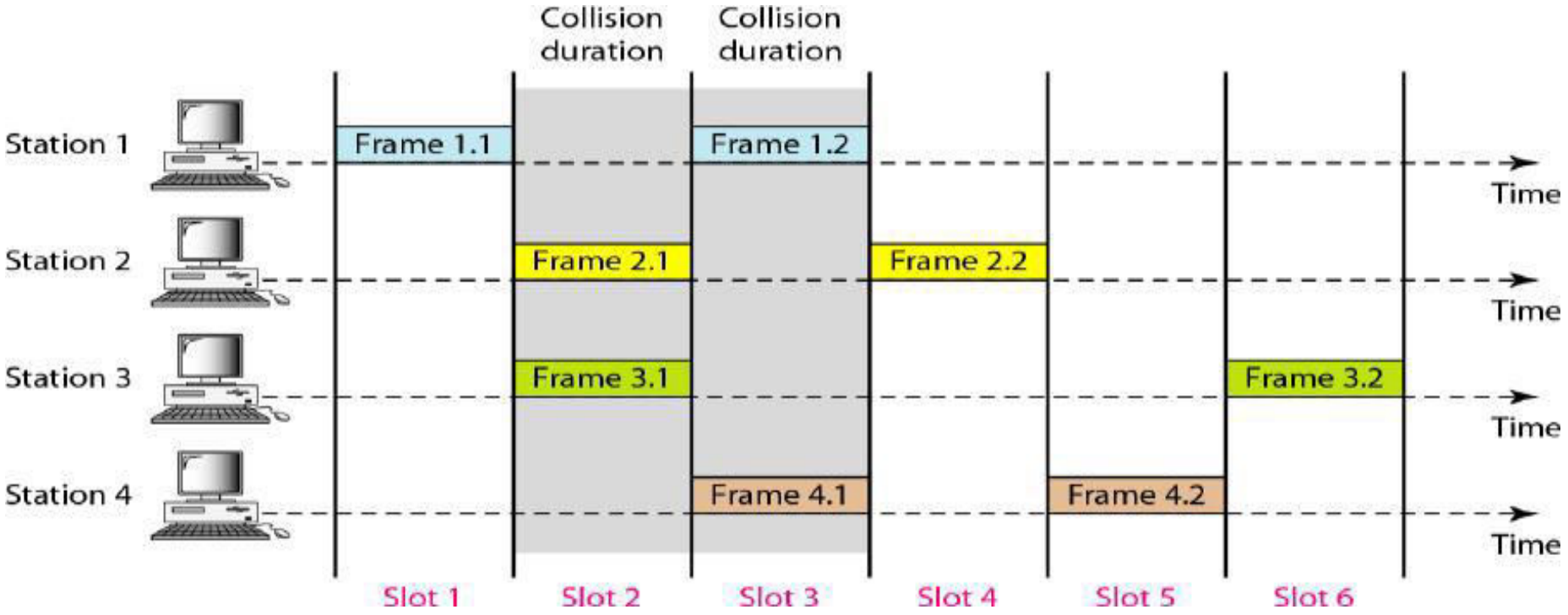
Computer Network

Lecture-24

Dharmendra Kumar (Associate Professor)
Department of Computer Science and Engineering
United College of Engineering and Research,
Prayagraj

Slotted ALOHA

- Slotted ALOHA was invented to improve the efficiency of pure ALOHA.
- In slotted ALOHA we divide the time into slots of T_{fr} and force the station to send only at the beginning of the time slot.
- Figure shows an example of frame collisions in slotted ALOHA.



Slotted ALOHA

- Since a station is allowed to send only at the beginning of the synchronized time slot, if a station misses this moment, it must wait until the beginning of the next time slot.
- There is still the possibility of collision if two stations try to send at the beginning of the same time slot.
- The vulnerable time is now reduced to one-half, equal to T_{fr}.
- Throughput, $S = G*e^{-G}$
- Maximum throughput $S_{max} = 0.368$, when $G = 1$.

Slotted ALOHA

Example:

A slotted ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces

a. 1000 frames per second

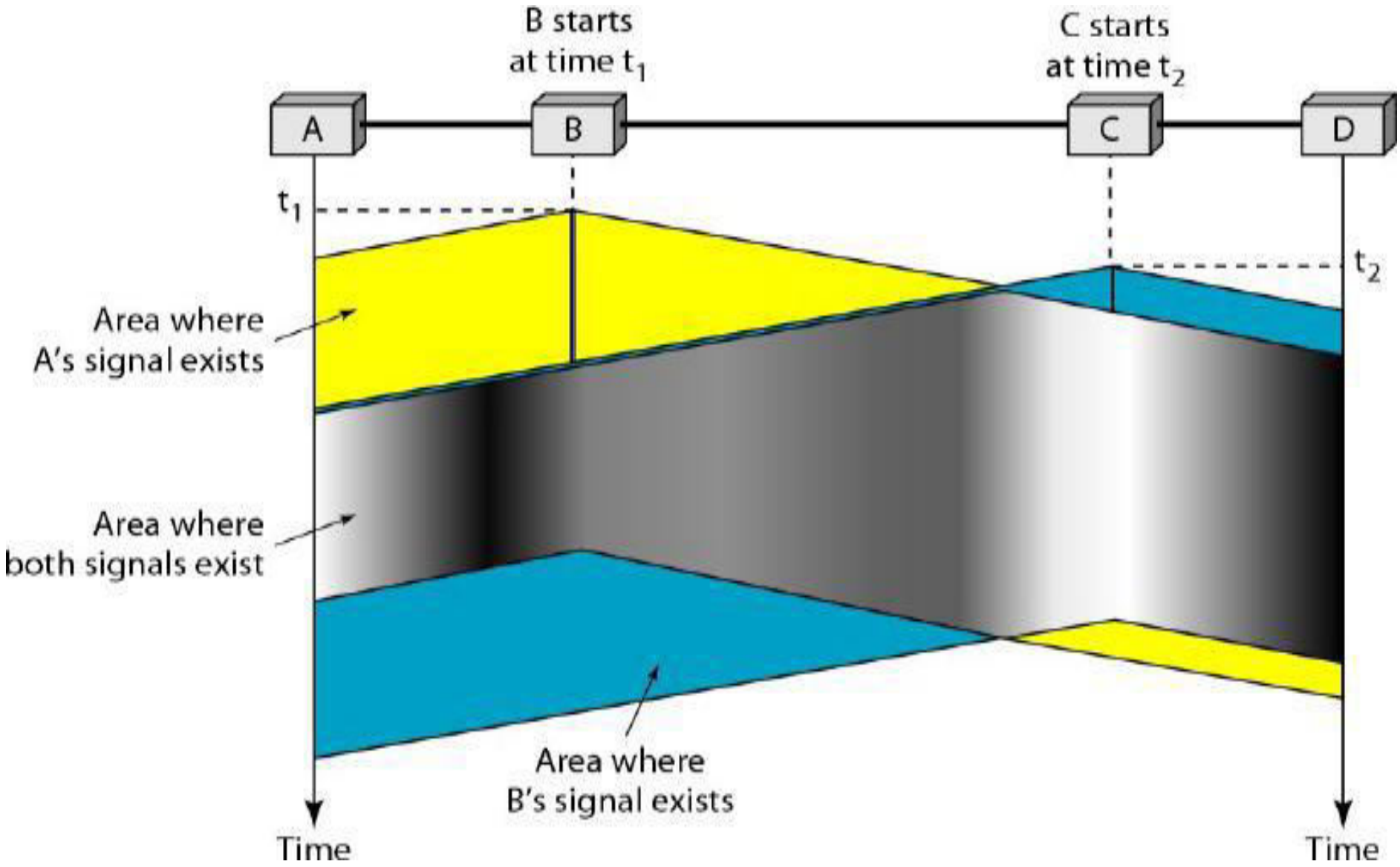
b. 500 frames per second

c. 250 frames per second

Carrier Sense Multiple Access (CSMA)

- To minimize the chance of collision and, therefore, increase the performance, the CSMA method was developed.
- Carrier sense multiple access (CSMA) requires that each station first listen to the medium (or check the state of the medium) before sending. In other words, CSMA is based on the principle "sense before transmit" or "listen before talk.“
- CSMA can reduce the possibility of collision, but it cannot eliminate it.
- The possibility of collision still exists because of propagation delay; when a station sends a frame, it still takes time for the first bit to reach every station and for every station to sense it.
- In other words, a station may sense the medium and find it idle, only because the first bit sent by another station has not yet been received.

Carrier Sense Multiple Access (CSMA)



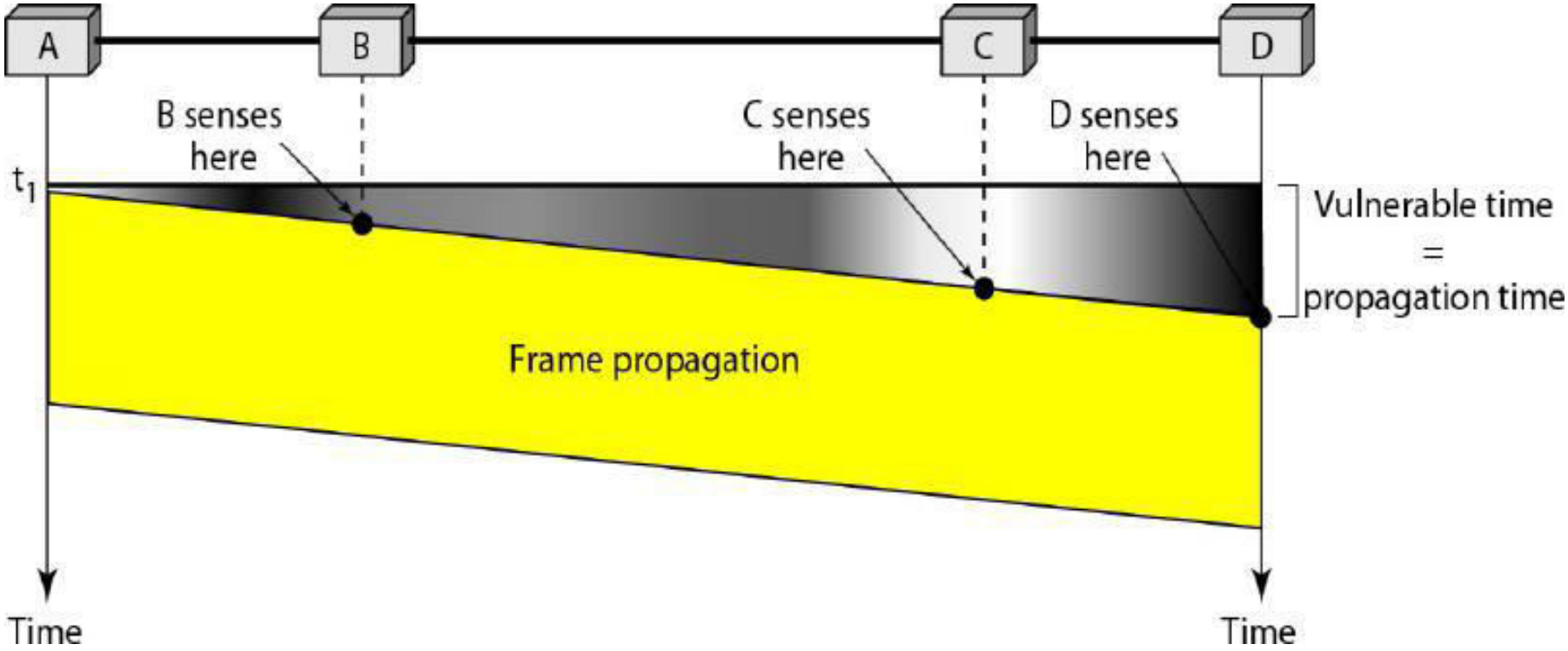
Carrier Sense Multiple Access (CSMA)

At time t_1 station B senses the medium and finds it idle, so it sends a frame. At time t_2 ($t_2 > t_1$) station C senses the medium and finds it idle because, at this time, the first bits from station B have not reached station C. Station C also sends a frame. The two signals collide and both frames are destroyed.

Carrier Sense Multiple Access (CSMA)

Vulnerable Time

- The vulnerable time for CSMA is the **propagation time T_p** .
- This is the time needed for a signal to propagate from one end of the medium to the other.



Carrier Sense Multiple Access (CSMA)

Persistence Methods

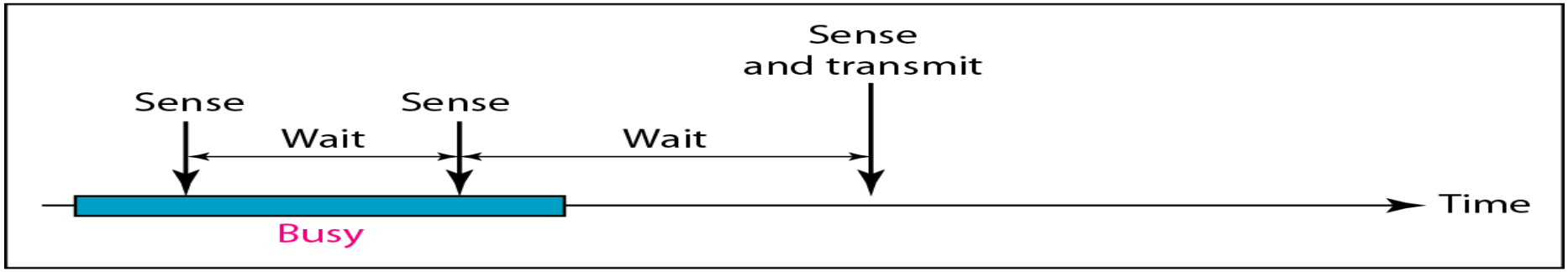
- What should a station do if the channel is busy?
- What should a station do if the channel is idle?

There are three methods to answer these questions:

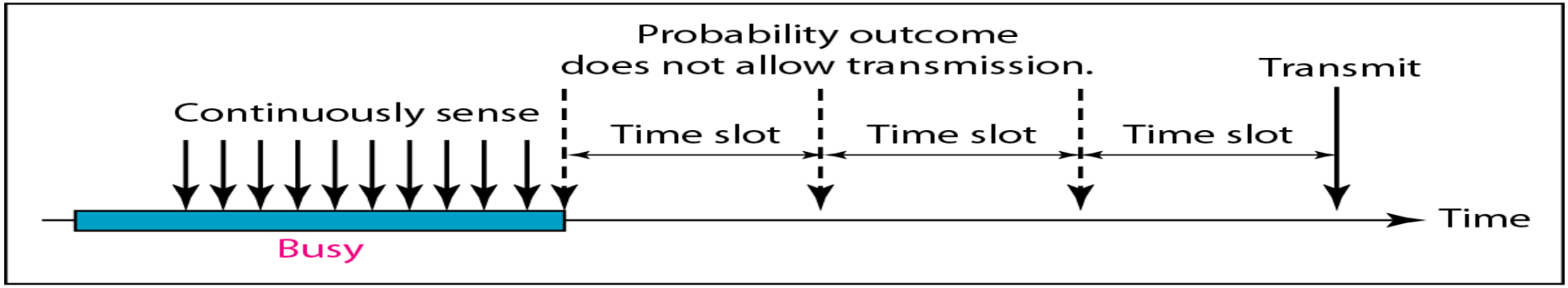
1. 1-persistent method
2. Non-persistent method
3. p-persistent method

Carrier Sense Multiple Access (CSMA)

a. 1-persistent



b. Nonpersistent



c. p-persistent

Carrier Sense Multiple Access (CSMA)

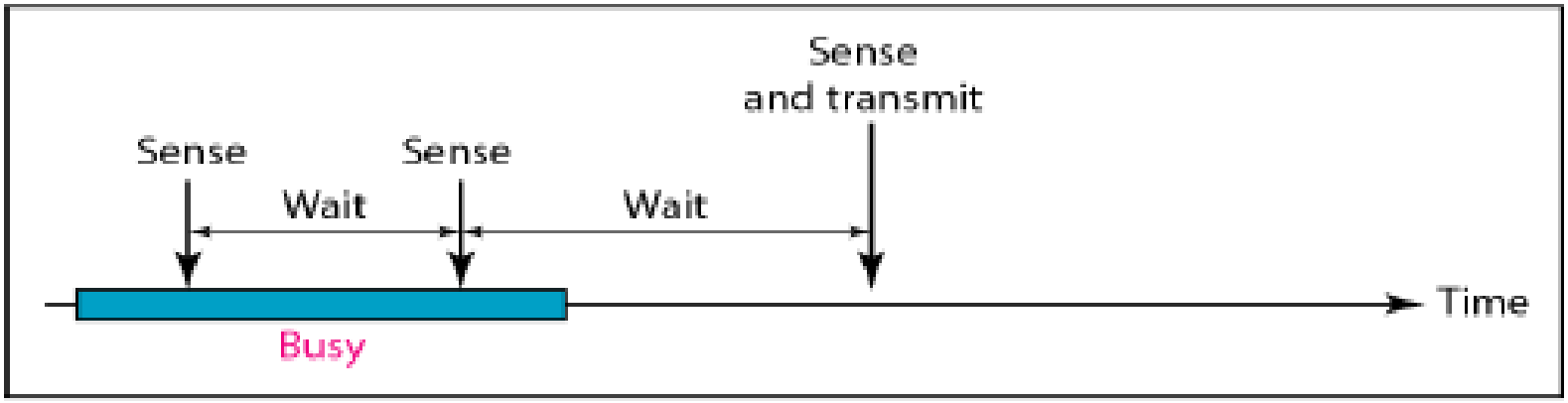
1-Persistent

a. 1-persistent

- In this method, after the station finds the line idle, it sends its frame immediately (with probability 1).
- This method has the highest chance of collision because two or more stations may find the line idle and send their frames immediately.

Carrier Sense Multiple Access (CSMA)

Non-persistent

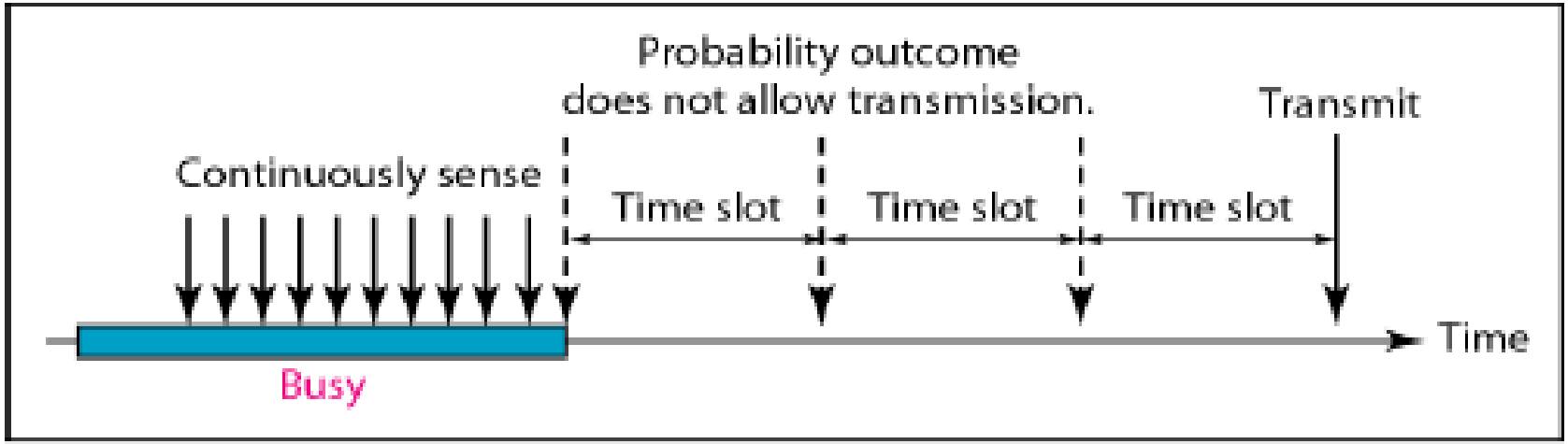


b. Nonpersistent

- In the non-persistent method, a station that has a frame to send senses the line. If the line is idle, it sends immediately. If the line is not idle, it waits a random amount of time and then senses the line again.
- The non-persistent approach reduces the chance of collision because it is unlikely that two or more stations will wait the same amount of time and retry to send simultaneously. However, this method reduces the efficiency of the network because the medium remains idle when there may be stations with frames to send.

Carrier Sense Multiple Access (CSMA)

p-Persistent



c. p-persistent

- The p-persistent method is used if the channel has time slots with a slot duration equal to or greater than the maximum propagation time.
- The p-persistent approach combines the advantages of the other two strategies.
- It reduces the chance of collision and improves efficiency.

Carrier Sense Multiple Access (CSMA)

In this method, after the station finds the line idle it follows these steps:

1. With probability p, the station sends its frame.
2. With probability q = 1 - p, the station waits for the beginning of the next time slot and checks the line again.

   a. If the line is idle, it goes to step 1.

   b. If the line is busy, it acts as though a collision has occurred and uses the backoff procedure.