CISC 7332X T6

Collision-free and Limited-contention Protocols

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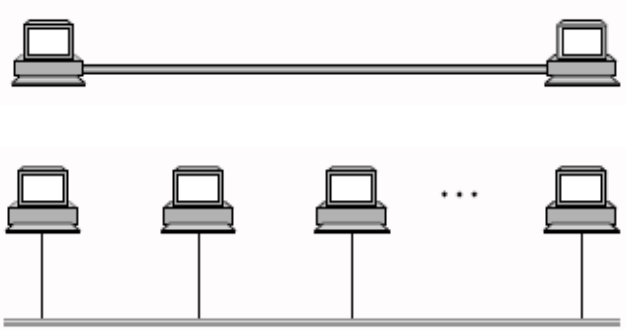
Outline

- Channel allocation problem
- Multiple Access Protocols
  - Discussed
    - ALOHA
    - CSMA (Carrier Sense Multiple Access)
    - CSMA/CD
  - Collision-free protocols
  - Limited-contention protocols
  - To discuss next week
    - Ethernet protocols
    - Wireless LAN protocols

Medium Access Control

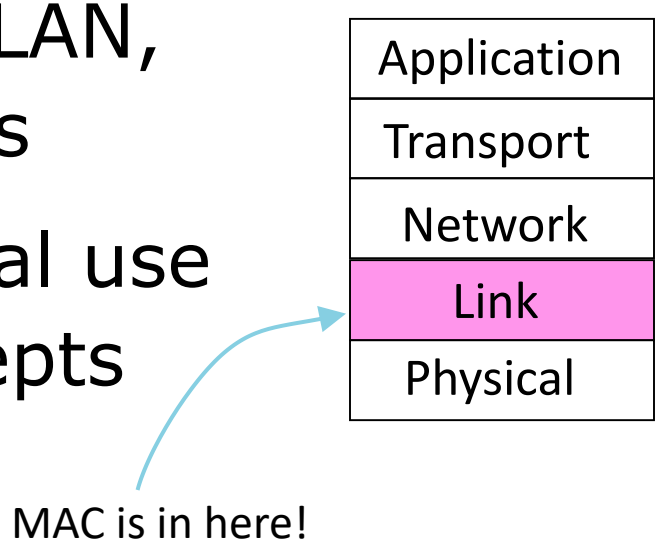
- Two types of network links
  - Point-to-point
  - Multiple access (broadcast)



- Key issue
  - Who gets to use the channel when there is a competition to it?
  - Multiaccess channel/random access channel
  - Medium Access Control (MAC)

The MAC Sublayer

- The protocols used to determine who goes next on a multiaccess channel
- Especially important for LAN, particularly wireless LANs
- In contrast, WANs general use point-to-point links, excepts for satellite networks



Multiple Access Protocols

- Discussed
  - ALOHA
  - CSMA (Carrier Sense Multiple Access)
- Collision-free protocols
- Limited-contention protocols
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Collision Free Protocols

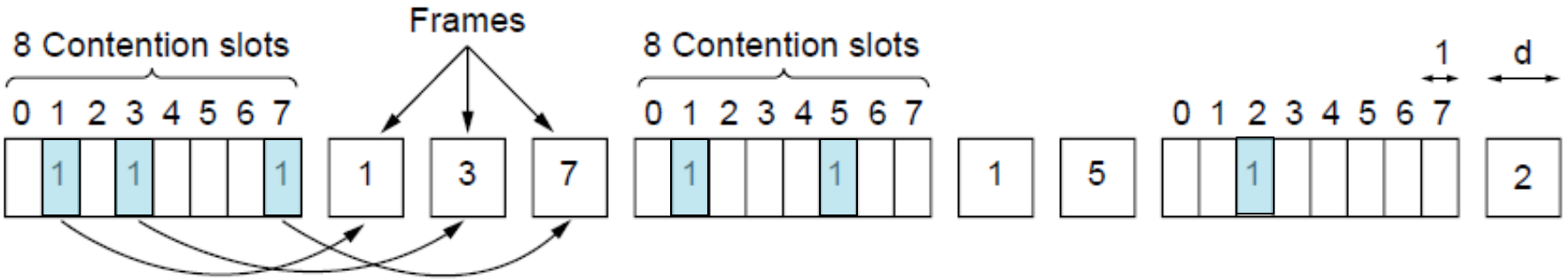
- Collision-free protocols avoid collisions entirely
  - Senders must know when it is their turn to send
- Bitmap

Bitmap

- The basic bit-map protocol:
  - The protocol consists of two phases
    - Contention
      - There are a fixed number of content slots.
      - Sender set a bit in contention slot if they have data
    - Sending frames
      - Senders send in turn; everyone knows who has data
- Protocols like this, in which, the desire to transmit is broadcast before actual transmission is called reservation protocols

Basic Bitmap: Example

- Each station announces whether it has data frame to transmit in *its* content slot
- After contention slots, transmit if any station has a frame to transmit



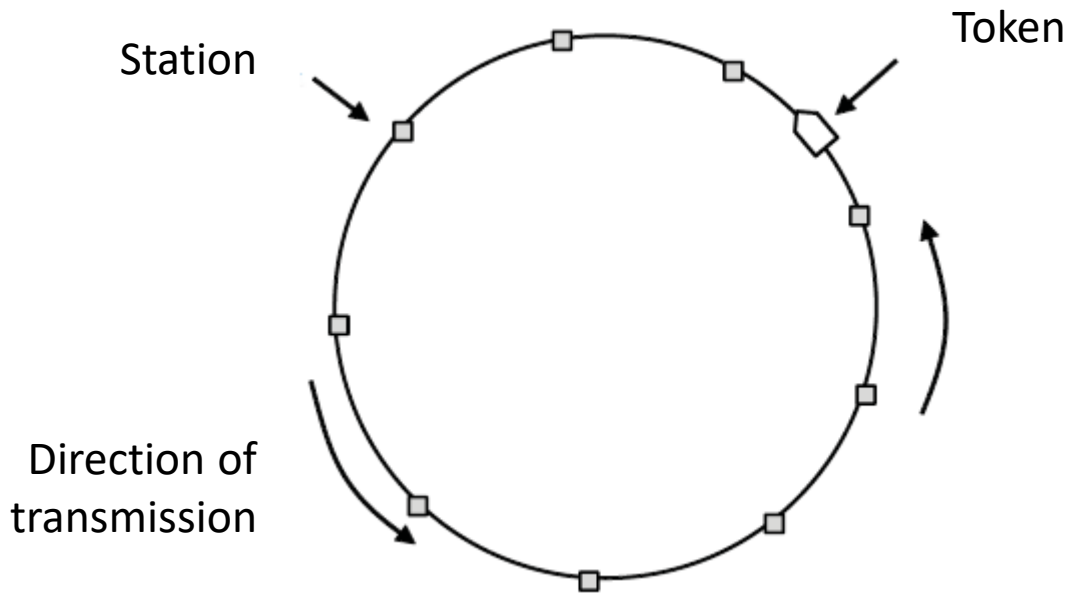
Basic Bitmap: Efficiency

- Channel efficiency/utilization: assume N slots, d bits per frame
  - Low load: ~ d/(d+N)
  - High load: ~ d/(d + 1)
- Mean delay
  - > (N-1)d/2 + N

Token Passing

- Token sent round ring defines the sending order
  - Station with token may send a frame before passing
  - Idea can be used without ring too, e.g., token bus

Token Passing: Example



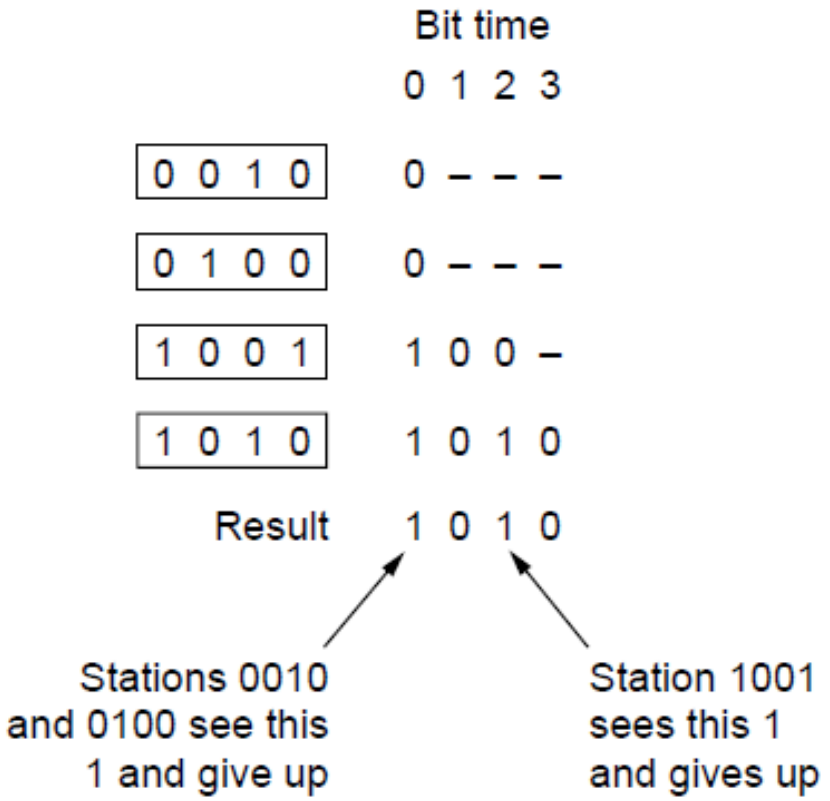
Token Passing: Example Protocols

- IEEE 802.5/Token Ring
- FDDI (Fiber Distributed Data Interface)
- IEEE 802.17/RPR (Resilient Packet Ring)

Count Down

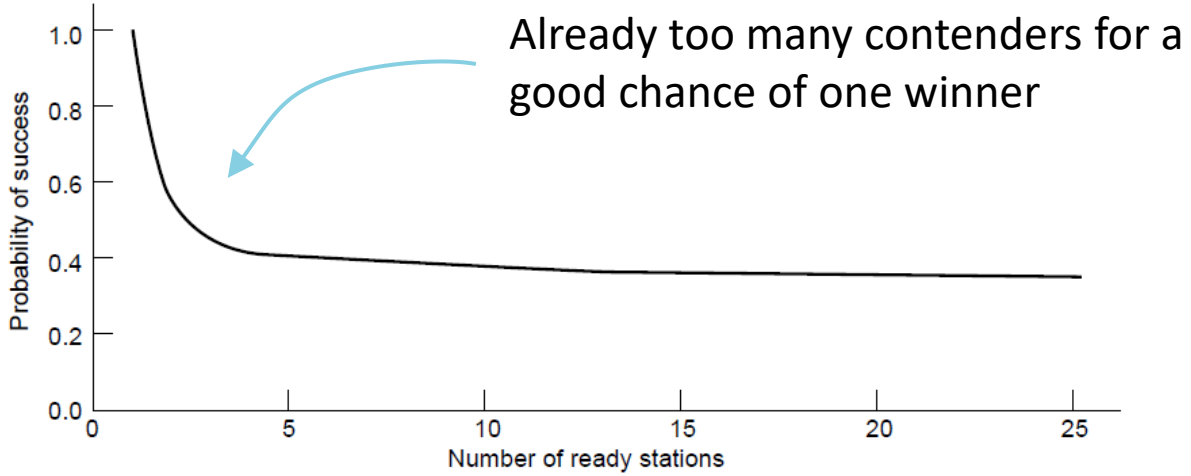
- An improvement over basic Bitmap
- Stations send their address in contention slot (log N bits instead of N bits), one bit at a time
- Medium ORs bits; stations give up when they send a “0” but see a “1”
- Station that sees its full address is next to send
- Requirement on physical layer?
  - Transmitting while receiving …

Count Down: Example



Limited-Contention Protocols

- To divide stations into groups within which only a very small number are likely to want to send
  - Avoids wastage due to idle periods and collisions



Adaptive Tree Walk: Motivating Example

- U.S. Army adopted a method to test soldiers for syphilis during World War II aiming at reducing tests.

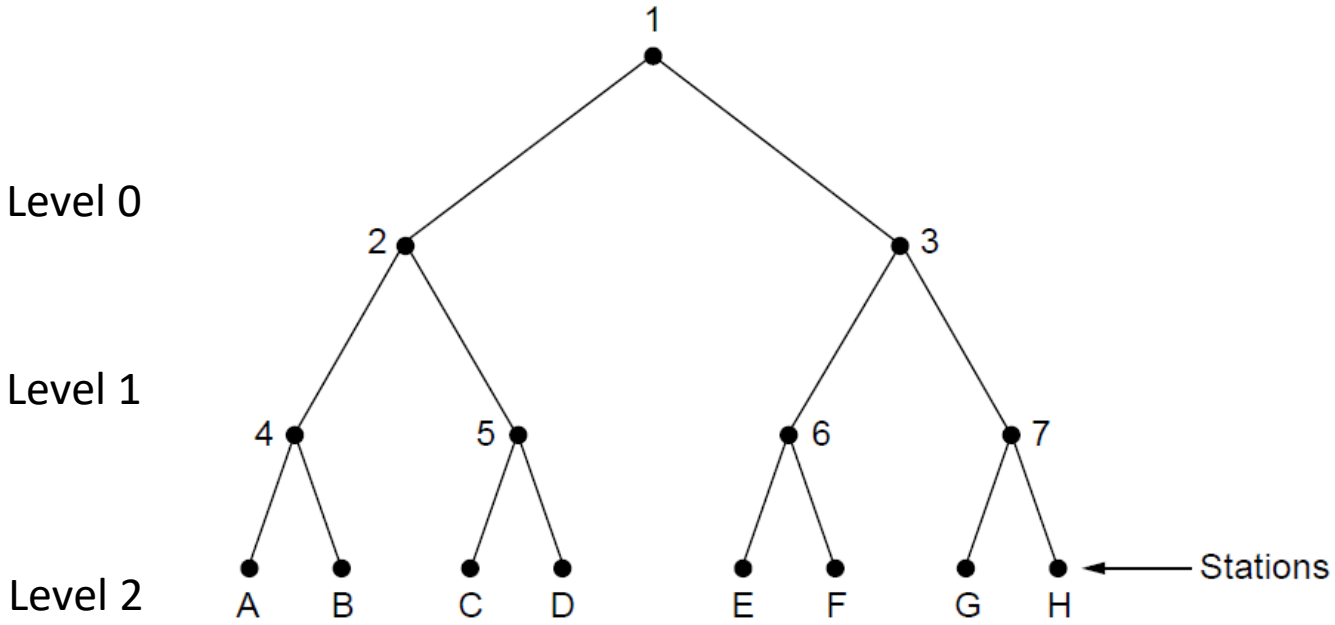
1. Took a blood sample from N soldiers
2. Pour a portion of each to a test tube
3. If the mixed sample is clean with antibodies, the N soldiers are declared healthy
4. Otherwise, divided N into two groups, each with N/2 soldiers
5. Repeat the testing protocol starting at step 1 (albeit for each group of N/2 soldiers) recursively until the infected soldier is found.

Limited Contention: Adaptive Tree Walk

- Tree divides stations into groups (nodes) to poll
  - Depth first search under nodes with poll collisions
  - Start search at lower levels if >1 station expected

Limited Contention: Adaptive Tree Walk: Example Tree

- 8 stations; time slots conveniently numbered 1, 2, … 7 as the node numbers in the tree; nodes are grouped accordingly
- If contention fails at time slot 1, nodes under 2 contends at slot 2, and nodes under 3 contends at slot 3 …



Questions?

- Collision-free protocols
- Limited-contention protocols