

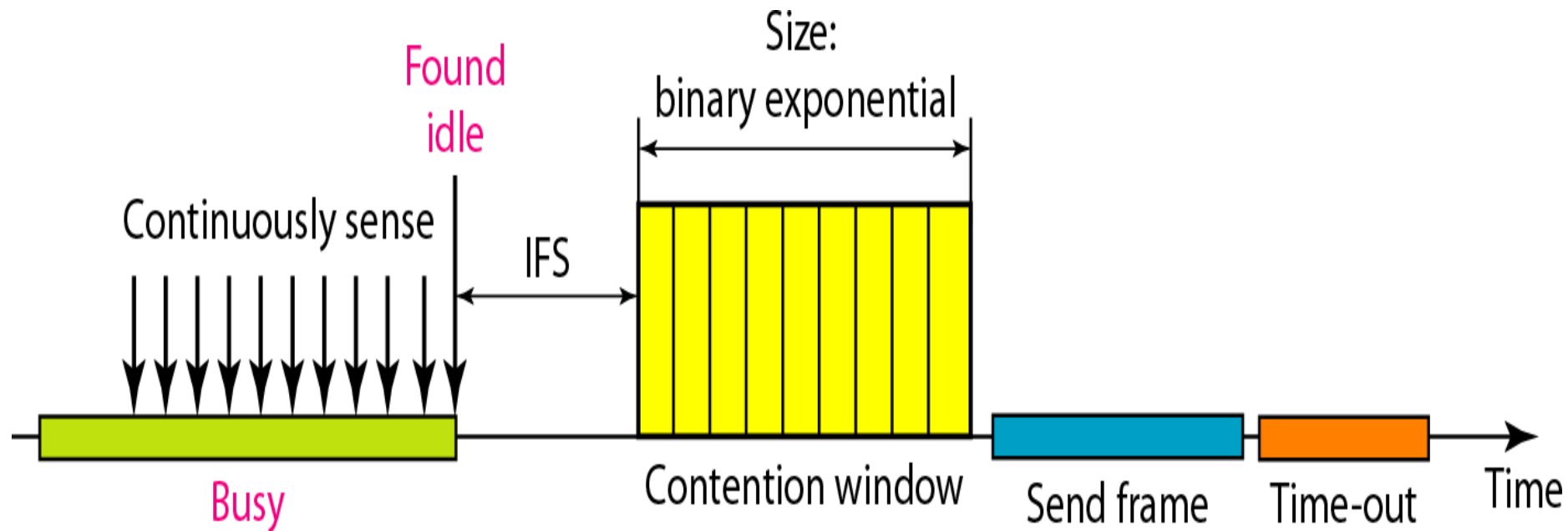
Computer Network

Lecture-26

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Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)

- ❖ CSMA/CA was invented for wireless network.
- ❖ Collisions are avoided through the use of CSMA/CA's three strategies: the interframe space, the contention window, and acknowledgments.



Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)

Interframe Space (IFS)

When an idle channel is found, the station does not send immediately. It waits for a period of time called the interframe space or IFS.

If after the IFS time the channel is still idle, the station can send, but it still needs to wait a time equal to the contention time.

In CSMA/CA, the IFS variable can also be used to define the priority of stations or frames.

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Contention Window

- ❖ The contention window is an amount of time divided into slots. A station that is ready to send chooses a random number of slots as its wait time. The number of slots in the window changes according to the binary exponential back-off strategy.
- ❖ The station senses the channel after each time slot. However, if the station finds the channel busy, it does not restart the process; it just stops the timer and restarts it when the channel is sensed as idle.

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Acknowledgment

With all these precautions, there still may be a collision resulting in destroyed data.

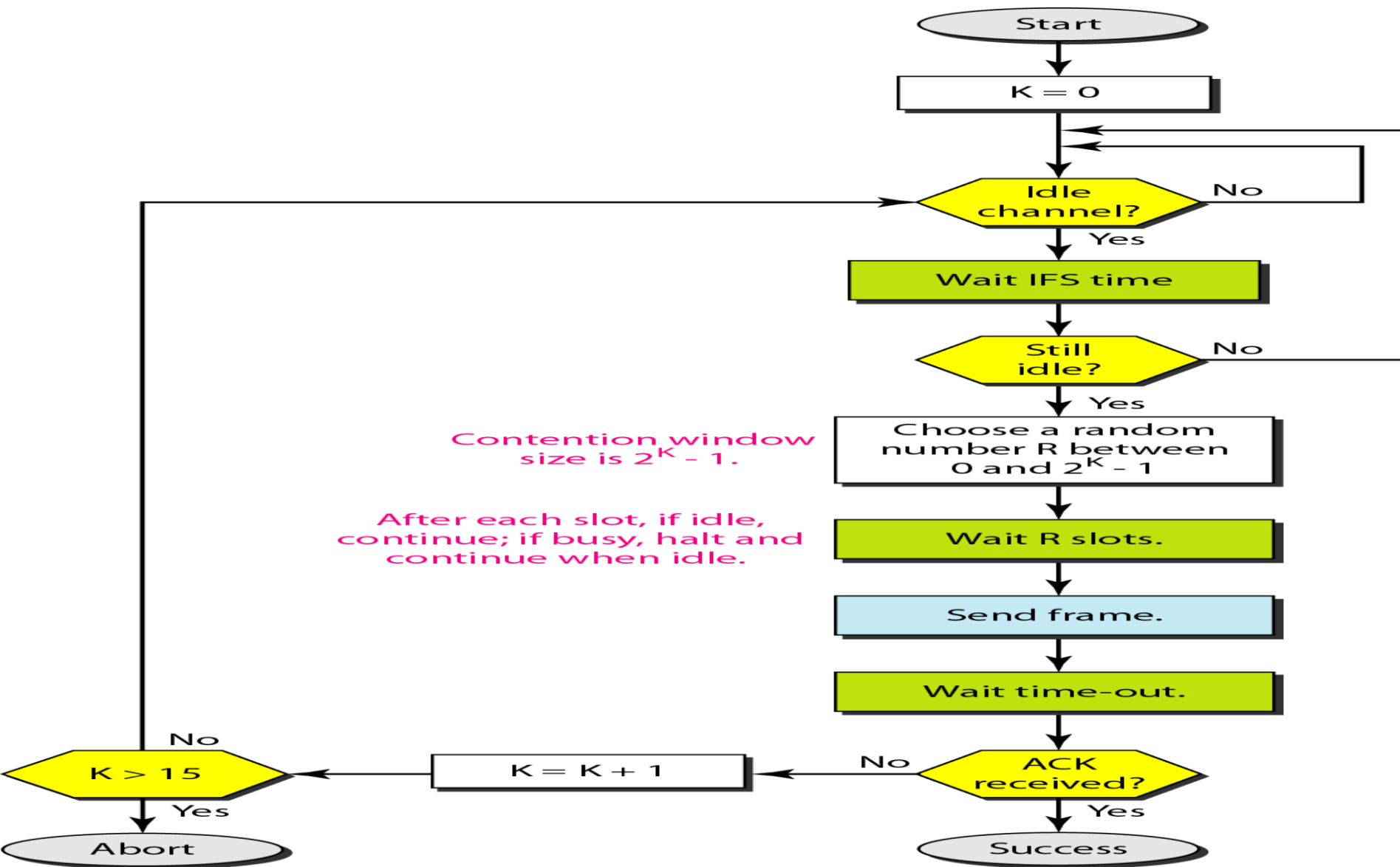
In addition, the data may be corrupted during the transmission. The positive acknowledgment and the time-out timer can help guarantee that the receiver has received the frame.

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Procedure

- ❖ The channel needs to be sensed before and after the IFS.
- ❖ The channel also needs to be sensed during the contention time.
- ❖ For each time slot of the contention window, the channel is sensed. If it is found idle, the timer continues; if the channel is found busy, the timer is stopped and continues after the timer becomes idle again.

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)

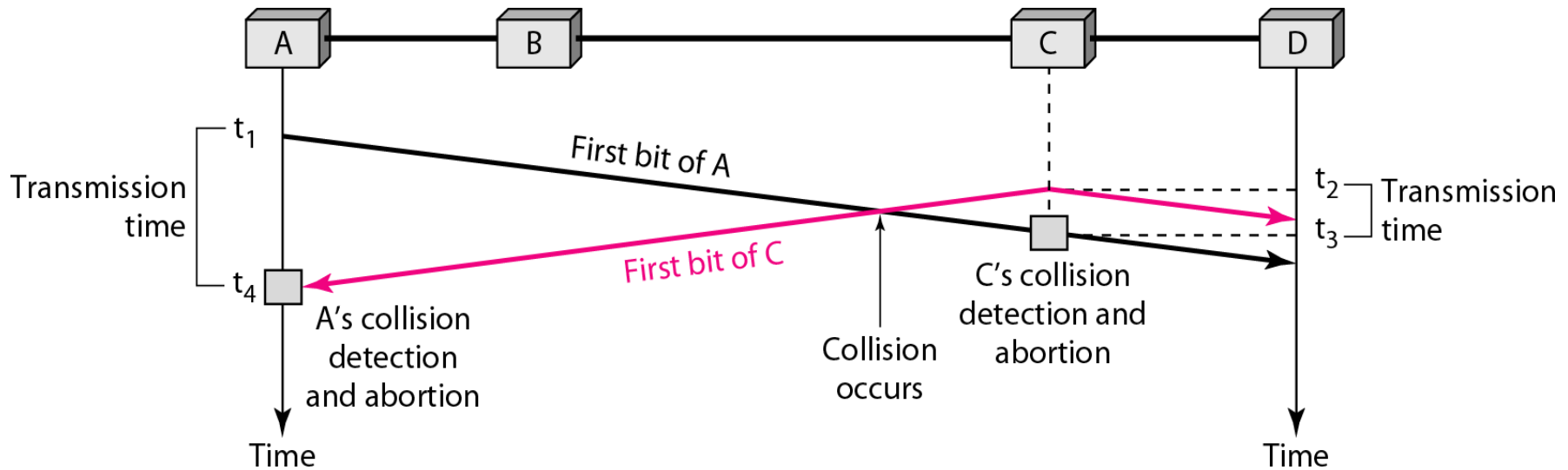


Exercise

1. In a CSMA/CD network with a data rate of 10 Mbps, the minimum frame size is found to be 512 bits for the correct operation of the collision detection process. What should be the minimum frame size if we increase the data rate to 100 Mbps? To 1 Gbps? To 10 Gbps?
2. One hundred stations on a pure ALOHA network share a 1-Mbps channel. If frames are 1000 bits long, find the throughput if each station is sending 10 frames per second.

Exercise

3.



The data rate is 10 Mbps, the distance between station A and C is 2000 m, and the propagation speed is 2×10^8 m/s. Station A starts sending a long frame at time $t_1 = 0$; station C starts sending a long frame at time $t_2 = 3\mu\text{s}$. The size of the frame is long enough to guarantee the detection of collision by both stations. Find:

- The time when station C hears the collision (t_3).
- The time when station A hears the collision (t_4).
- The number of bits station A has sent before detecting the collision.
- The number of bits station C has sent before detecting the collision.