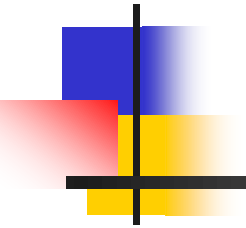


Multiple Access

Figure 12.1 *Data link layer divided into two functionality-oriented sublayers*

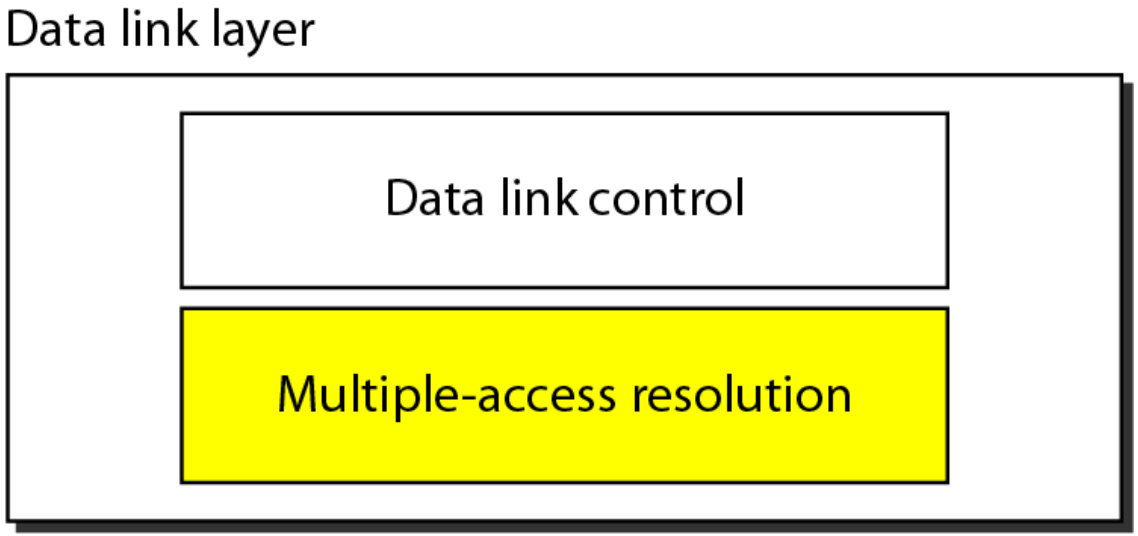
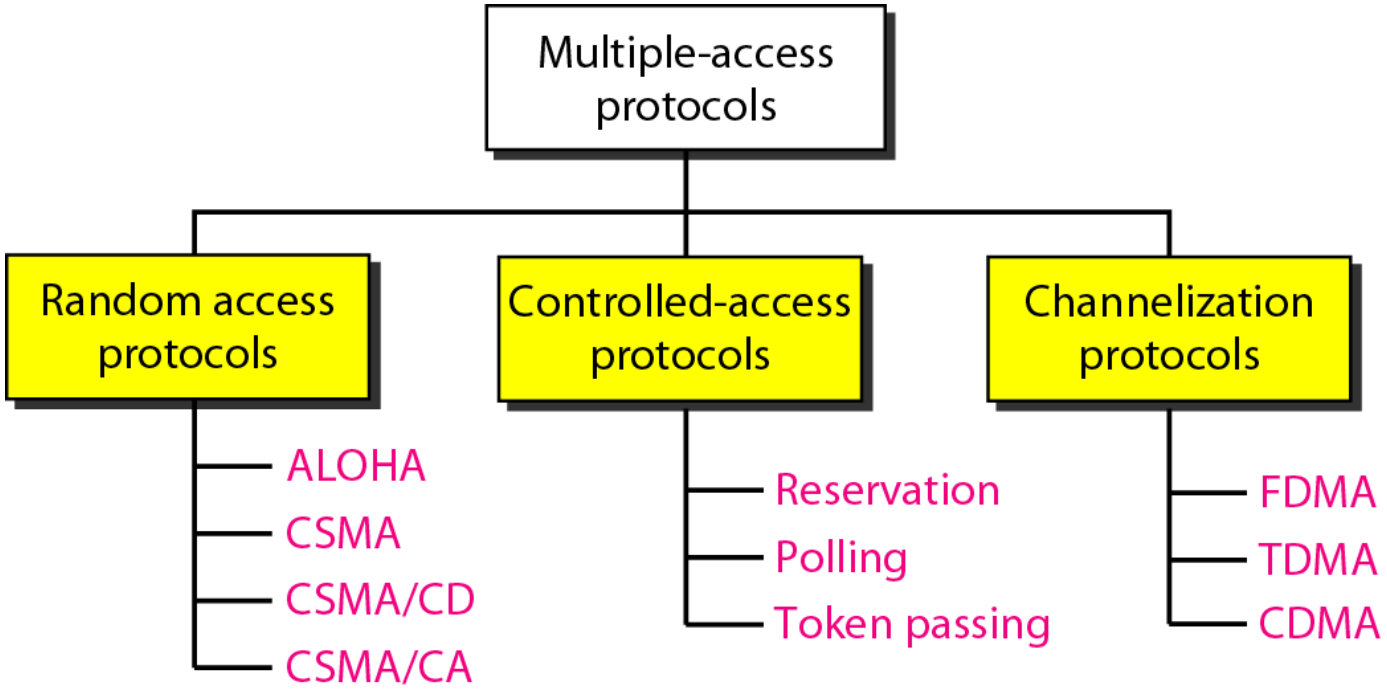


Figure 12.2 *Taxonomy of multiple-access protocols discussed in this chapter*



12-1 RANDOM ACCESS

In random access or contention methods, no station is superior to another station and none is assigned the control over another. No station permits, or does not permit, another station to send. At each instance, a station that has data to send uses a procedure defined by the protocol to make a decision on whether or not to send.

Topics discussed in this section:

ALOHA
Carrier Sense Multiple Access
Carrier Sense Multiple Access with Collision Detection
Carrier Sense Multiple Access with Collision Avoidance

Figure 12.3 *Frames in a pure ALOHA network*

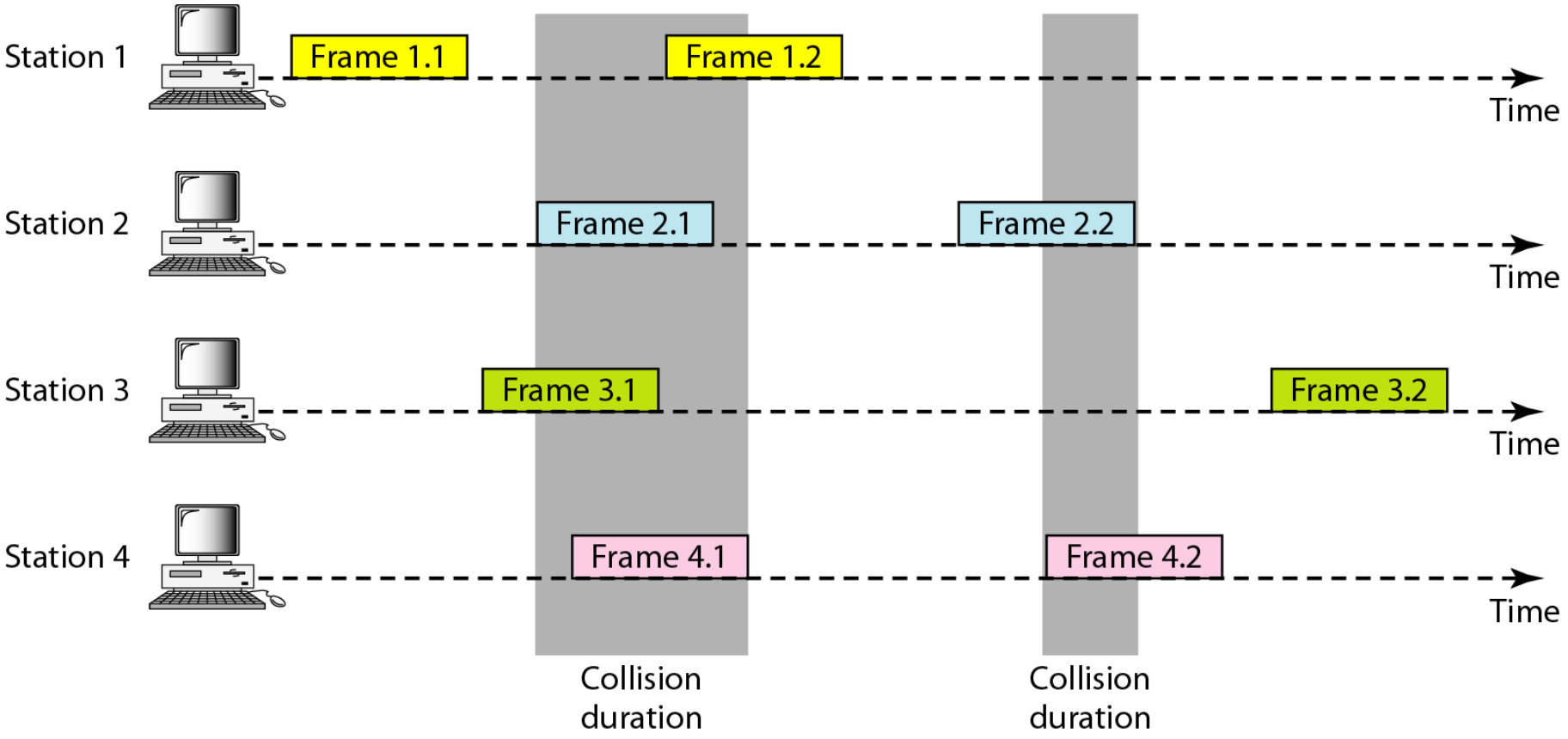


Figure 12.4 *Procedure for pure ALOHA protocol*

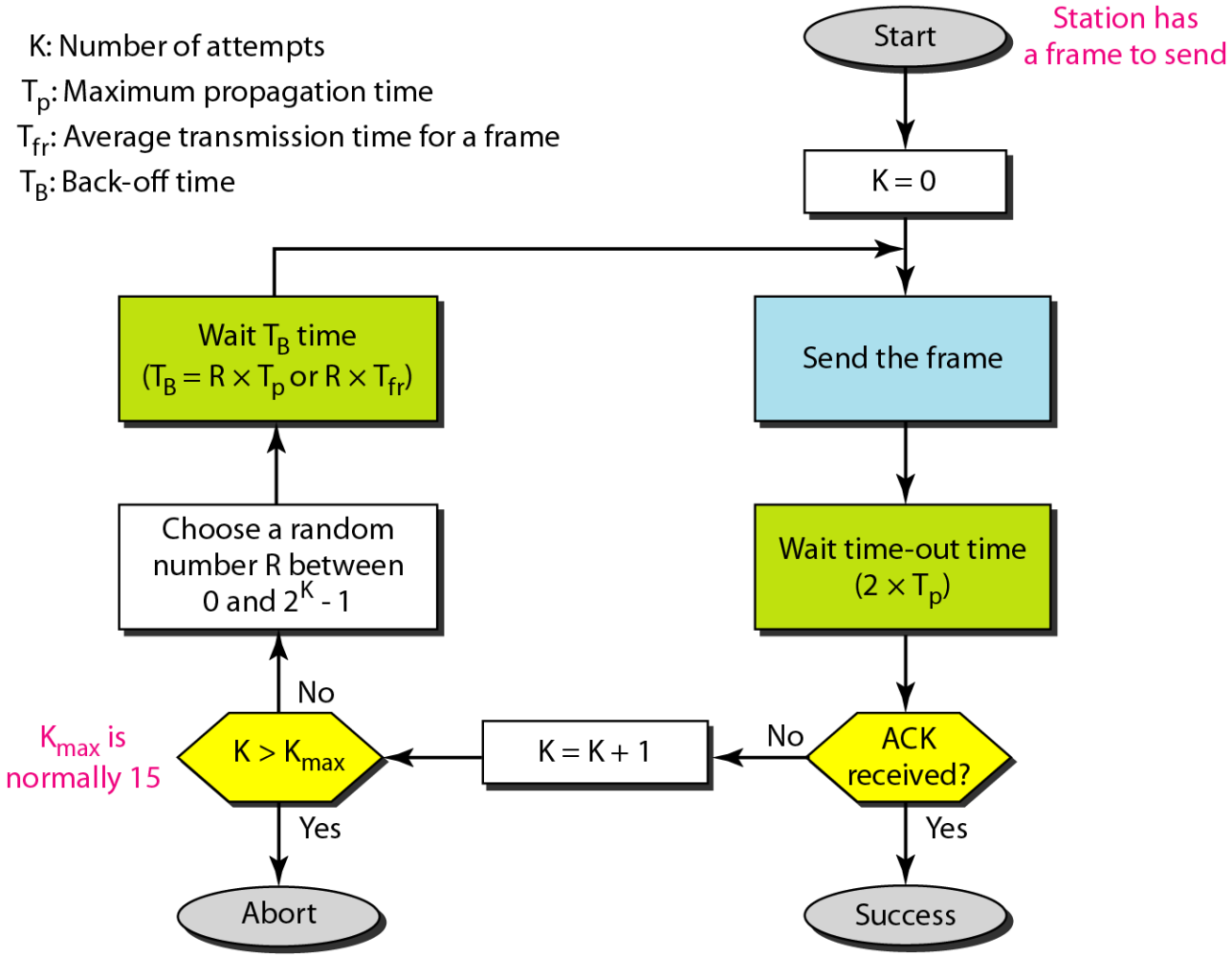
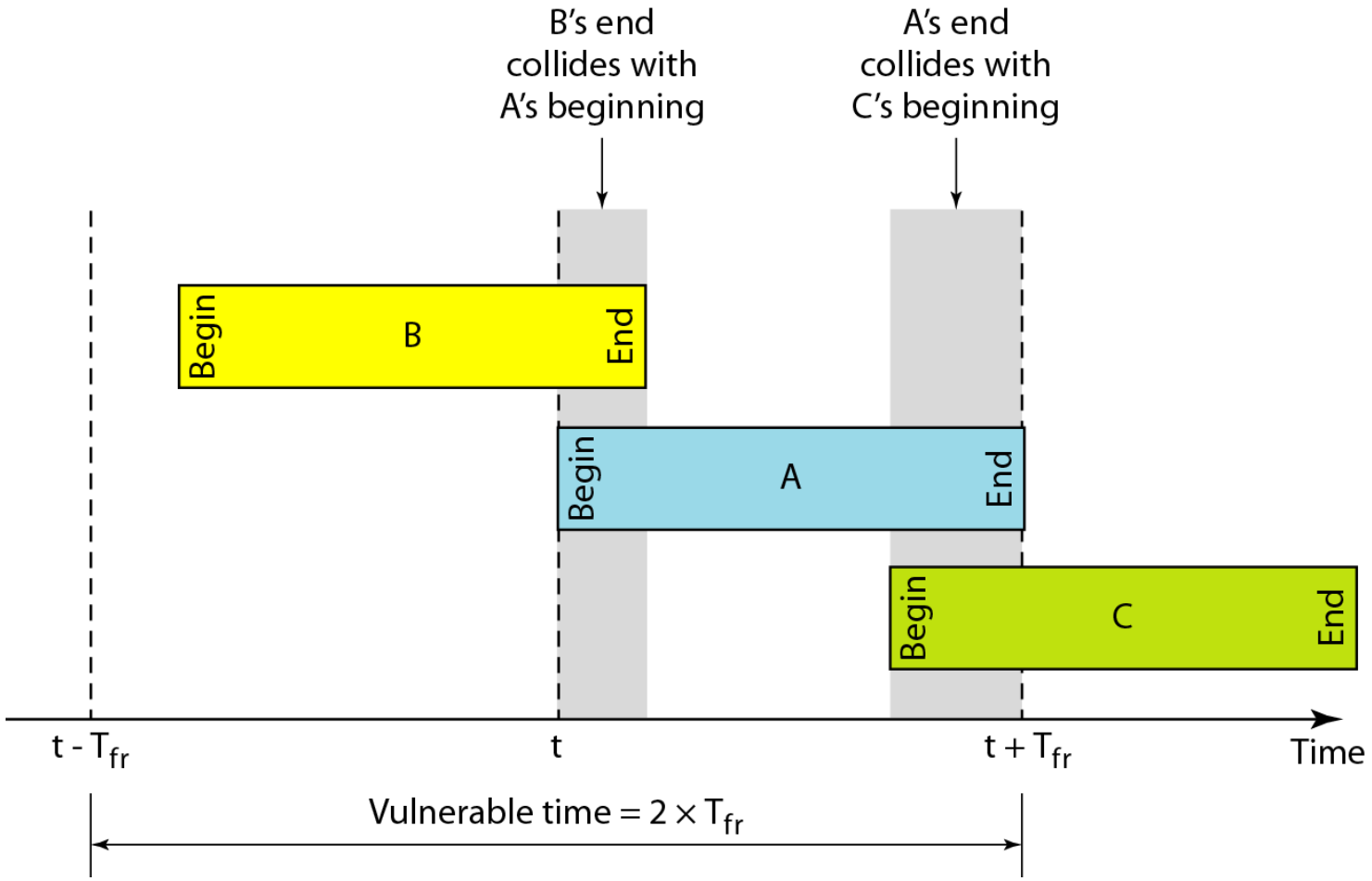


Figure 12.5 *Vulnerable time for pure ALOHA protocol*



Note

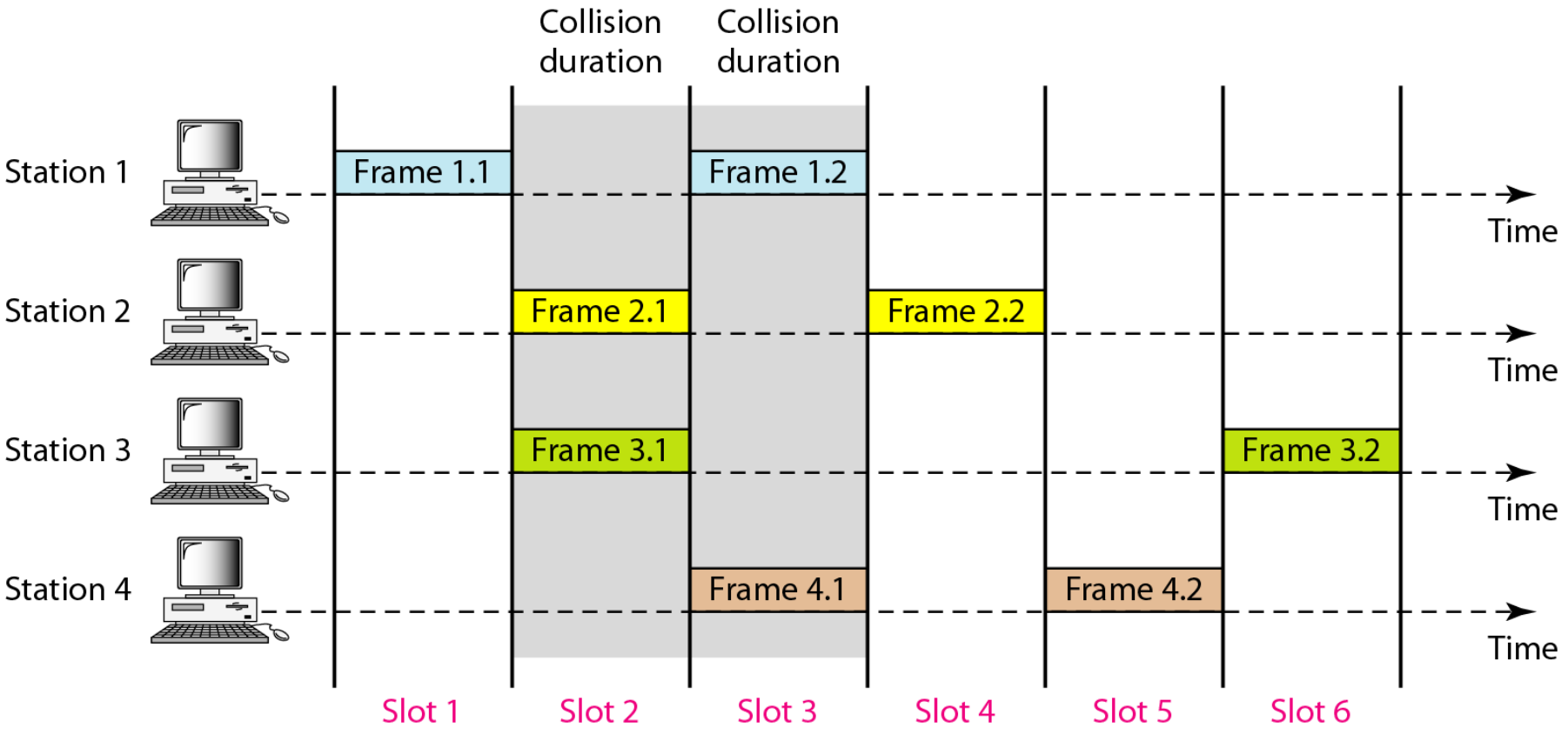
The throughput for pure ALOHA is

$$S = G \times e^{-2G} .$$

The maximum throughput

$$S_{max} = 0.184 \text{ when } G = (1/2).$$

Figure 12.6 *Frames in a slotted ALOHA network*



Note

The throughput for slotted ALOHA is $S = G \times e^{-G}$.

The maximum throughput $S_{max} = 0.368$ when G = 1.

Figure 12.7 *Vulnerable time for slotted ALOHA protocol*

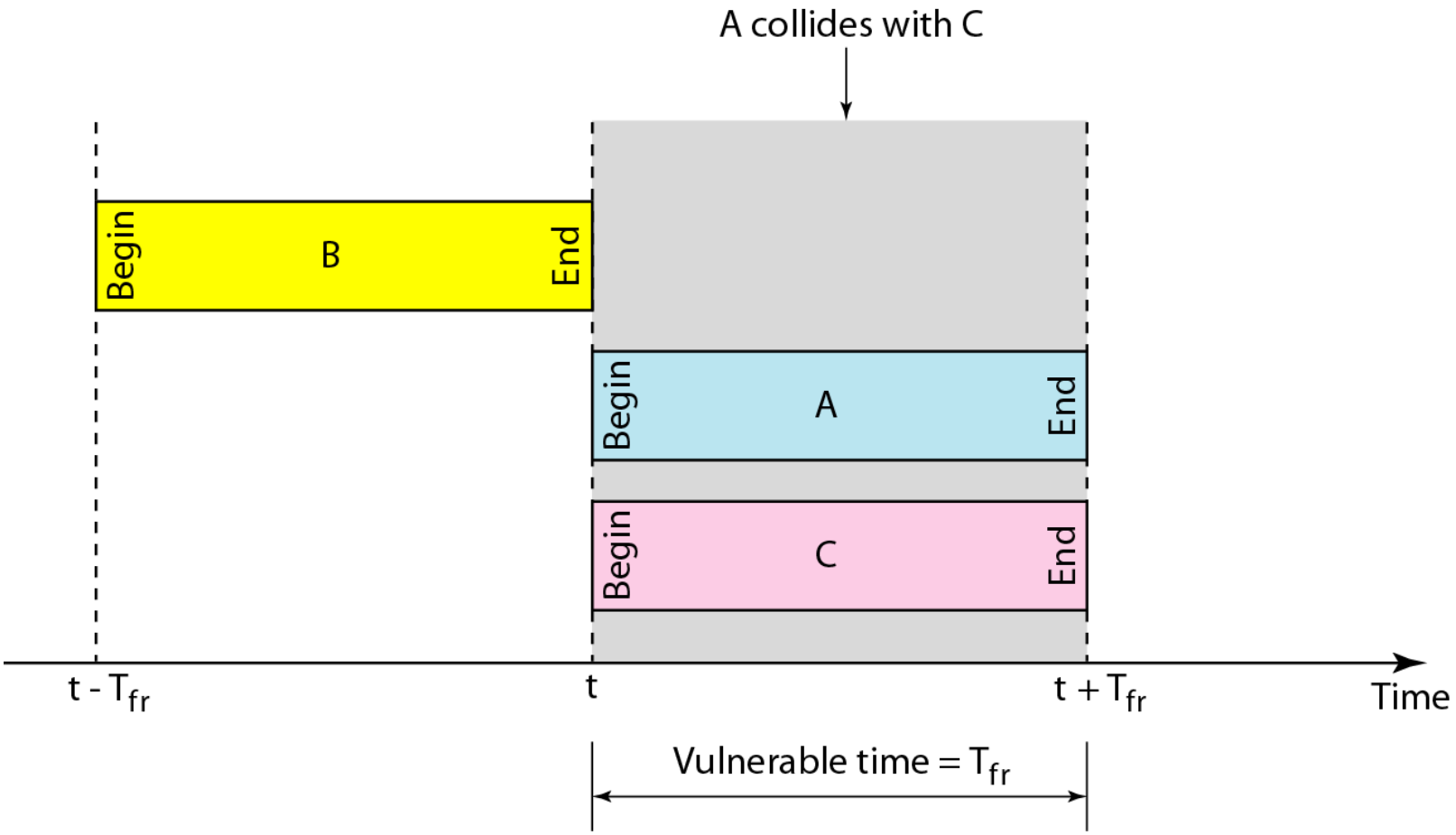


Figure 12.9 *Vulnerable time in CSMA*

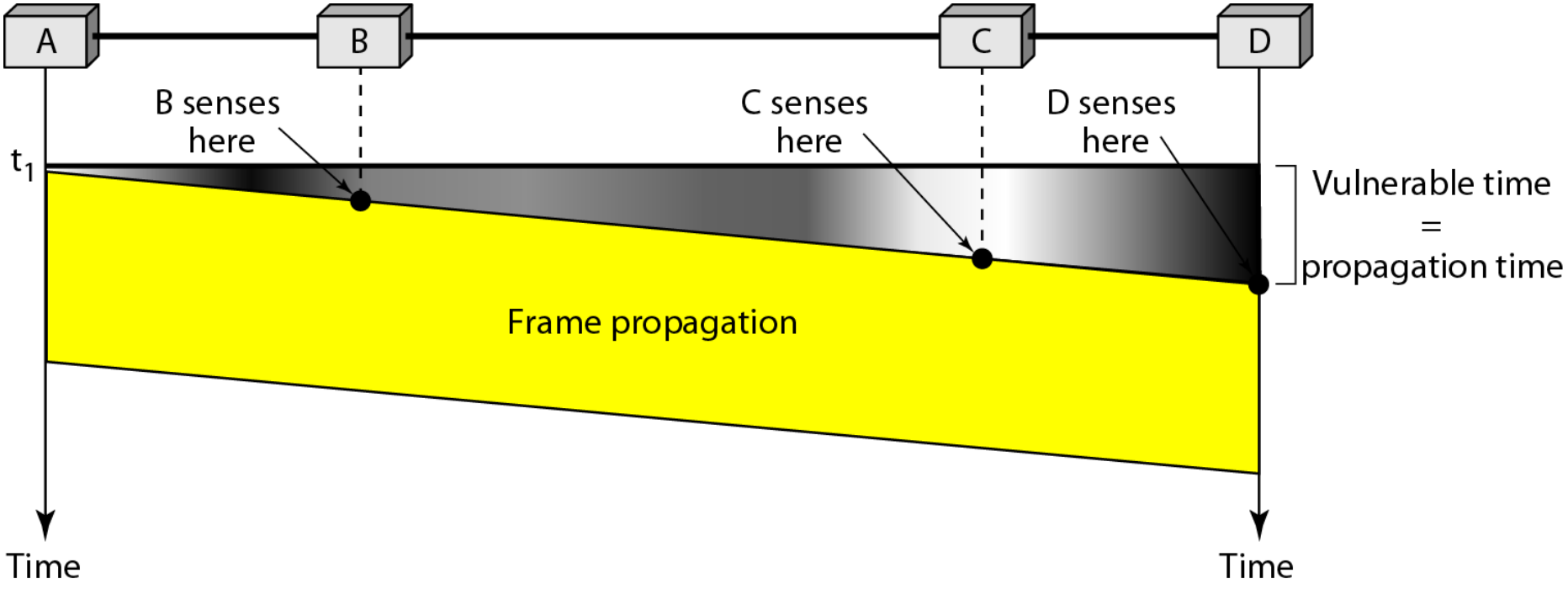
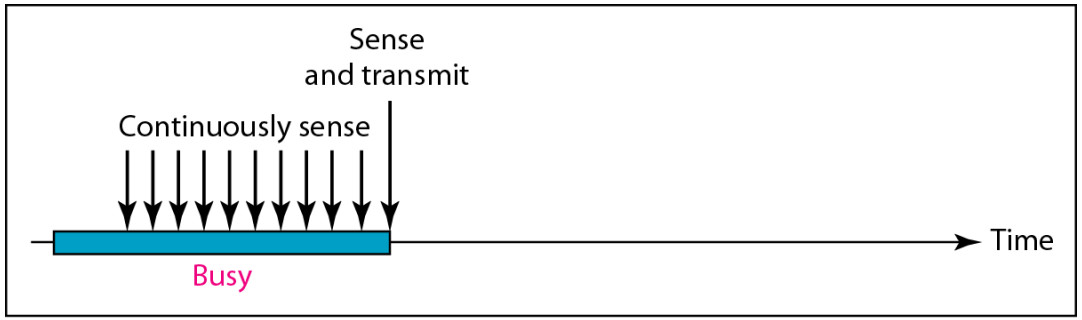
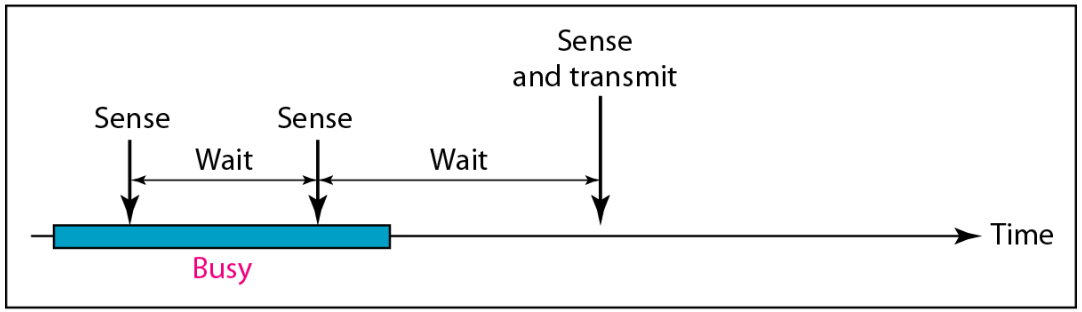


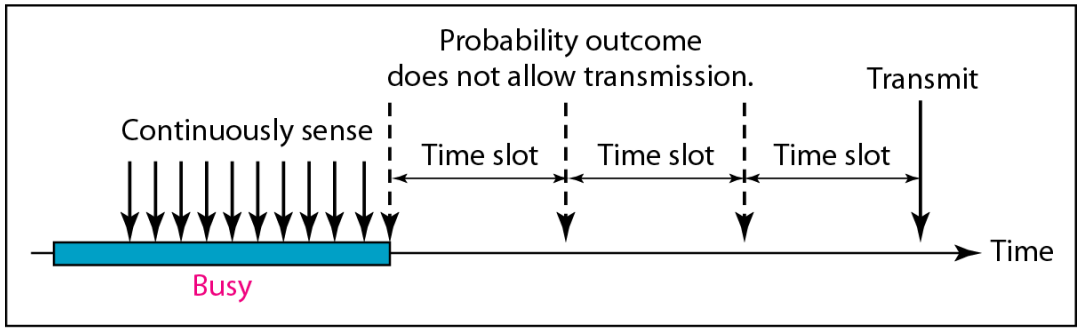
Figure 12.10 *Behavior of three persistence methods*



a. 1-persistent



b. Nonpersistent



c. p-persistent

Figure 12.11 *Flow diagram for three persistence methods*

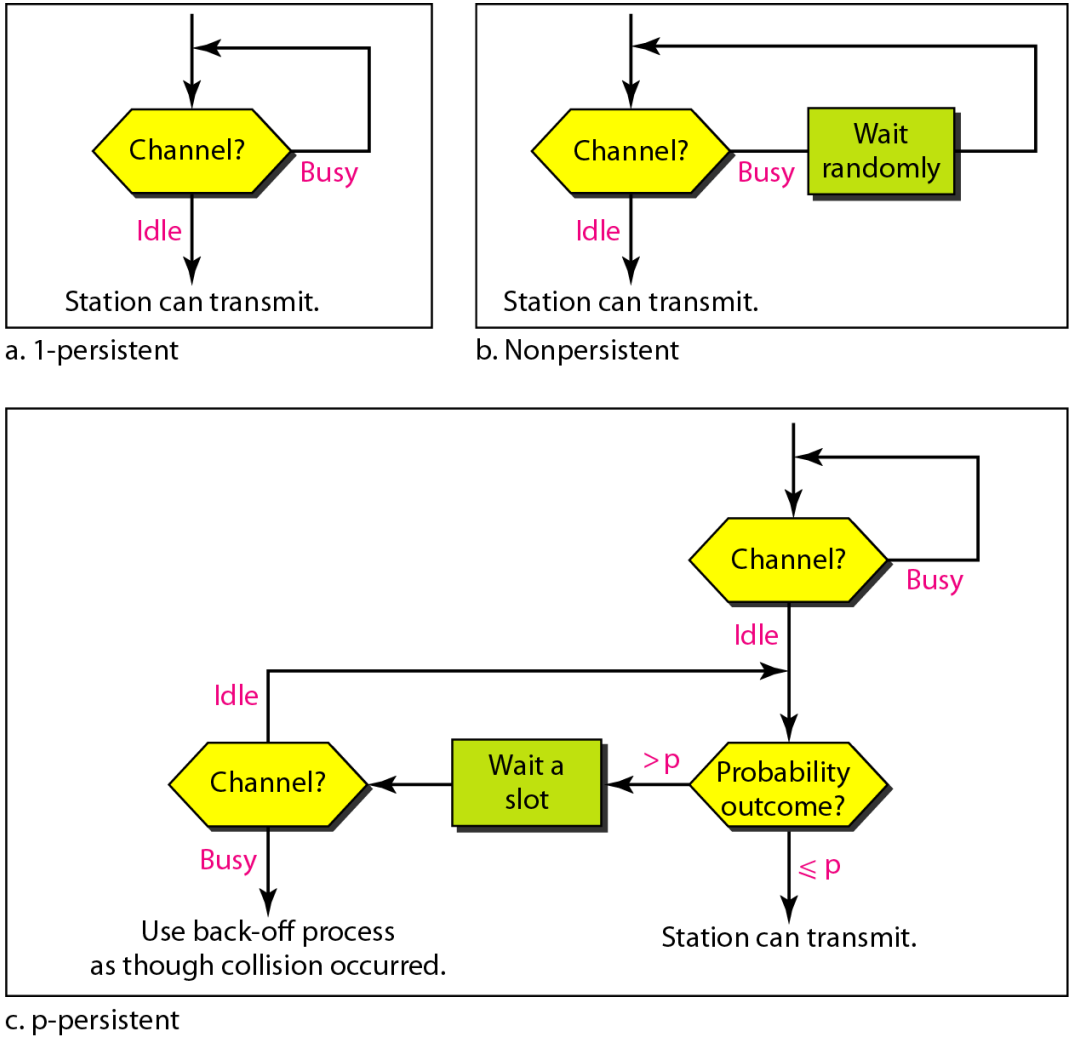


Figure 12.12 *Collision of the first bit in CSMA/CD*

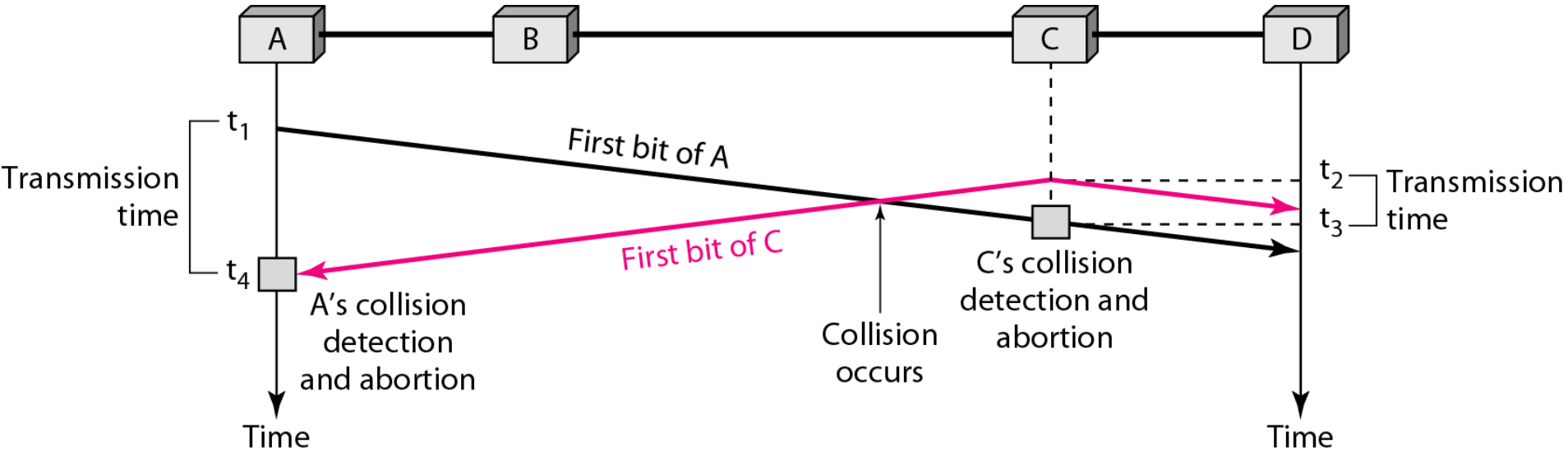


Figure 12.13 *Collision and abortion in CSMA/CD*

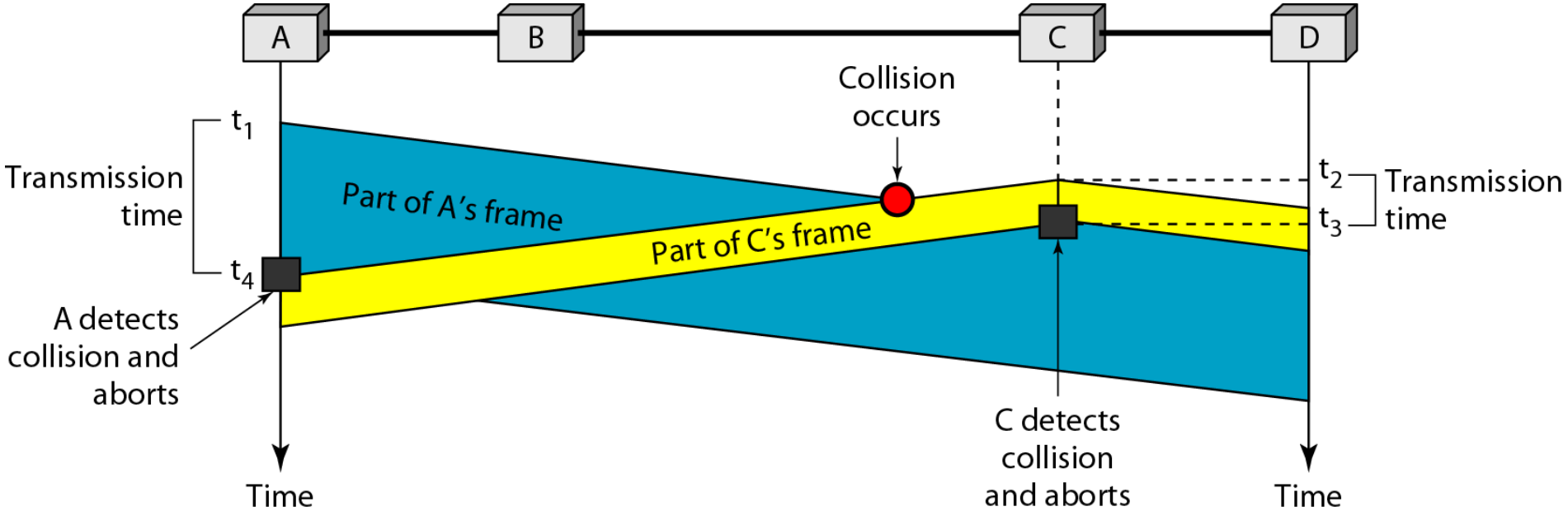


Figure 12.14 *Flow diagram for the CSMA/CD*

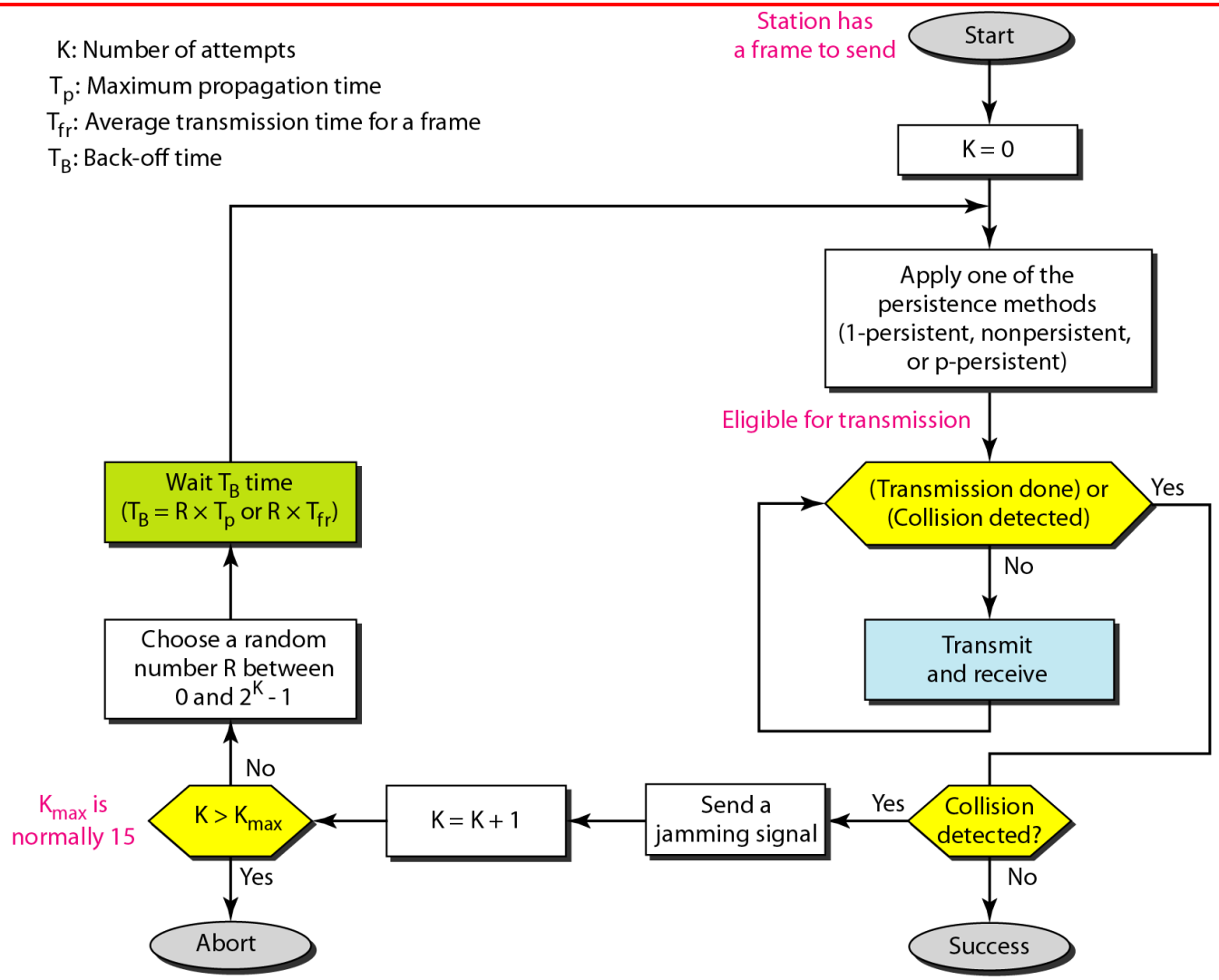


Figure 12.15 *Energy level during transmission, idleness, or collision*

Zero level: channel is idle.
Normal: station has successfully captured the channel and sending the frame.
Abnormal: collision.

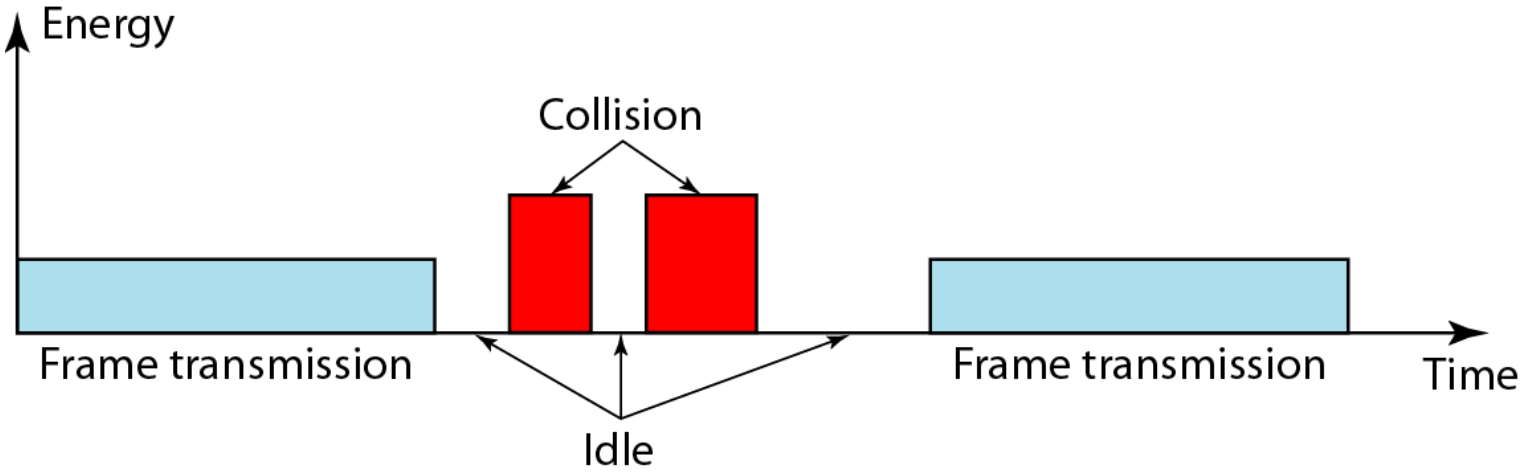
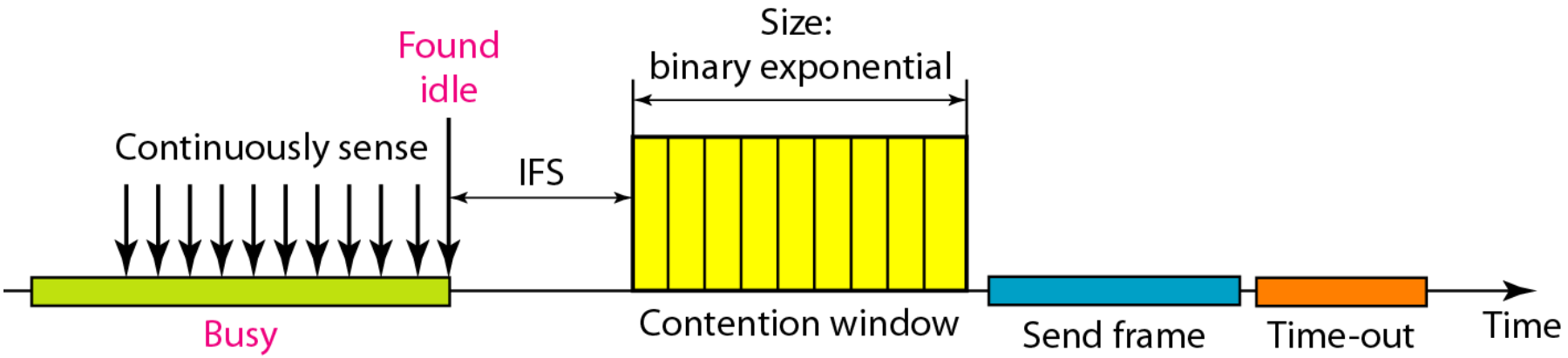


Figure 12.16 *Timing in CSMA/CA*

Interframe space, contention window, ACK



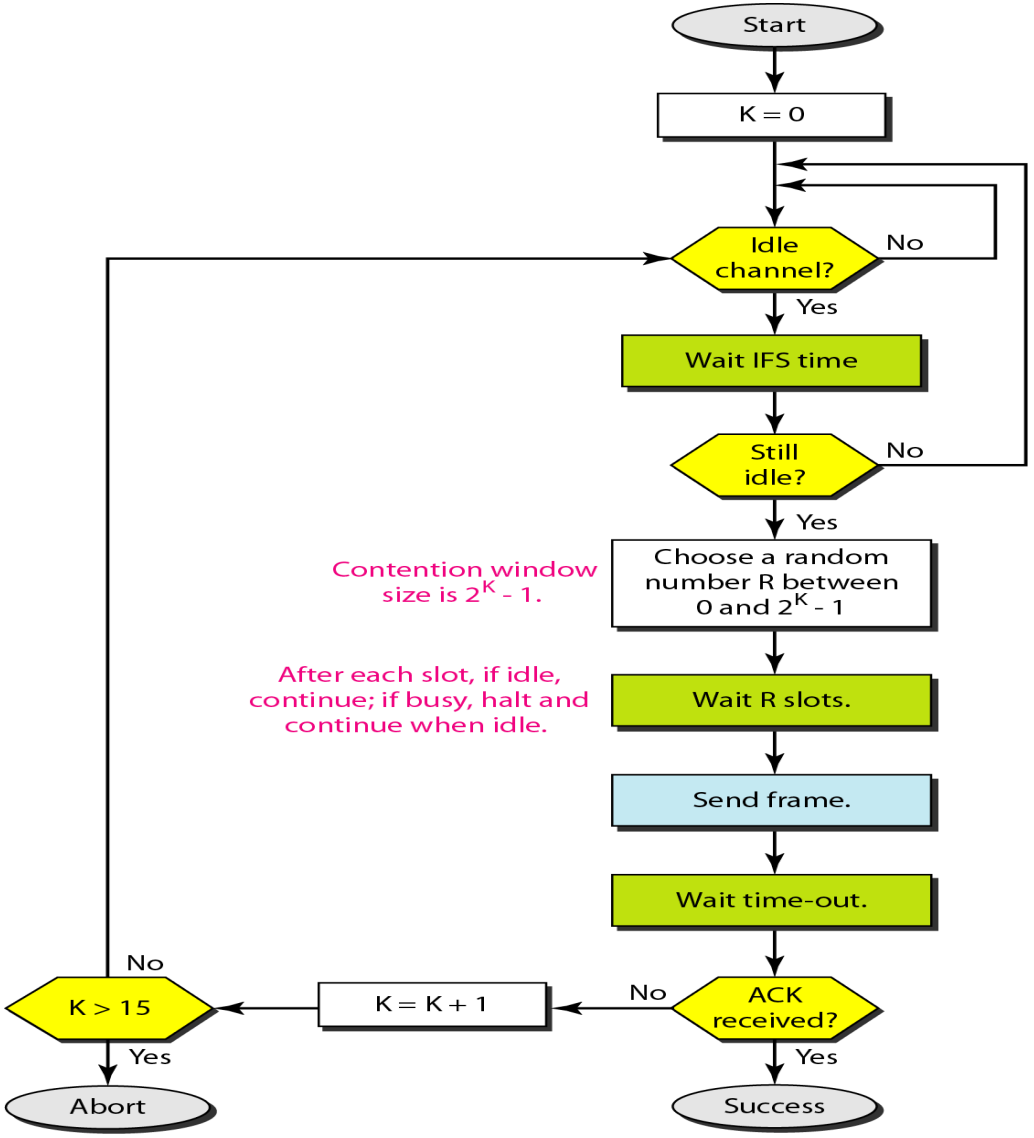
Note

In CSMA/CA, the IFS can also be used to define the priority of a station or a frame.

Note

In CSMA/CA, if the station finds the channel busy, it does not restart the timer of the contention window; it stops the timer and restarts it when the channel becomes idle.

Figure 12.17 *Flow diagram for CSMA/CA*



12-2 CONTROLLED ACCESS

In controlled access, the stations consult one another to find which station has the right to send. A station cannot send unless it has been authorized by other stations. We discuss three popular controlled-access methods.

Topics discussed in this section:

Reservation
Polling
Token Passing

Figure 12.18 *Reservation access method*

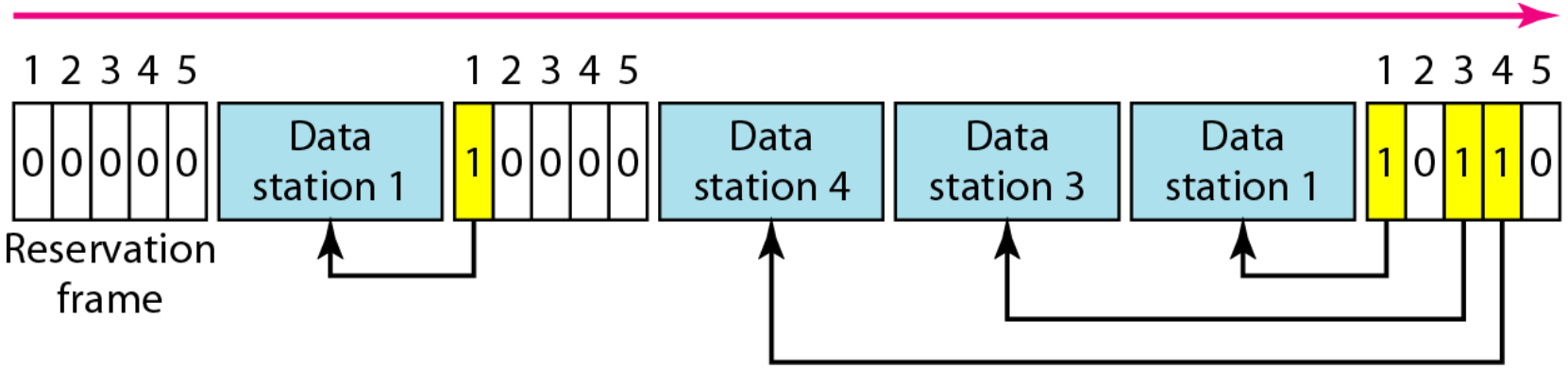
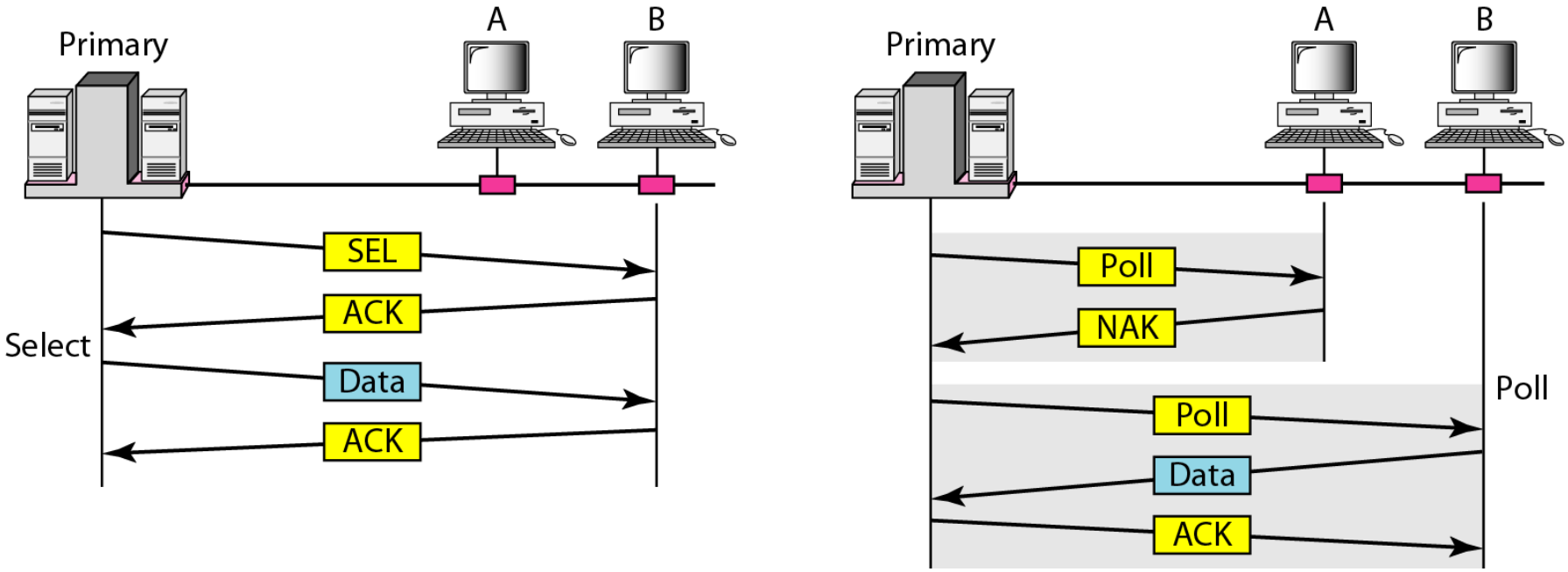


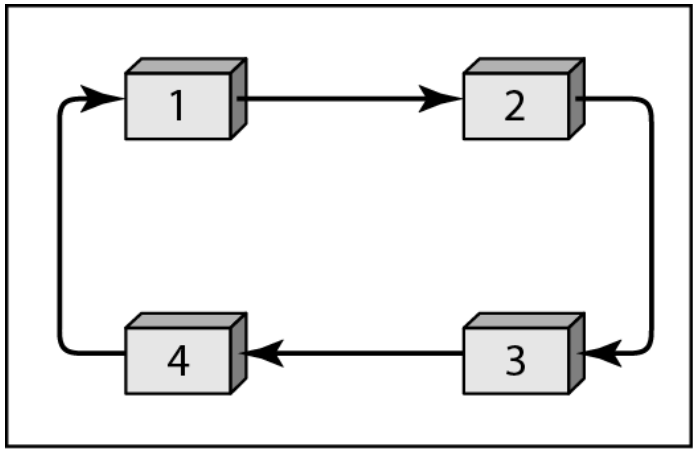
Figure 12.19 *Select and poll functions in polling access method*

Primary device control the link, secondary device follow its instruction.

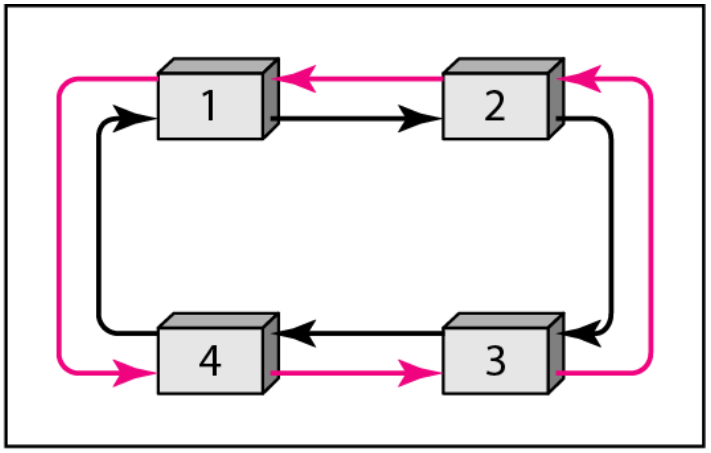


SEL: Primary device has something to send.
Poll: ready to receive data.

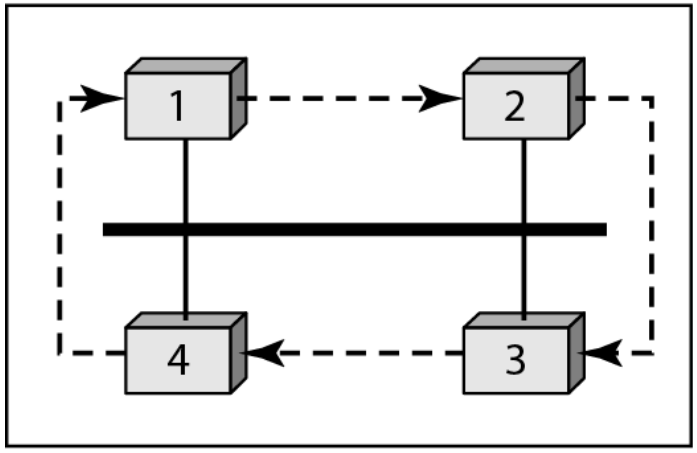
Figure 12.20 *Logical ring and physical topology in token-passing access method*



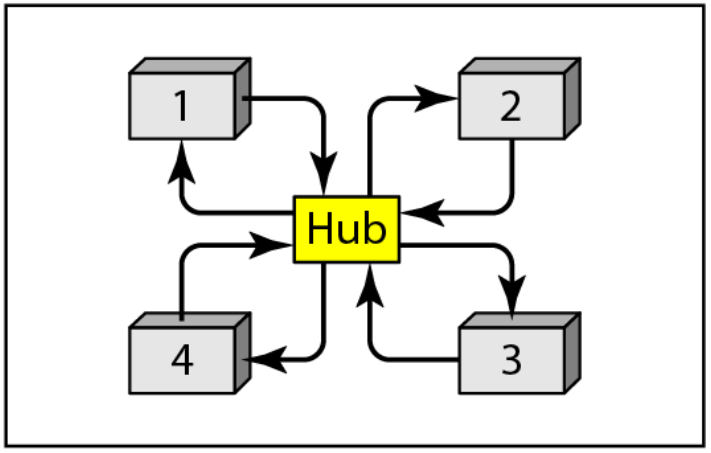
a. Physical ring



b. Dual ring



c. Bus ring



d. Star ring