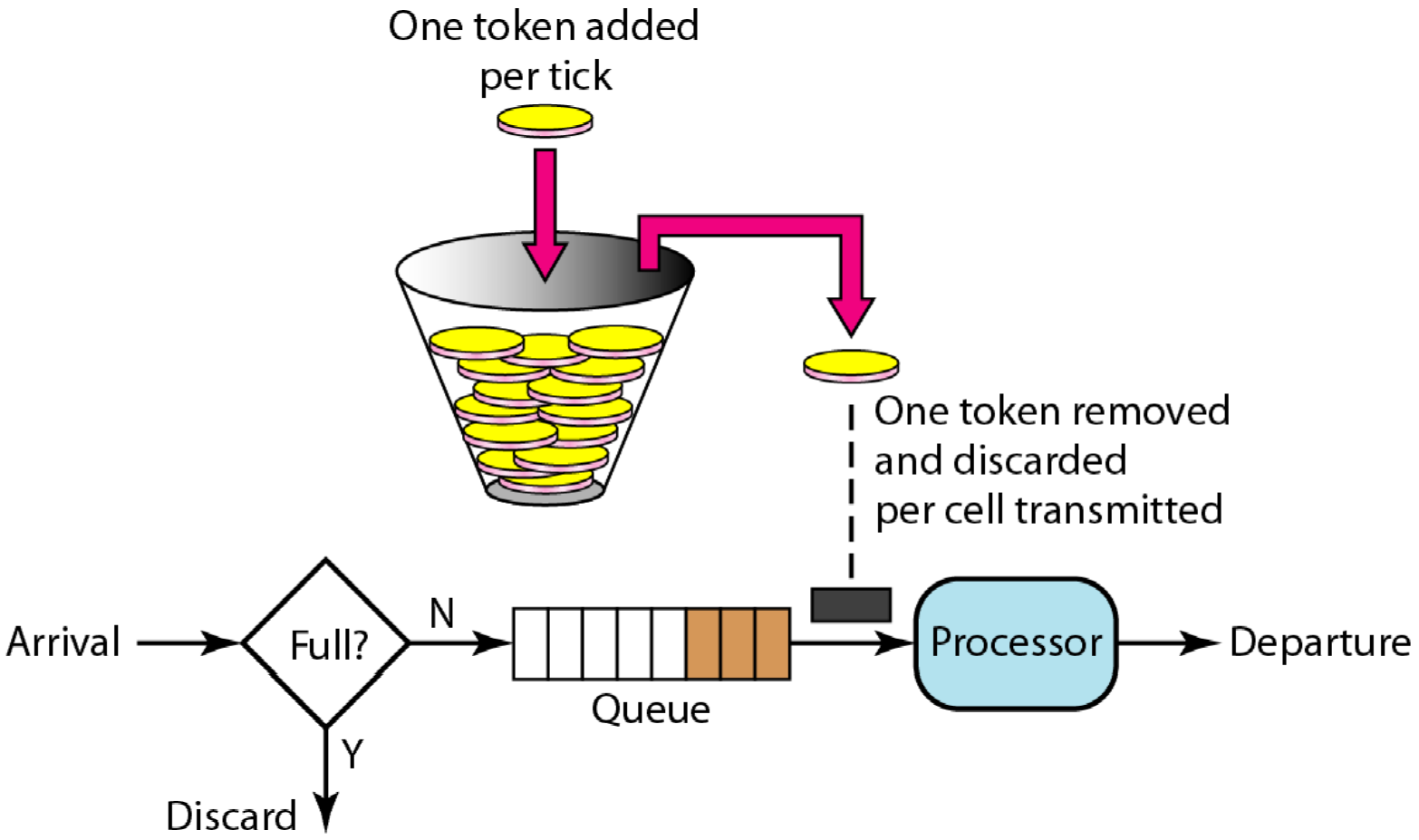
Note

A leaky bucket algorithm shapes bursty traffic into fixed-rate traffic by averaging the data rate. It may drop the packets if the bucket is full.

Note

The token bucket allows bursty traffic at a regulated maximum rate.

Token bucket



Thanks..

References From Forouzan, Tata MCGraw Hill