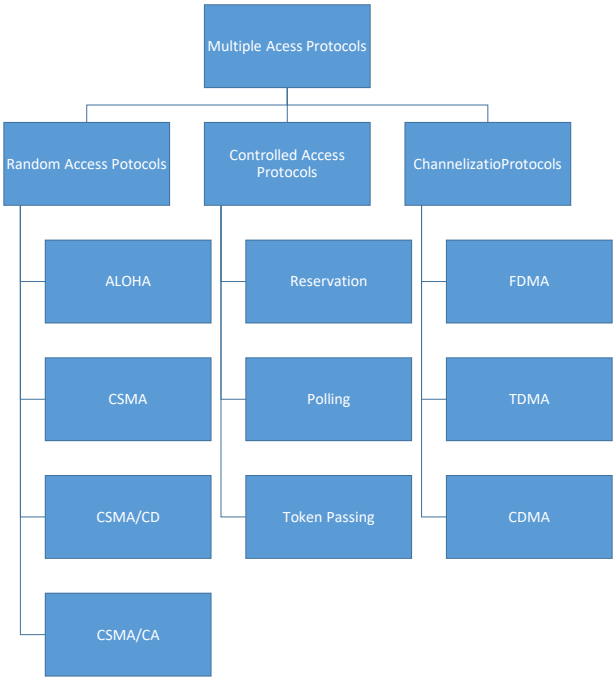
CSMA/CA -NOTES

(Nitesh Kumar - 33, Tania Aggarwal - 60)

MULTIPLE ACCESS CONTROL

- If there is a dedicated link between the sender and the receiver then data link control layer is sufficient, however if there are no dedicated link present then multiple stations can access the channel simultaneously.
- Hence multiple access protocols are required to decrease collision and avoid crosstalk.
- **For example,** in a classroom full of students, when a teacher asks a question and all the students (or stations) start answering simultaneously (**send data at same time**) then a lot of chaos is created (data overlap or data lost) then it is the job of the teacher (**multiple access protocols**) to manage the students and make them answer one at a time.
- Multiple access protocols can be subdivided further as –



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 decide on whether to send.

- This decision depends on the state of the medium (**idle or busy**). In other words, each station can transmit when it desires on the condition that it follows the predefined procedure, including the testing of the state of the medium.

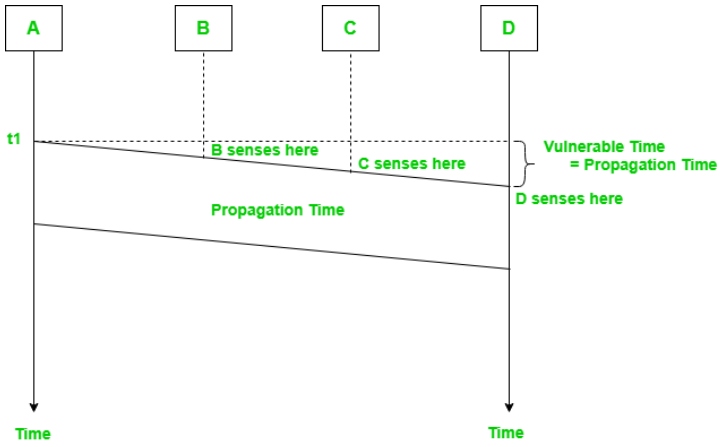
Two features give this method its name.

1. First, there is no scheduled time for a station to transmit. Transmission is random among the stations. That is why these methods are called random access. Second, no rules specify which station should send next. Stations compete with one another to access the medium. That is why these methods are also called contention methods.
2. In a random-access method, each station has the right to the medium without being controlled by any other station. However, if more than one station tries to send, there is an access conflict-collision-and the frames will be either destroyed or modified. To avoid access conflict or to resolve it when it happens, each station follows a procedure that answers the following **questions:**

- *When can the station access the medium?*
- *What can the station do if the medium is busy?*
- *How can the station determine the success or failure of the transmission?*
- *What can the station do if there is an access conflict?*

Carrier Sense Multiple Access (CSMA)

- To minimize the chance of collision and, therefore, increase the performance, the CSMA method was developed.
- The chance of collision can be reduced if a station senses the medium before trying to use it
- 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.
- Reason: -
- Stations are connected to a shared channel (usually a dedicated medium).
- The possibility of collision still exists because of ***propagation delay***.
- when a station sends a ***frame***, it still takes time (***although very short***) 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.



1. At time tI' station B senses the medium and finds it idle, so it sends a frame.
2. At time t2 (t2> tI)' station C senses the medium and finds it idle because, currently, the first
3. bits from station B have not reached station C. Station C also sends a frame.
4. The two signals collide and both frames are destroyed

Vulnerable Time

- The vulnerable time for CSMA is the propagation time ***Tp***.
- This is the time needed for a signal to propagate from one end of the medium to the other.
- When a station sends a ***frame***, and any other station tries to send a frame during this time, a ***collision*** will result. But if the first bit of the frame reaches the end of the medium, every station will already have heard the bit and will refrain from sending.
- The leftmost station ***A*** sends a frame at time ***tI'*** which reaches the rightmost station ***D*** at time ***tI + Tp***. The gray area shows the vulnerable area in time and space.

Persistence Methods

It is basically tells the station what to do when the channel is in different state .

1. What should a station do if the channel is busy?
2. What should a station do if the channel is idle?

Three methods have been devised to answer these questions:

1. I-persistent method
2. the nonpersistent method
3. the p-persistent method

I-Persistent

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

Nonpersistent

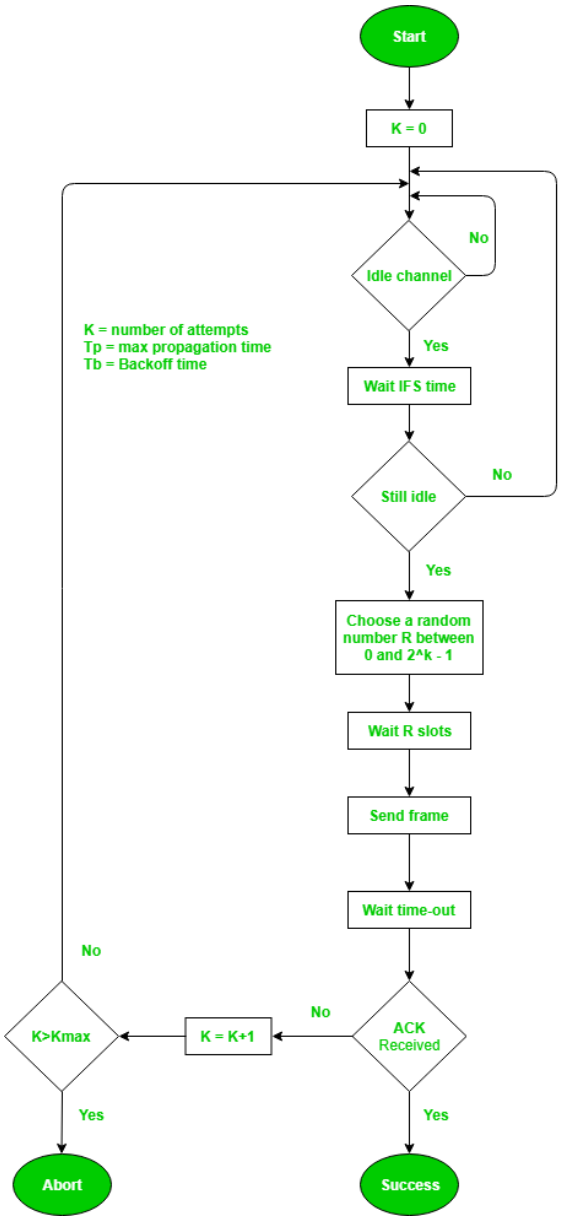
- In the nonpersistent method, a station that has a frame to send
- senses the line. If the line is idle, it sends immediately.
- If the line is not idle, it waits a random amount of time and then senses the line again.
- The nonpersistent approach reduces the chance of collision because it is unlikely 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.

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.
- In this method, after the station finds the line idle it follows these steps:
    - With probability p, the station sends its frame.
    - With probability q = 1 - p, the station waits for the beginning of the next time slot and checks the line again.
        - If the line is idle, it goes to step 1.
        - If the line is busy, it acts as though a collision has occurred and uses the backoff procedure.

CSMA/CA and Wireless Networks

CSMA/CA was mostly intended for use in wireless networks. The procedure described above, however, is not sophisticated enough to handle some issues related to wireless networks, such as hidden terminals or exposed terminals.



Steps:

1. First a station waits for IFS (inter frame space) that is decided by the network administrator.
2. To give priority to certain station like servers they can be assigned less IFS.
3. Every station then senses the carrier using methods (1-persistent, p-persistent, on-persistent).
4. As soon as the carrier is found **idle.** They do not immediately send they go and wait for Contention window depending on the attempt of the station.
   While waiting if the carrier gets busy in that case the station can wait here no need to go step 1.

5. After finishing the contention window waiting time station transmits the frame.
6. Now to ensure the delivery of the frame we use another mechanism that is Acknowledgement
7. This mechanism consists of time out time. If there is acknowledgement comes in the specified time, then the task is complete for that station
8. If there is no acknowledgement in the specified time, then the value of K becomes K+1
9. If the maximum number of attempts reached, then the operation is aborted.
10. If the attempt is within the limit (let say **Kmax**) then again, the whole process is repeated.