# Multiple Access Protocols

# Taxonomy of Multiple Access Protocols

- Random Access Protocols
  - Aloha
  - Slotted Aloha
  - Carrier sense multiple access (CSMA): Ethernet
  - Group random access
- Controlled Access Protocols
  - Predetermined allocation (TDMA)
  - Reservation protocols
  - Token passing protocols

# Aloha

- If you have a packet, just send it.
- If multiple people try it and so there is collision, then try resending it later!
- Theoretical analysis (based on Poisson distribution) shows a throughput of only 18%.

# Slotted Aloha

- Synchronous, that is time is divided into slots
- Slot size is equal to the transmission time of a packet
- When you are ready, transmit at the start of the time slot.
- Doubles the efficiency of Aloha (38% throughput)
- But requires synchronization!

# Carrier Sense Multiple Access

- CSMA
- Listen to channel. If busy then wait for a random time and then listen again. If not busy then transmit
- Collision may still happen

# p-persistent CSMA

- Quite like CSMA.
- But, when the channel is idle then you transmit with probability p. Otherwise, even when it is idle, you wait for a random time before you listen to the channel.

# CSMA/CD

- CSMA with collision detection(CD):
  - Listen while you are sending packets
  - Stop sending when collision happens
- Wait random time before you attempt to resend.
- IEEE 802.3 standard
- Used in coaxial cable.  You do exponetial backoff.

# Group Random Access

- Instead of random backoff, use a structured search to find one unit to transmit
- First enable a group.
- If collision happens, then divide the group into two parts and let one part try.

# Token Passing

- Form a circular list.  Pass a token around. Whoever has the token can transmit.
- Only the station that wants to trasmit, seize the token and release it after successful transmission.

# Reservation Aloha

- Channel is divided into time slots of equal size.
- Each slot is large enough to transmit a packet.
- Slots are arranged into frames of equal size.
- Frame size is proportional to propagation delay.
- Units compete for slots. Once a unit gets a slot, it retains the slot (across frames) until it no longer needs it.
- Efficient for bursty data but no so for single packet.

# FIFO Reservation

- Channel is divided into slots. Units compete and make reservation for these slots in FIFO manner.
- Every one keeps track of the order.
- After every M slots, one slot is broken into small reservation slots using which units try to reserve next M slots.
- Efficient in handling bursty data. No frame size limitation. But requires tracking of queue!

# Round Robin

- Channel is divided into equal slots where each unit is a owner of  a slot.  (Just like TDMA)
- But, others can use the slot of a unit UNTIL the unit wants it by creating a collision.
- No activity is a signal for others to contend for the slot.
- Good for burst data.  But contend using other protocols for unused slots.