Chapter 4

Lesson 10: The Medium Access Control Sublayer

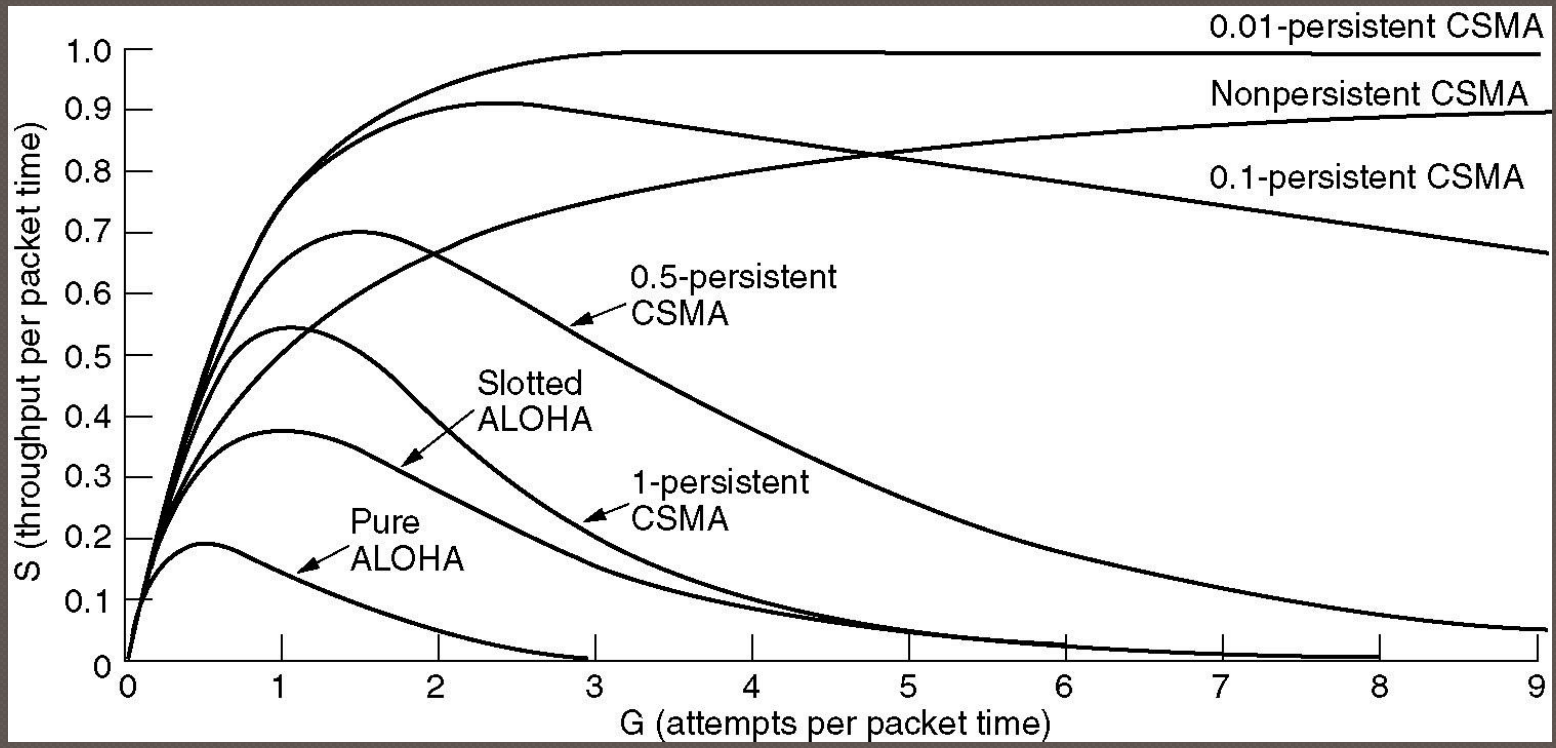
CSMA: Carrier Sense Multiple Access Protocol

- Improvements to ALOHA
  - In ALOHA, stations do not pay attention to what other stations are doing.
- 1-persistent CSMA.
  - Before transmission sense the carrier.
  - If no one else is transmitting then transmit.
  - If others are transmitting, wait till the end of transmission
  - Attempt to transmission again at the end of current transmission

Non-persistent and p-persistent CSMA

- Non-persistent CSMA (or 0 persistent)
  - Before transmission sense the carrier.
  - If no one else is transmitting then transmit.
  - If others are transmitting, wait a random amount of time and repeat the process.
  - less greedy than 1-persistent.
- p-persistent CSMA
  - Before transmission sense the carrier.
  - If no one else is transmitting then transmit.
  - If others are transmitting, flip a coin with probability p of head.
    - If head retransmit at the end of current transmission.
    - If tail, wait and flip the coin again at the end of the second transmission.
    - If tail again.. Repeat
  - less greedy than 1-persistent, more greedy than non-persistent.

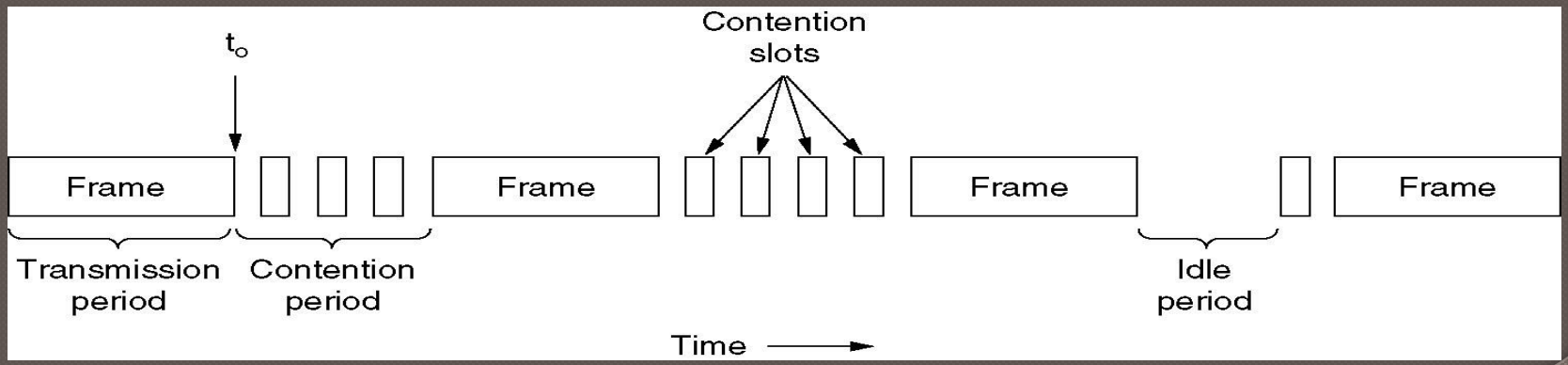
Persistent and Nonpersistent CSMA



Comparison of the channel utilization versus load for various random access protocols.

CSMA with Collision Detection

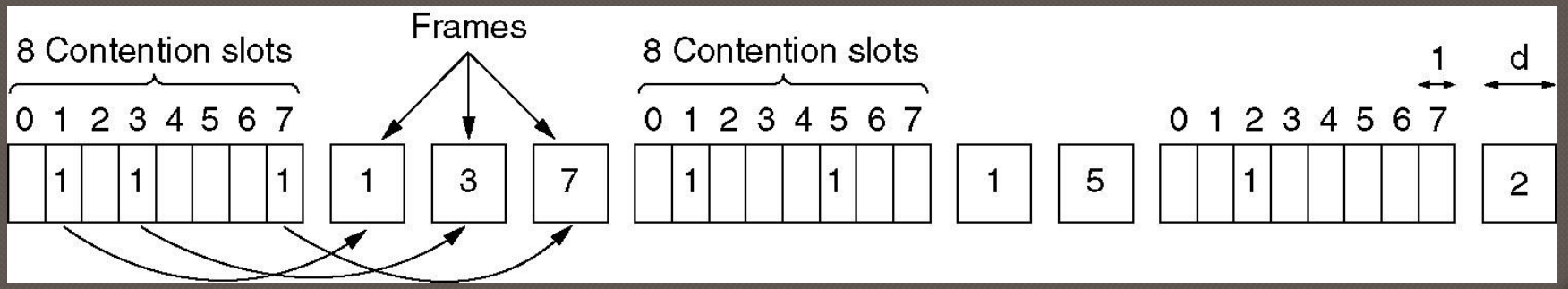
- CSMA/CD can be in one of three states: contention, transmission, or idle – inherently half-duplex
- Transmit when channel is free and keep sensing the channel
  - If there is a collision, abort transmission (why bother transmitting the whole frame).
- How long a station have to wait to realize that there has been a collision if T is the time to propagate between the furthest stations?
  - 2T -ε
    - i.e T -ε when the other station detects the channel free and starts transmitting plus T to get back to the first station



Collision-Free Protocols: The bit-map protocol

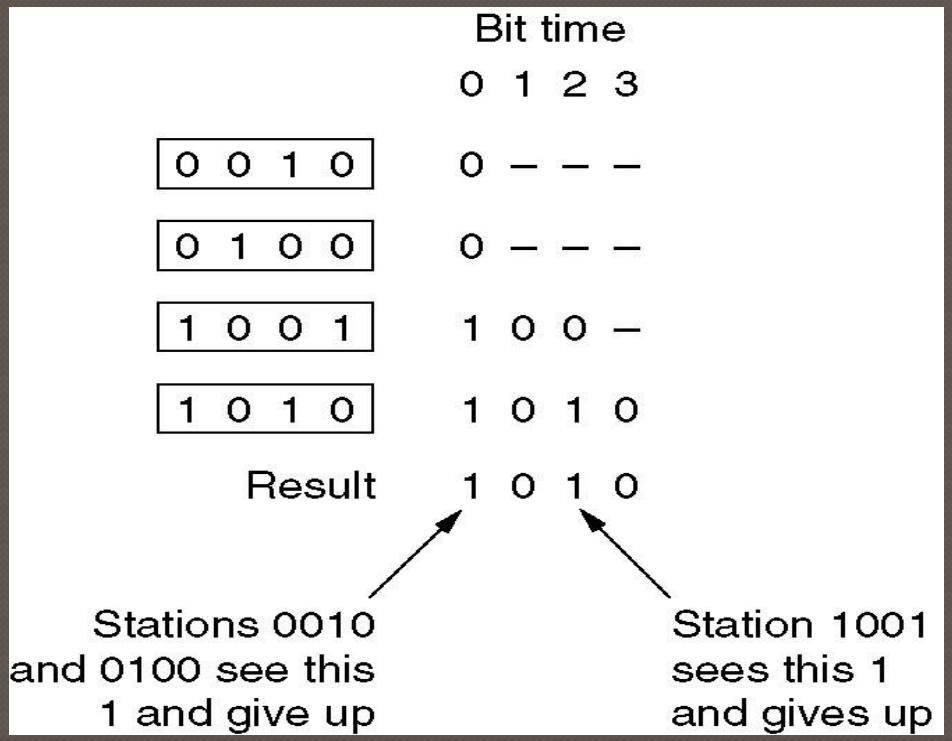
The basic bit-map protocol is a reservation protocol

- use a 1 bit to show the desire to transmit
  - Station 0 transmits a 1 bit in the 0^{th} slot
  - Station 1 transmits a 1 bit in the 1^{st} slot and so on…in turn
- Low stations wait N/2 + N slots in the average
- High stations are favorite and wait N/2
- Considering an average delay of N slots , at a low load the efficiency of a *d* bits data is *d/(N+d)*, at a high load is *d/(d+1)*



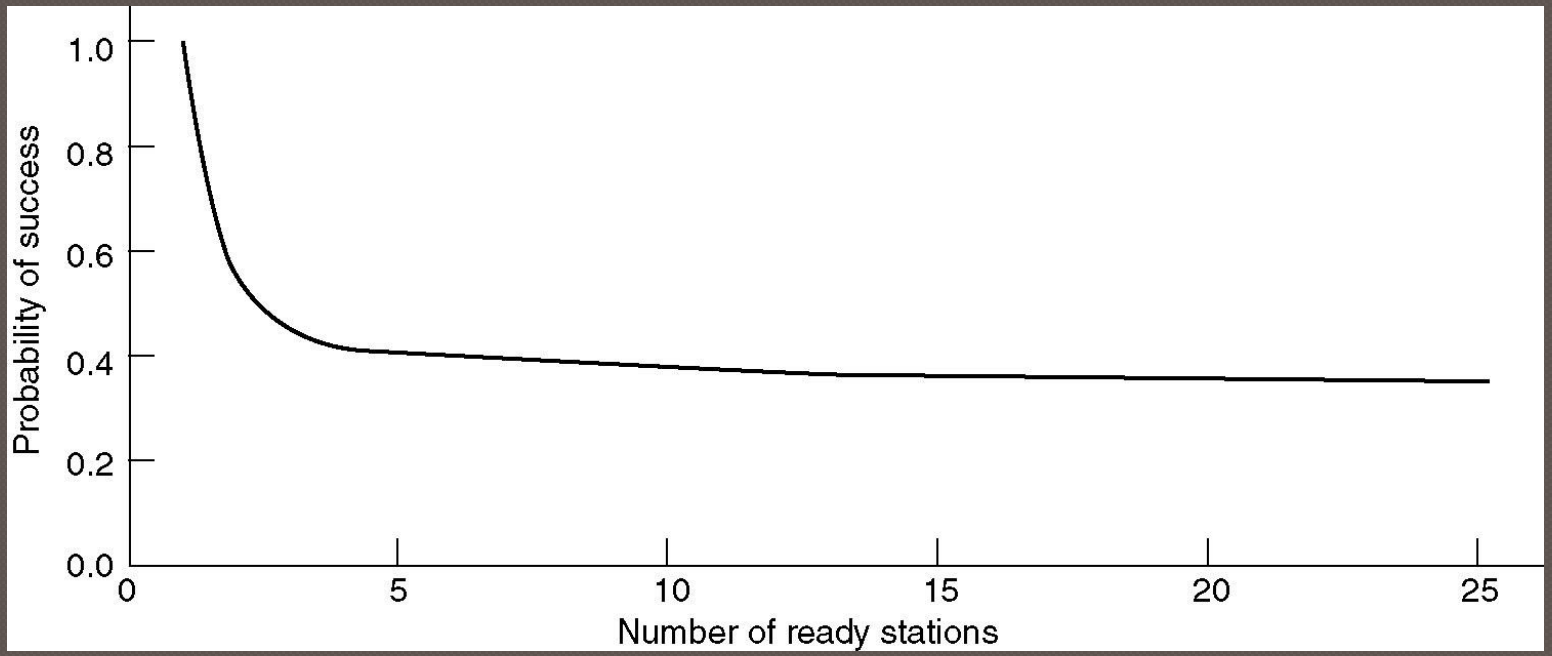
Collision-Free Protocols: The binary countdown protocol

- Stations have addresses
- The highest transmits - priority
- A dash indicates silence.



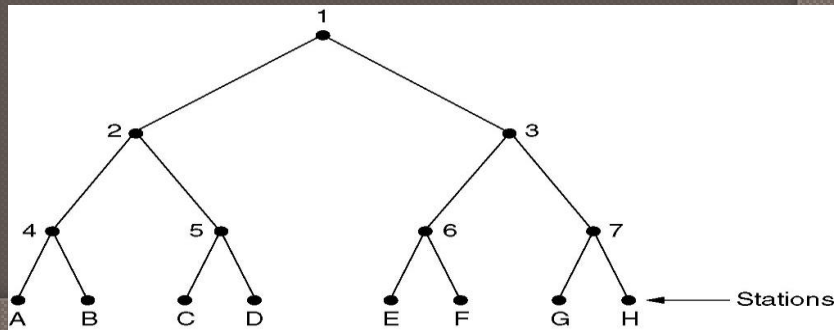
Limited-Contention Protocols

Acquisition probability for a symmetric contention channel.



Limited-Contention Protocols: Adaptive Tree Walk Protocol

- Combine the best properties of contention and collision-free protocols
- In the first slot a group of N stations (node 1) attempts to acquire the channel
  - If collision occurs only those station falling under node 2 can make an attempt
  - If a station in node 2 gets the channel then next slot is reserved for node 3, otherwise node 4 take its turn

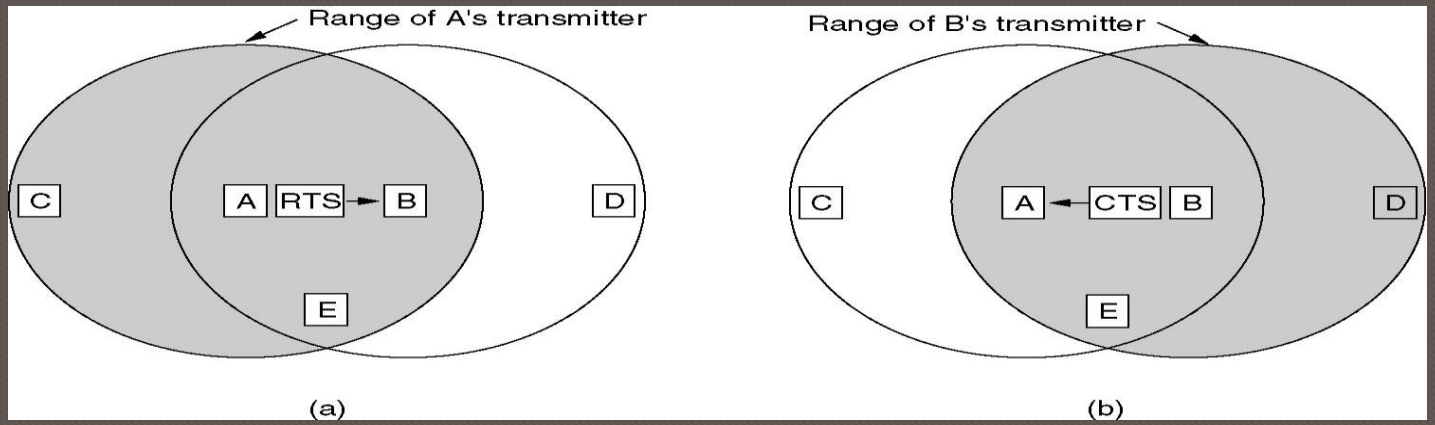


Wireless LAN Protocols

A wireless LAN.
(a) A transmitting. (b) B transmitting.

- Problems for Wireless:
  - Different medium: radio waves vs. fiber
  - Hidden station problem (not being able to detect a competitor
  - Exposed station problem(detects an unrelated station that stops its activity)

Wireless LAN Protocols (2)



The MACA (Multiple Access with Collision Avoidance) protocol.

(a) A sending an RTS (Request to Send) that contains that length of the frame to B.

(b) B responding with a CTS (Clear to Send) that contains the length of the frame to A.

Multiple Access Protocols

1. ALOHA
2. Carrier Sense Multiple Access Protocols
3. Collision-Free Protocols
4. Limited-Contention Protocols
5. Wavelength Division Multiple Access Protocols
6. Wireless LAN Protocols

Next Time

- Ethernet and Intro to Wireless LAN