Chapter 24Congestion Control

24-1 DATA TRAFFIC

Topics discussed in this section:

Traffic Descriptor (qualitative values that represent a data flow)

Traffic Profiles

Figure 24.1 Traffic descriptors

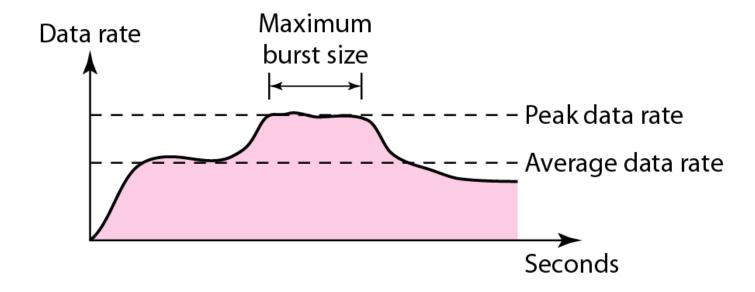
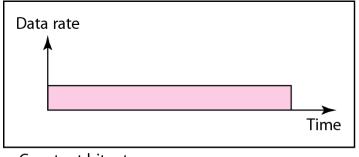
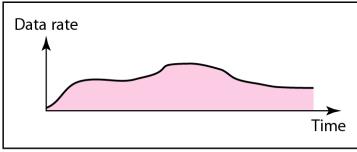


Figure 24.2 Three traffic profiles





a. Constant bit rate

b. Variable bit rate



c. Bursty

24-2 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

Figure 24.3 Queues in a router

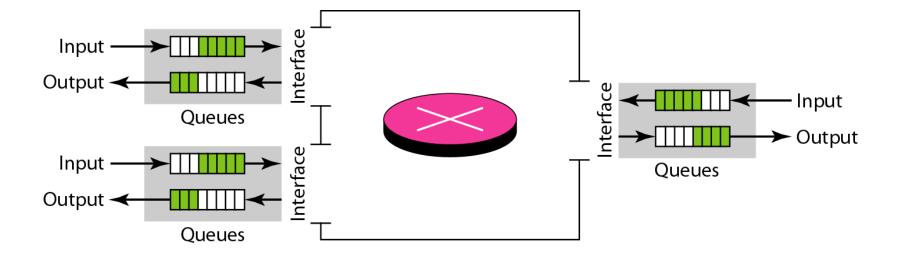
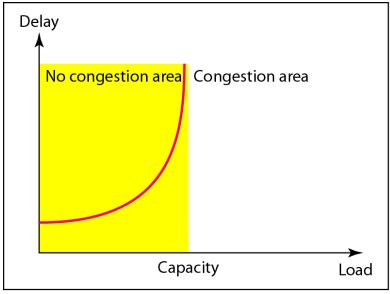
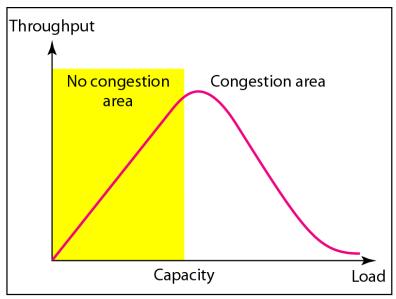


Figure Packet delay and throughput as functions of load



a. Delay as a function of load



b. Throughput as a function of load

24-3 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: openloop congestion control (prevention) and closed-loop congestion control (removal).

Topics discussed in this section:

Open-Loop Congestion Control Closed-Loop Congestion Control

Figure 24.5 Congestion control categories

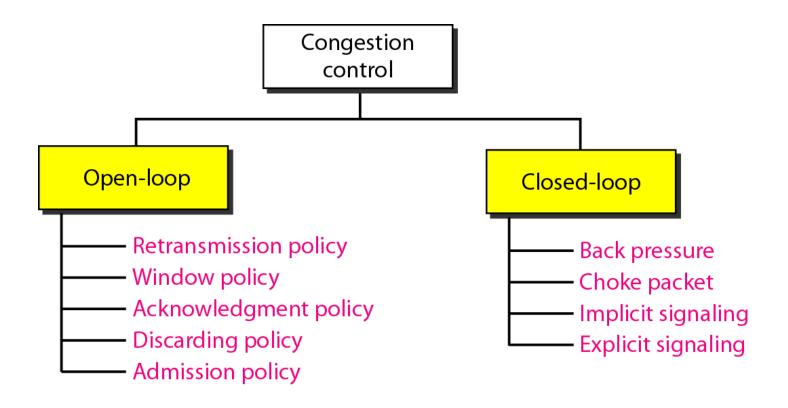


Figure 24.6 Backpressure method for alleviating congestion

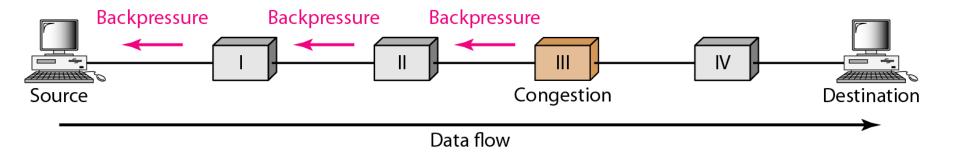
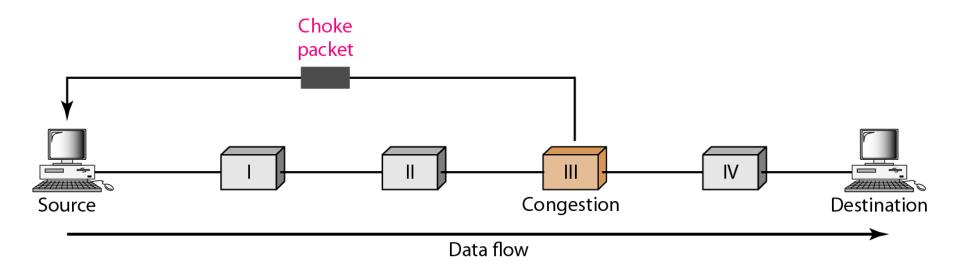


Figure 24.7 Choke packet



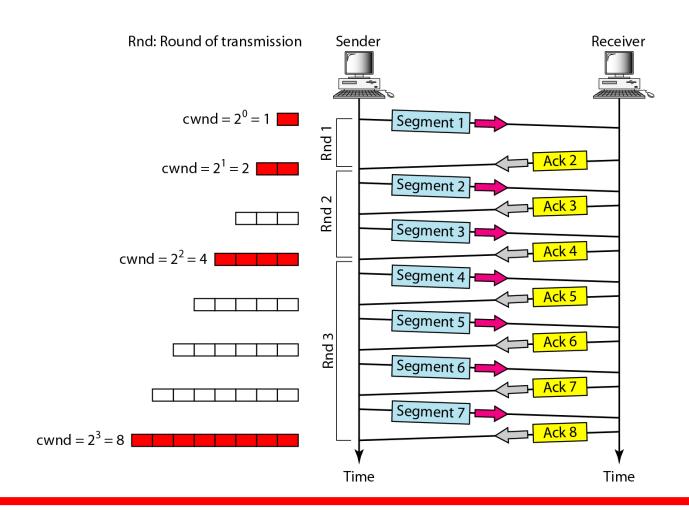
24-4 ONE EXAMPLE

Topics discussed in this section:

Congestion Control in TCP

- Congestion policy
 - Three phases (slow start, avoidance, detection)

Figure 24.8 Slow start, exponential increase

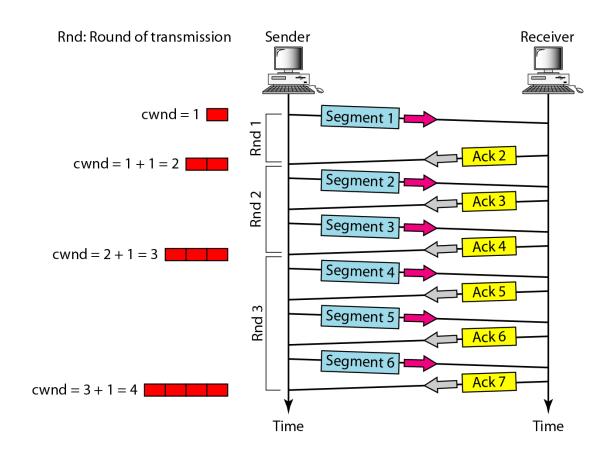




Note

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

Figure 24.9 Congestion avoidance, additive increase





Note

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



Note

- An implementation reacts to congestion detection in one of the following ways:
- If detection is by time-out, a new slow start phase starts.
- If detection is by three ACKs, a new congestion avoidance phase starts.

Figure 24.10 *TCP congestion policy summary*

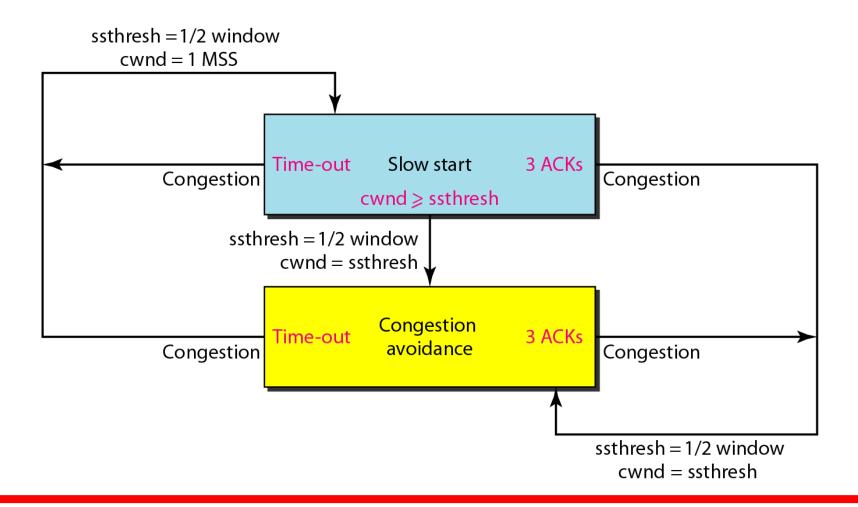


Figure 24.11 Congestion example

