CSE3151

COMPUTER NETWORKS

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MAC (Medium Access Control)

- The protocols used to determine who goes next on a multiaccess channel belong to a sublayer of the data link layer called the **MAC (Medium Access Control)** sublayer.
- The MAC sublayer is especially important in LANs, particularly wireless ones because wireless is naturally a broadcast channel.

From Syllabus

Physical Layer: Circ
reference model.

Medium Access Subl
detection and collisio

, ATM

with collision

Medium Access Sublayer

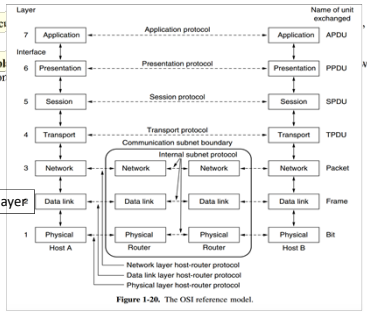
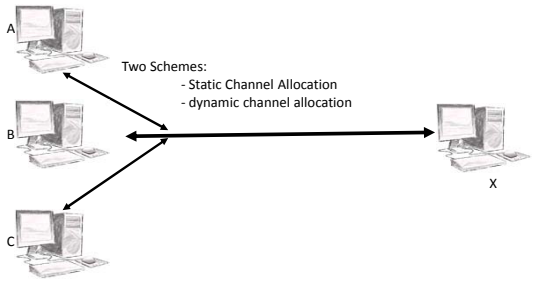
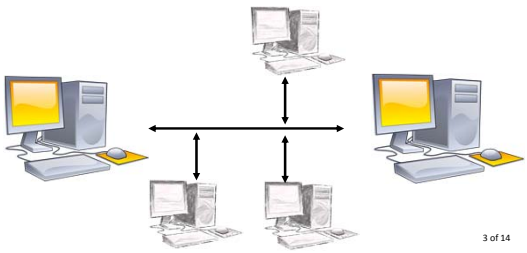


Figure 1-20. The OSI reference model.

The Channel Allocation Problem

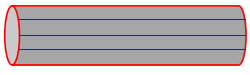


- Network links can be divided into **two categories**:
  - those using point-to-point connections and
  - those using broadcast channels.



Static Channel Allocation

- FDM (Frequency Division Multiplexing).



- User needed to be constant N
- When some users are quiescent, their bandwidth is simply lost.
- A static allocation is a poor fit to most computer systems… peak traffic to mean traffic ratios of **1000:1**
- Most of the channels will be idle most of the time

Dynamic Channel Allocation

- ASSUMPTIONS:
  1. **INDEPENDENT TRAFFIC.:**
     - The model consists of N independent stations ….
     - The expected number of frames generated in an interval of length $\Delta t \; is \; \lambda \Delta t$, where λ is a constant (the arrival rate of new frames).
     - Once a frame has been generated, the station is blocked and does nothing until the frame has been successfully transmitted

Dynamic Channel Allocation

2. **SINGLE CHANNEL.**
   - A single channel is available for all communication.
   - All stations can transmit on it and all can receive from it.
3. **OBSERVABLE COLLISIONS.**
   - If two frames are transmitted simultaneously, they **overlap** in time and the resulting signal is garbled.
   - This event is called a **collision**.
   - All stations can detect that a collision has occurred.
   - A collided frame must be transmitted again later. No errors other than those generated by collisions occur

Dynamic Channel Allocation

4. **CONTINUOUS OR SLOTTED TIME.**
   - Time may be assumed continuous, in which case frame transmission can begin at any instant.
   - Alternatively, time may be slotted or divided into discrete intervals (called slots).
   - Frame transmissions must then begin at the start of a slot.
   - A slot may contain 0, 1, or more frames, corresponding to an idle slot, a successful transmission, or a collision, respectively.

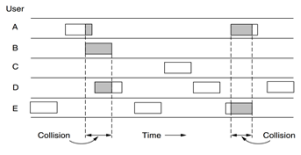
Dynamic Channel Allocation

5. **CARRIER SENSE OR NO CARRIER SENSE.**
   - With the carrier sense assumption, stations can tell if the channel is in use before trying to use it.
   - No station will attempt to use the channel while it is sensed as busy.
   - If there is no carrier sense, stations cannot sense the channel before trying to use it.
   - They just go ahead and transmit.
   - Only later can they determine whether the transmission was successful

MULTIPLE ACCESS PROTOCOLS

- Popular Dynamic Channel Allocation Protocol:
  - ALOHA
    - Pure ALOHA protocol
    - Slotted ALOHA protocol

- Systems in which multiple users share a common channel in a way that can lead to conflicts are known as **CONTENTION SYSTEMS**



- Let users transmit whenever they have data to be sent.
- There will be collisions, of course, and the colliding frames will be damaged. Senders need some way to find out if this is the case.
- After each station has sent its frame to the central computer, this computer rebroadcasts the frame to all of the stations.
- A sending station can thus listen for the broadcast from the hub to see if its frame has gotten through.
- If the frame was destroyed, the sender just waits a random amount of time and sends it again.

Slotted ALOHA

- … proposal was to divide time into discrete intervals called slots, each interval corresponding to one frame
- This approach requires the users to agree on slot boundaries.
- One way to achieve synchronization would be to have one special station emit a **pip** at the start of each interval, like a clock.
- it is required to wait for the beginning of the next slot

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Carrier Sense Multiple Access Protocols

- **C**arrier **S**ense **M**ultiple **A**ccess Protocols – CSMA
- Protocols in which stations listen for a carrier (i.e., a transmission) and act accordingly are called carrier sense protocols

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