CSc 450/550
Computer Networks
Medium Access Control

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Review

- Link layer mechanisms
  - frame control
  - error control
  - flow control
- Link layer protocols
  - HDLC, SLIP, PPP
- What if there are multiple transmitters?
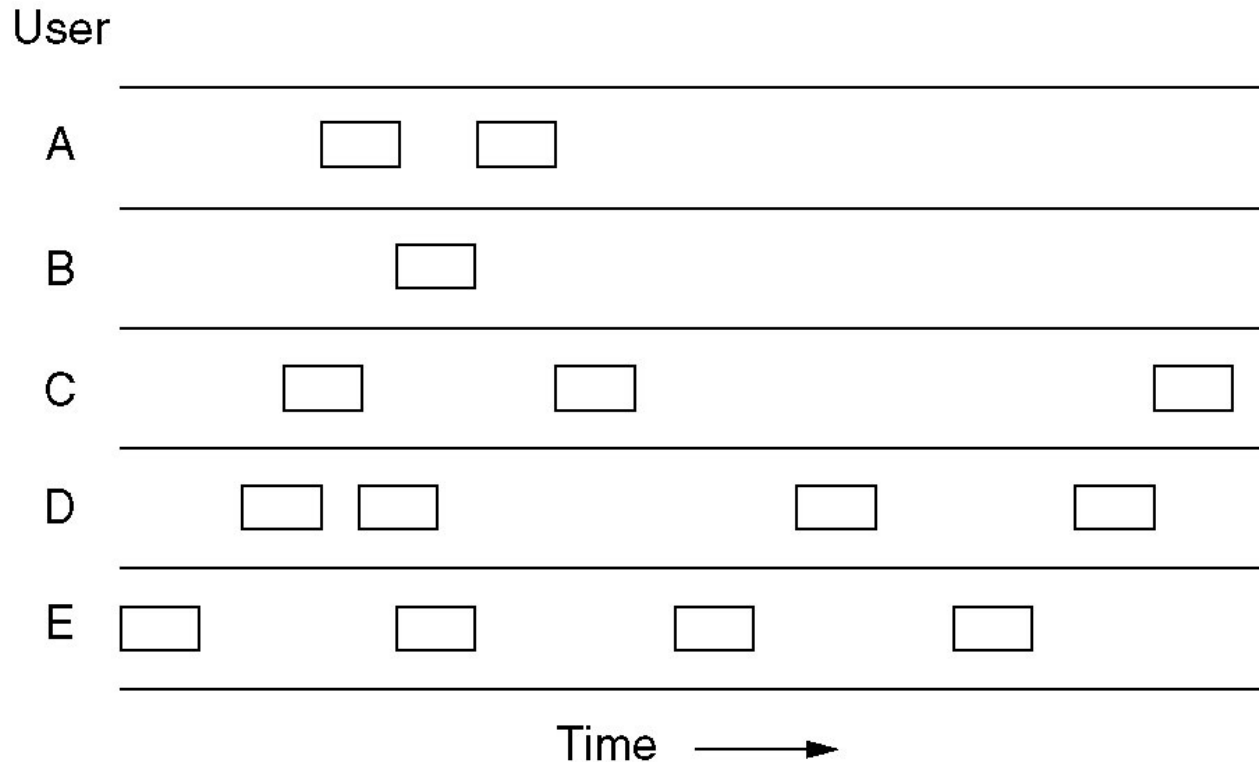 - media access control

Types of links

- Point-to-point link
  - dedicated medium for a pair of transceivers
  - e.g., PPP, switched Ethernet
- Broadcast link
  - shared medium by multiple nodes
  - e.g., traditional Ethernet, 802.11
  - collision by concurrent transmission
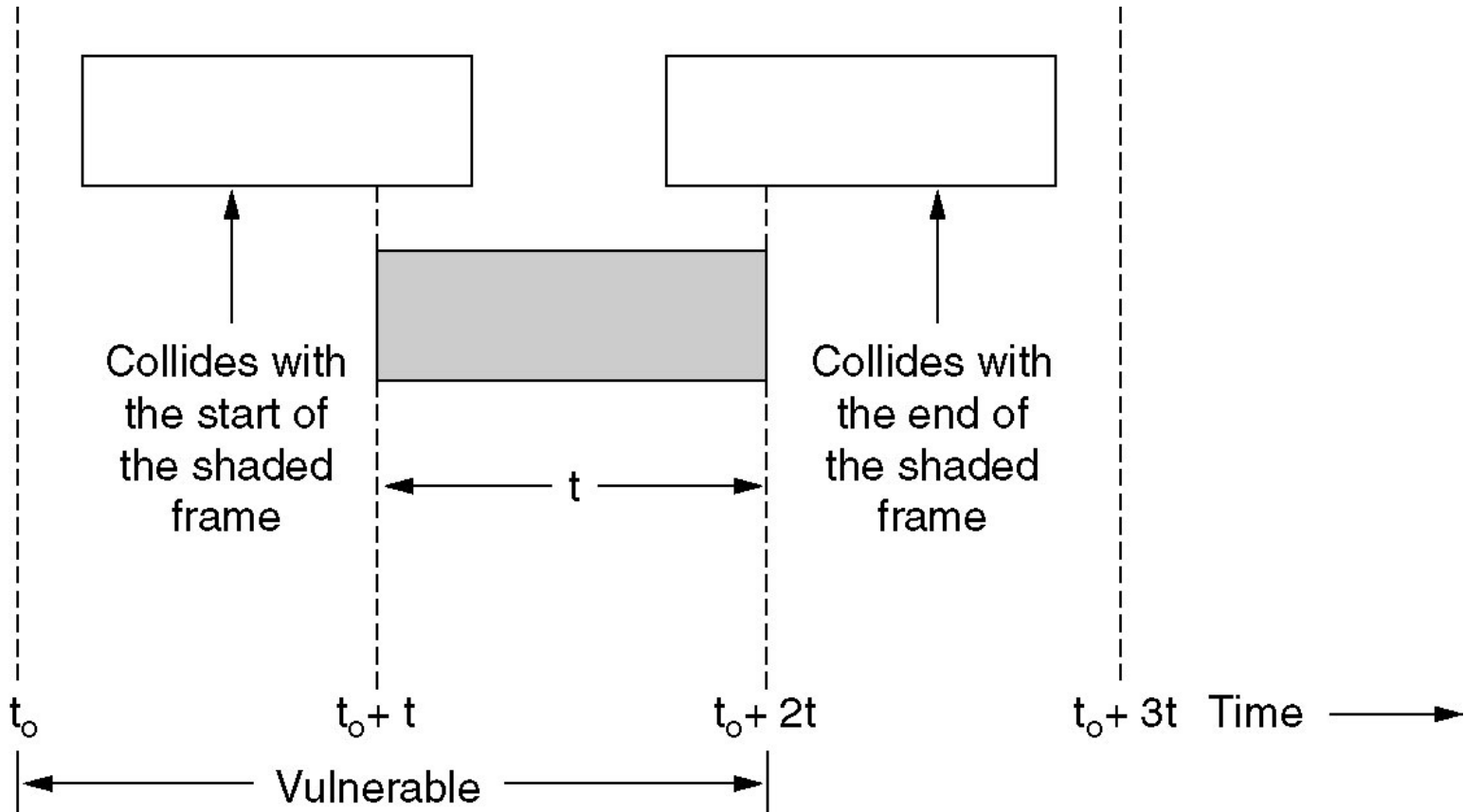
Media access control

- Deterministic allocation
  - frequency division multiple access (FDMA)
  - time division multiple access (TDMA)
  - code division multiple access (CDMA)
- Contention-based
  - ALOHA
  - CSMA
  - CSMA/CD

Pure Aloha

- Transmission at any time
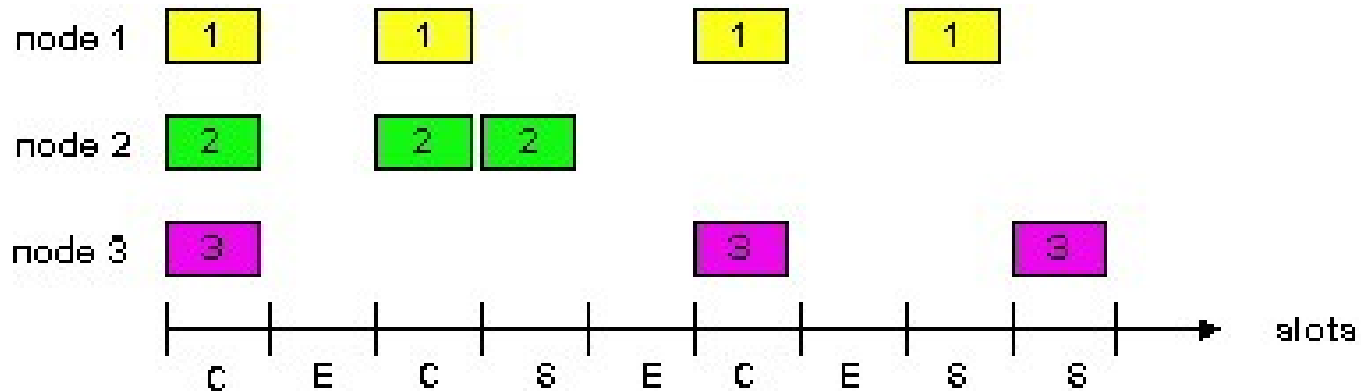 - if collision, random back-off

Pure Aloha: vulnerable period

Collides with the start of the shaded frame

Collides with the end of the shaded frame

t

t_o $t_o + t$ $t_o + 2t$ $t_o + 3t$ Time

Vulnerable

Slotted Aloha

- Slotted time
- Synchronized nodes
- Transmission only at the beginning of a slot
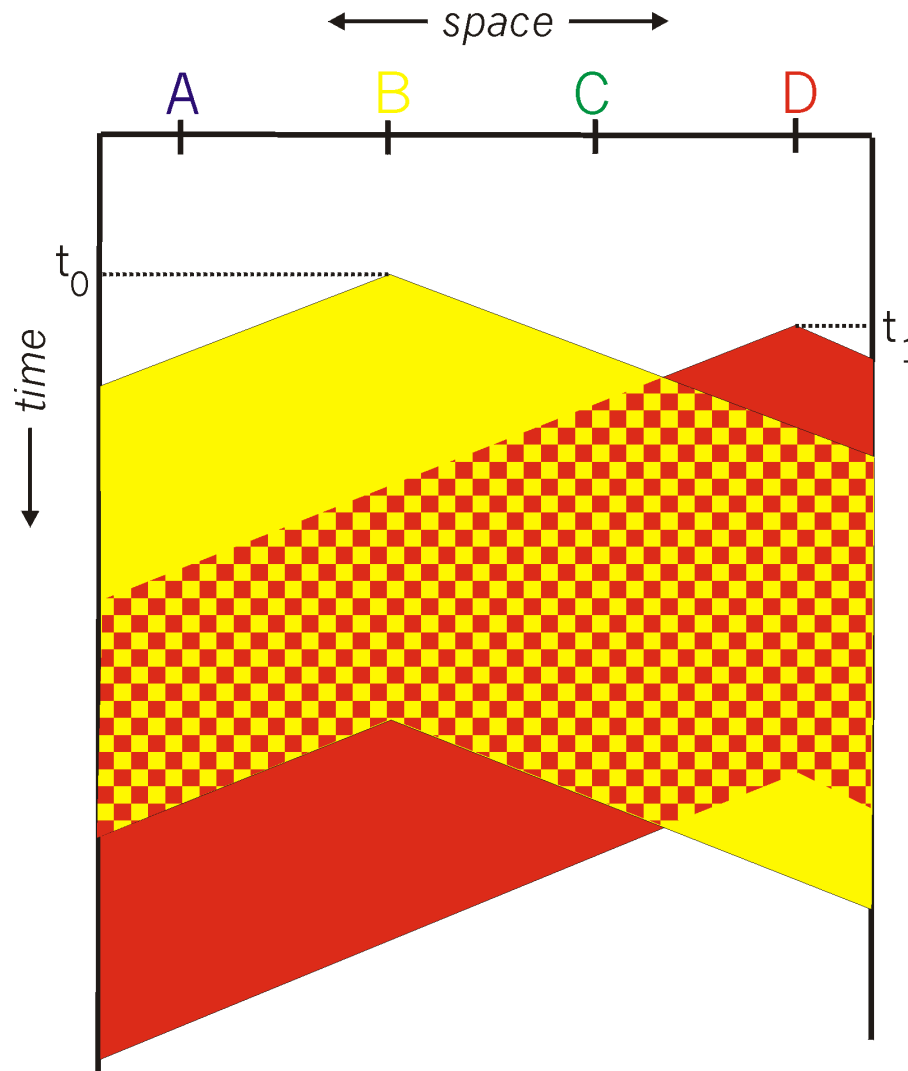 - if collision, retransmit in next slot with prob. p
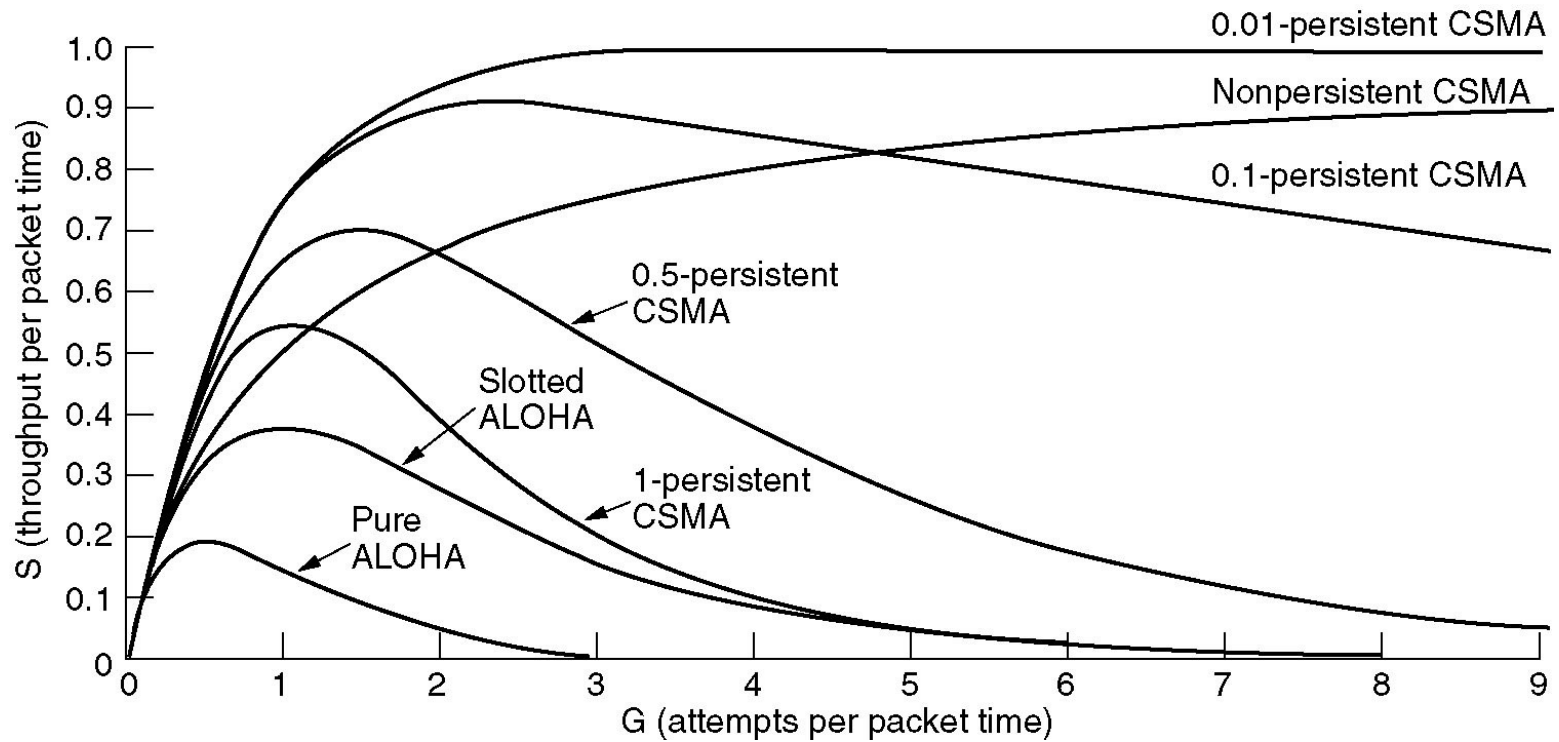
Carrier sense multiple access

- 1-persistent CSMA
  - is channel is busy, wait
  - if channel is idle, transmit immediately
    - if collision, random back-off
- *p*-persistent CSMA
  - if busy, wait
  - if idle, transmit with probability *p*
- Non-persistent CSMA
  - if busy, back-off

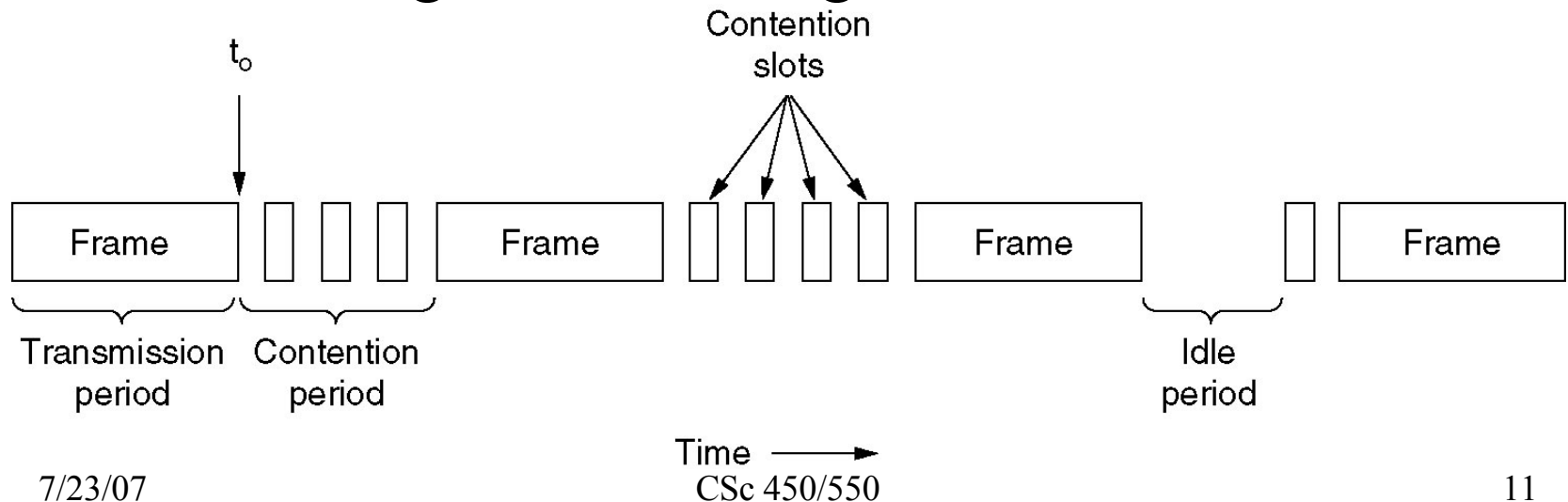# CSMA: collision "area"

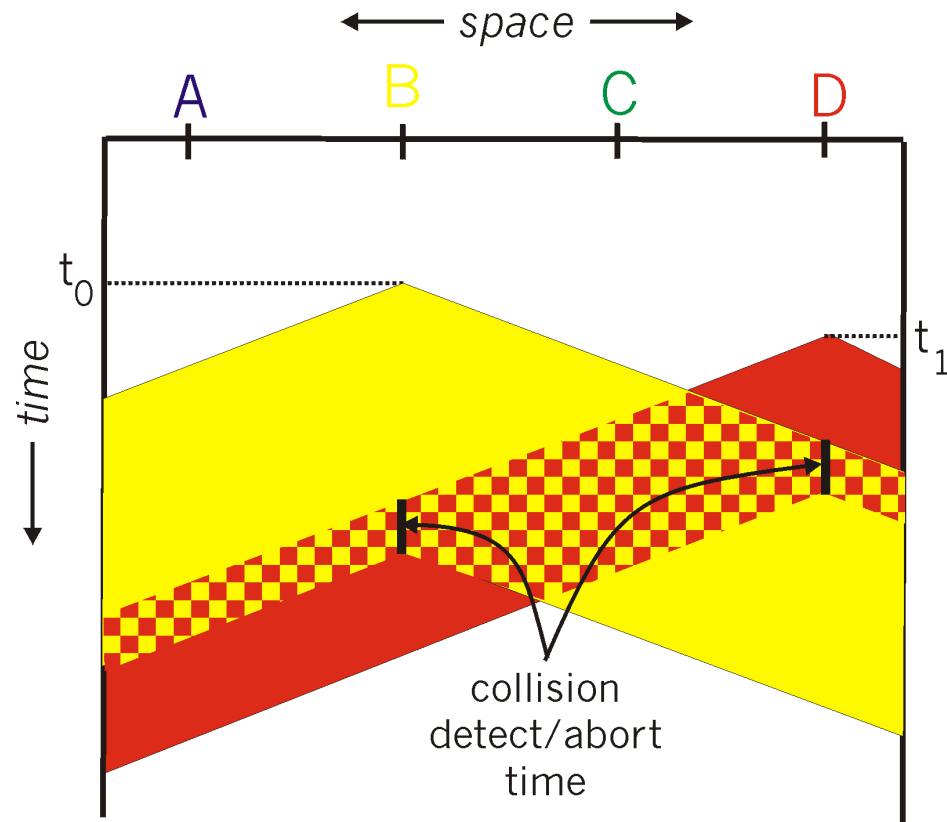spatial layout of nodes

Performance comparison

CSMA/collision detection

- ## CSMA

- ## CD
  - if collision, *abort* and back-off
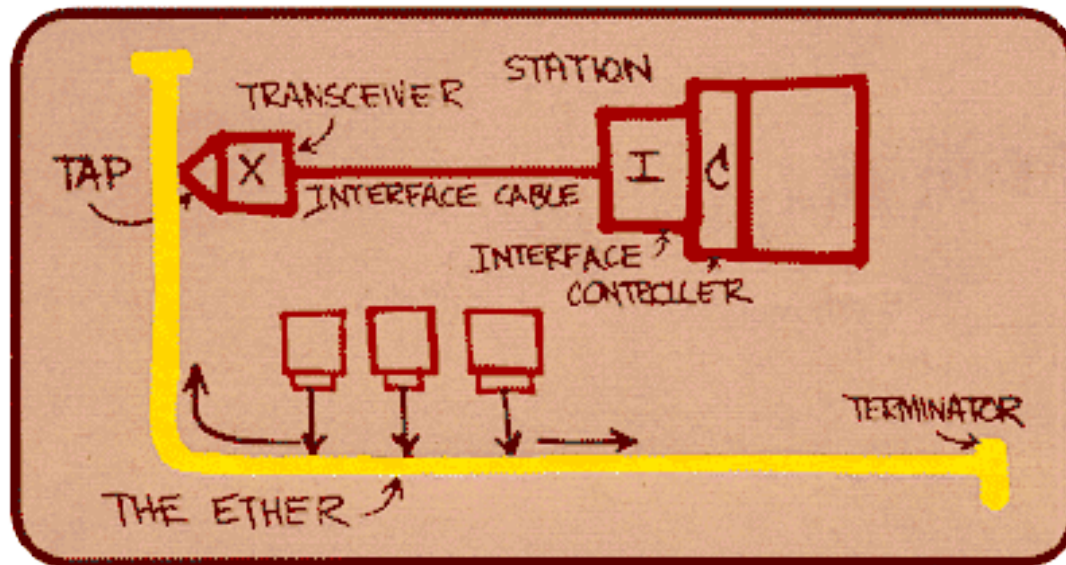 - receiving while sending
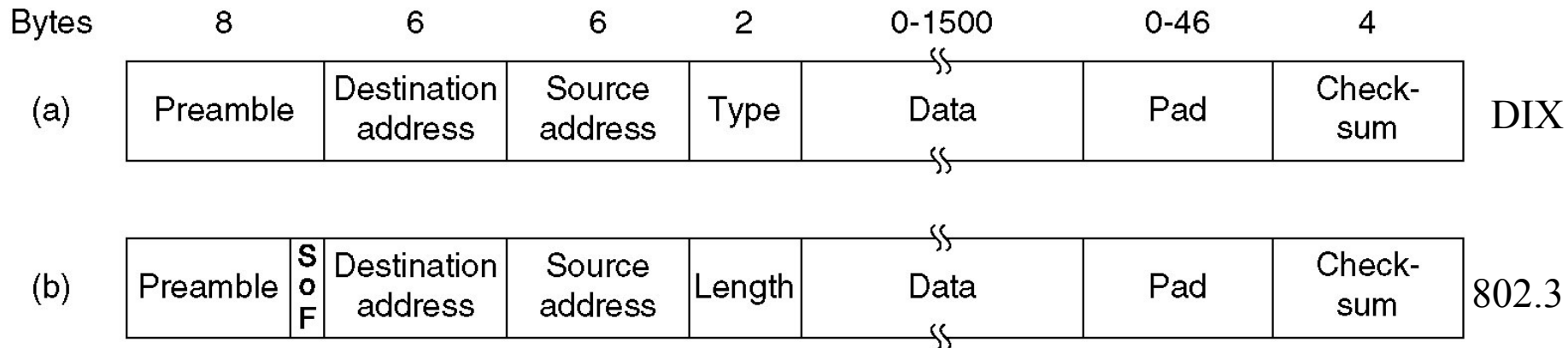
CSMA/CD: collision "area"

Ethernet

- Pervasive!
  - speed: 10Mbps, 100Mbps, 1Gbps, 10Gbps
  - medium: coaxial, twist-pair, fiber
  - topology: bus, tree, star; range: LAN, MAN

Ethernet frames

- ## DIX format
  - type
- ## IEEE 802.3 format
  - length

Bytes	8	6	6	2	0-1500	0-46	4	
(a)	Preamble	Destination address	Source address	Type	Data	Pad	Check-sum	DIX

	8		6	6	2	0-1500	0-46	4	
(b)	Preamble	SOF	Destination address	Source address	Length	Data	Pad	Check-sum	802.3

Ethernet frame

- Destination/source addresses (6-byte each)
- Type (2-byte): e.g., 0x0800 (IP)
  - length in 802.3 frame with 802.2 LLC
- Data: 0~1500 bytes
- Pad: 0~46 bytes
  - minimal frame length
- CRC: 4-byte
- CSMA/CD with binary exponential back-off

This lecture

- MAC
  - Aloha
  - slotted Aloha
  - CSMA
  - CSMA/CD
  - IEEE 802.3

Next lectures

- July 26: IEEE 802.11
- July 30: Interworking

- August 2: 3rd in-class midterm exam
  - extra before-exam office hours
    - July 25, August 1: 10:30-11:30am
  - regular office hours
    - Mondays and Thursdays: 10:30-11:30am
  - also use the google group