

**i. 1-persistent method**

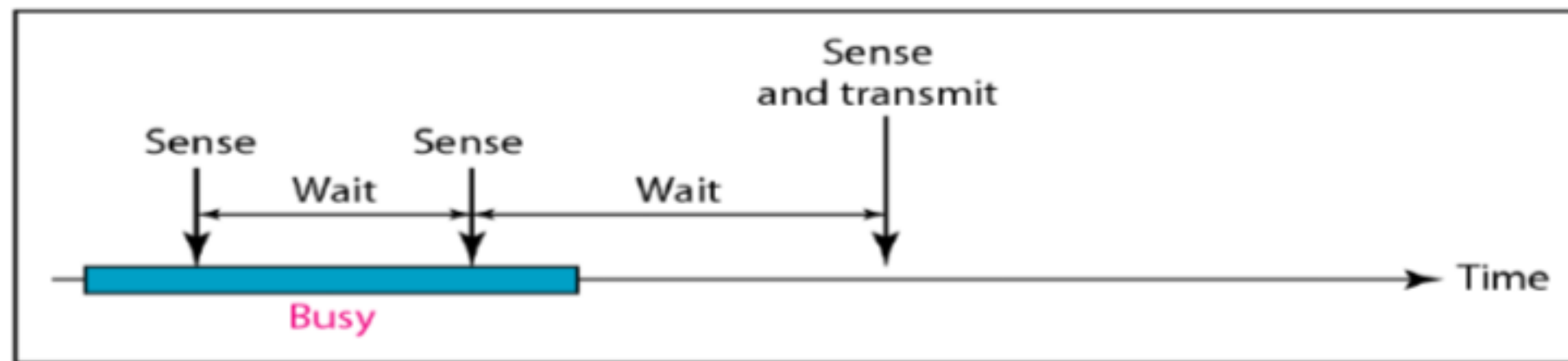
In this strategy, the station will sense the channel and transmit packets immediately if the channel is sensed free. If the medium is busy it will wait until the channel becomes idle. Then it will send the data with probability of 1.

**ii. P-persistent method**

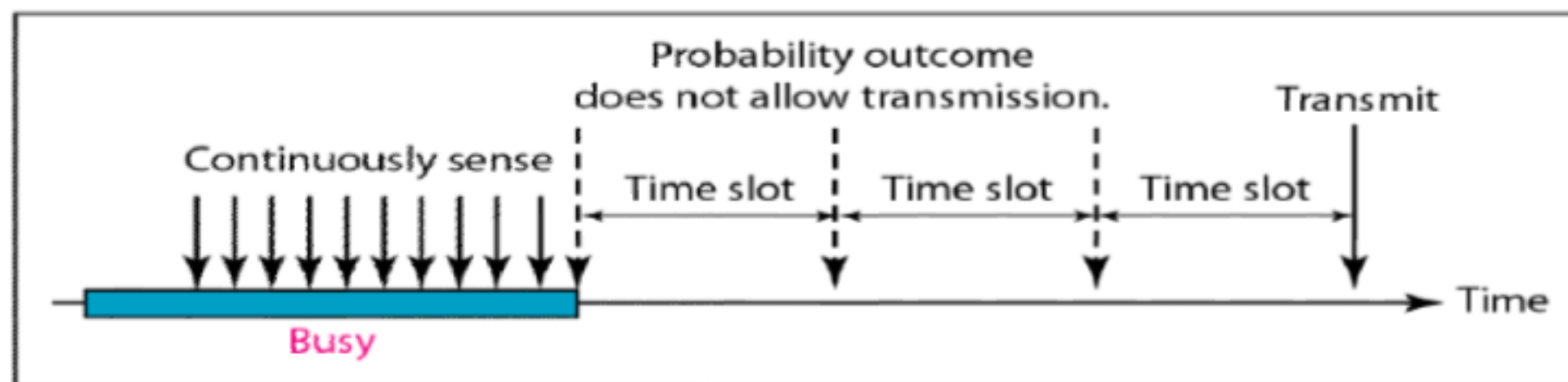
In P-persistent protocol, when the line is free the sender will transmit frame with probability  $p$ . If the medium is busy, it will wait until the line is free before sending the packet with probability  $p$ . If the station choose to hold back, it will not transmit with the probability  $1-p$ . The sender will wait and the process will be repeated until the frame are sent with the same probability  $p$  when the next time slot is available. The strategy are used in WiFi and packet radio systems.



a. 1-persistent



b. Nonpersistent



c. p-persistent

Figure 1.0 Behaviour of three persistent method

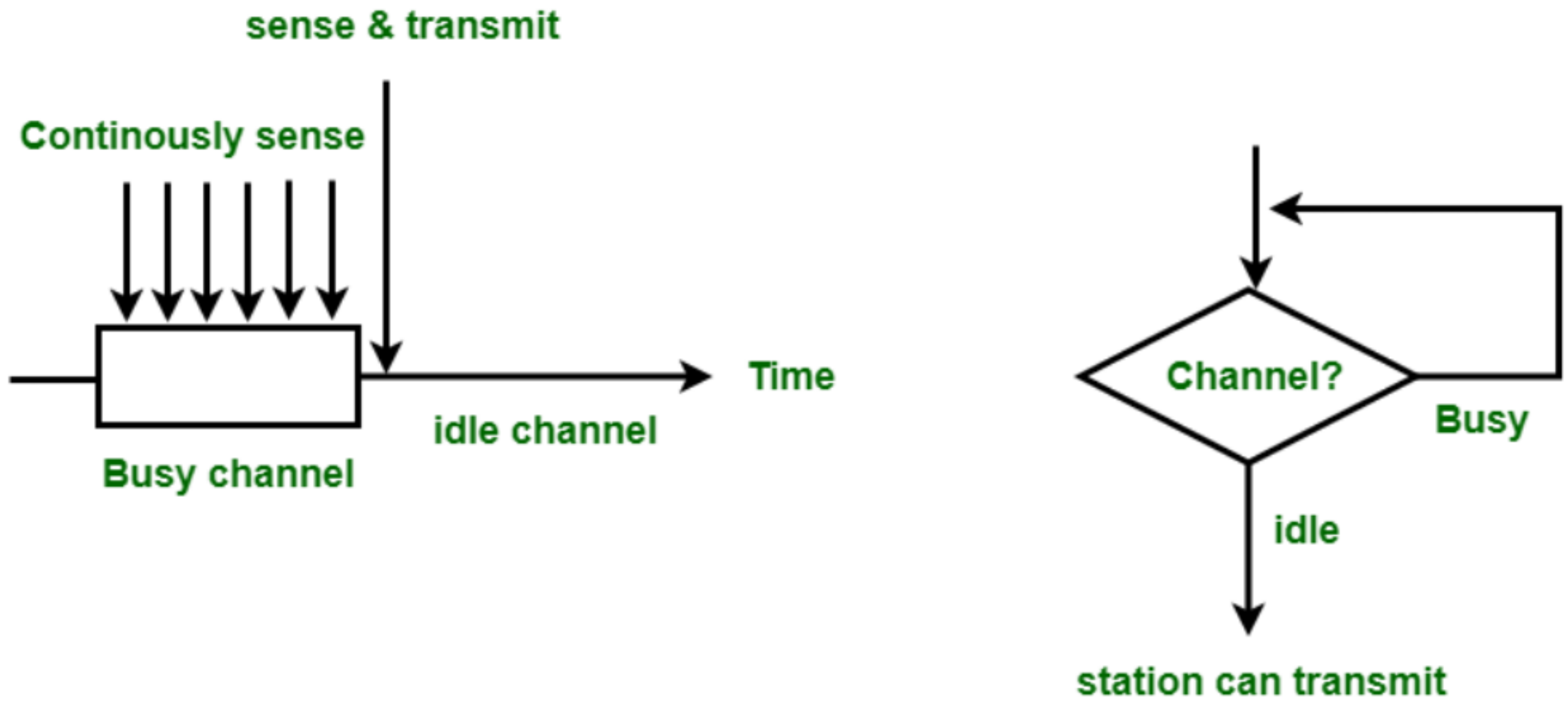
Retrieved from :<http://networking.khu.ac.kr/...03.../Chapter12%20Multiple%20Access.ppt>

**iii. Non-persistent method**

Station will sent immediately if the line is idle or the station will have to wait for a random amount of time and then sense the line again to check its status. The advantage of this strategy is that, it reduces the chances of collision since it is out of ordinary for two station to wait for the same period of time before retrying concurrently.

## **1. 1-persistent CSMA :**

In 1-persistent CSMA, station continuously senses channel to check its state i.e. idle or busy so that it can transfer data. In case when channel is busy, station will wait for channel to become idle. When station finds an idle channel, it transmits frame to channel without any delay with probability 1. Due to probability 1, it is called 1-persistent CSMA. The problem with this method is that there is a huge chance of collision, as two or more stations can find channel in idle state and transmit frames at the same time. At the time when a collision occurs station has to wait for random time for channel to be idle and to start all again.



**Figure – 1-persistent CSMA**

# Non-persistent CSMA protocol

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In non-persistent CSMA, when a transmitting station has a frame to send and it senses a busy channel, it waits for a random period of time without sensing the channel in the interim, and repeats the algorithm again.

# Algorithm

The algorithm of non-persistent CMSA is

- When a frame is ready, the transmitting station checks whether the channel is idle or busy.
- If the channel is idle then it transmits the frame immediately.
- If the channel is busy, the station waits for a random time period during which it does not check whether the channel is idle or busy.
- At the end of the waiting time period, it again checks the status of the channel and restarts the algorithm.



## **Advantage of non-persistent CSMA**

Its rate of collisions is much reduced than 1-persistent CSMA. This is because each station waits for a random amount of time before attempting retransmission. The probability that multiple stations will wait for the same amount of time is extremely low. So, collision between contending stations is greatly reduced.

## **Disadvantage of non-persistent CSMA**

It reduces the bandwidth usage of the network. This is because the channel remains idle even if there are stations who have frames to transmit. This occurs since each station waits for a random time before attempting retransmission. There may be multiple stations who are waiting while the channel is idle.

P-persistent CSMA protocol



In p-persistent CSMA, when a transmitting station has a frame to send and it senses a busy channel, it waits for the end of the transmission, and then transmits with a probability  $p$ . Since, it sends with a probability  $p$ , the name  $p$  - persistent CSMA is given.

# Algorithm

The algorithm of p-persistent CMSA is:

- When a frame is ready, the transmitting station checks whether the channel is idle or busy.
- If the channel is idle then it transmits the frame immediately.
- If the channel is busy, the station waits and continually checks until the channel becomes idle.
- When the channel becomes idle, the station transmits the frame with a probability  $p$ .
- With a probability  $(1 - p)$ , the channel waits for next time slot. If the next time slot is idle, it again transmits with a probability  $p$  and waits with a probability  $(1 - p)$ .

- The station repeats this process until either frame has been transmitted or another station has begun transmitting.
- If another station begins transmitting, the station waits for a random amount of time and restarts the algorithm.

# CSMA with Collision Detection (CSMA/CD)

Carrier Sense Multiple Access with Collision Detection (CSMA/CD) is a network protocol for carrier transmission that operates in the Medium Access Control (MAC) layer. It senses or listens whether the shared channel for transmission is busy or not, and defers transmissions until the channel is free. The collision detection technology detects collisions by sensing transmissions from other stations. On detection of a collision, the station stops transmitting, sends a jam signal, and then waits for a random time interval before retransmission.

## WHAT IS CSMA/CD?



➤ CSMA/CD protocol can be considered as a refinement and modification of pure "Carrier Sense Multiple Access" (CSMA).

➤ In a CSMA system, the chance of collision can be reduced if a station senses the medium before trying to use it, but it can not eliminate it.

➤ CSMA/CD is used to improve CSMA performance and it augments the algorithm to handle the collision.



- This is used in combination with COLLISION DETECTION in which a transmitting station detects collisions by sensing transmissions from other stations while it is transmitting a frame.
- When this collision condition is detected, the station stops transmitting that frame, transmits a jam signal, and then waits for a random time interval before trying to resend the frame.



# How to CSMA/CD Protocol works?

1.

If Medium  
IDLE

- TRANSMIT,
- Otherwise step 2

2.

If Medium  
BUSY

- WAIT until idle,
- Then, TRANSMISSION with  $p=1$

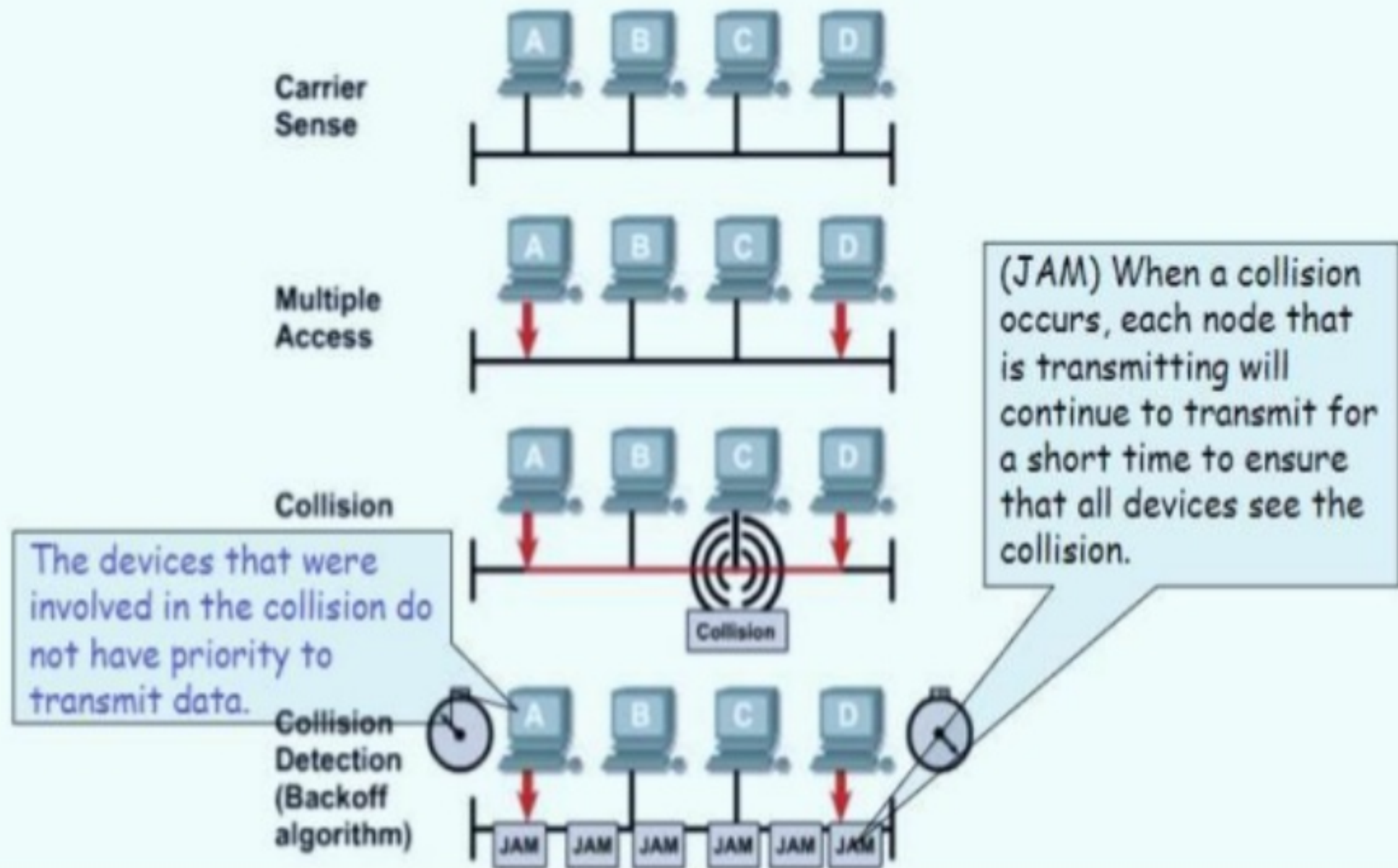
3.

If Collision  
DETECTED

- Transmit brief "**JAMMING SIGNAL**"
- ABORT Transmission

**After Aborting- WAIT RANDOM Time, Try again**

# COLLISION DETECTION PROCEDURE





# COLLISION DETECTION METHOD

Use one of the **“PERSISTENT METHOD”** as-

- Non-Persistent
- 1-Persistent
- P-Persistent

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

Constantly monitor in order to detect one of two conditions:



Transmission is Finished or

A Collision is detected.

Proceed according to the conditions.

Sending of a short **“JAMMING SIGNAL”** that enforces the collision in case **other stations have not yet sensed the collision.**

K: Number of attempts  
 $T_p$ : Maximum propagation time  
 $T_{fr}$ : Average transmission time for a frame  
 $T_B$ : Back-off time

