CSC 524

Computer Networks

Dr. Esam A. Alwagait

Lecture 5

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Agenda

1. Introduction
2. Medium Access Control sub-Layer
3. Channel Allocation
4. Multiple Access Protocols
5. Ethernet
6. Summary & Discussion

Introduction

- There are two types of networks
  - Point-to-point
  - Broadcast
- Broadcasting.. If there are many senders.. Who gets the channel ?
- Medium Access Control (MAC) sub-layer is part of Data Link Layer

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Channel Allocation

- 1 channel .. Multiple users ..
  - How do you allocate it between them ?
- If 2 users send at the same time it will results in a collision ! Data will become garbage !
- Two methods
  - Static
  - dynamic

Channel Allocation

- Static allocation
- Use FDM to divide the channel between N users so that each will get a specific frequency
- PROs
  - Easy
- CONs
  - Limited (what if N is large ?)
  - Wastes resources (idle users)

Channel Allocation

- Dynamic Allocation
  - Station Model : several stations (computer, phone, network device..etc)
  - Single Channel
  - Collisions: 2 frames sent at the same time results in a collision .. Stations could detect that
  - Continuous time: transmission can start any time
  - Slotted time: time is divided in discrete intervals
  - Carrier Sense: stations can sense of channel is busy
  - No Carrier Sense: stations just transmit at will

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4. **Multiple Access Protocols**
5. Ethernet
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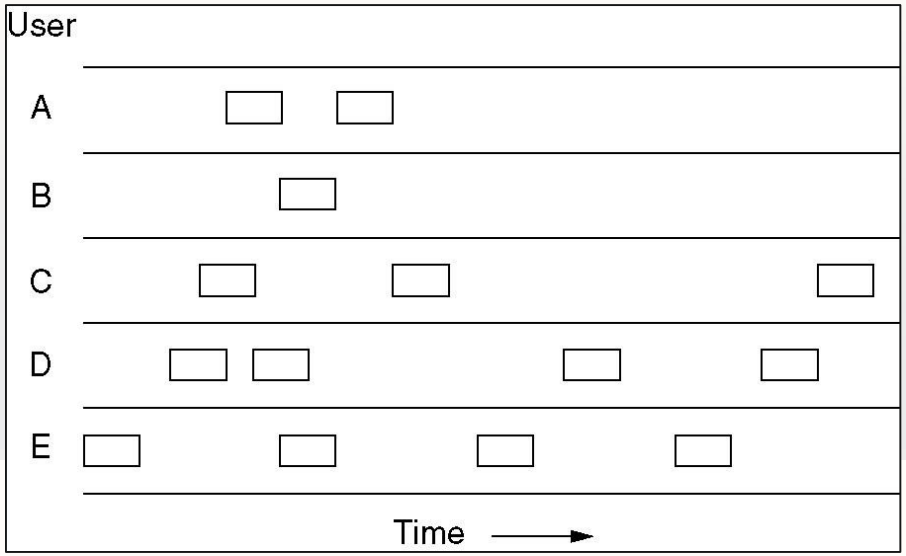
Multiple Access Protocols

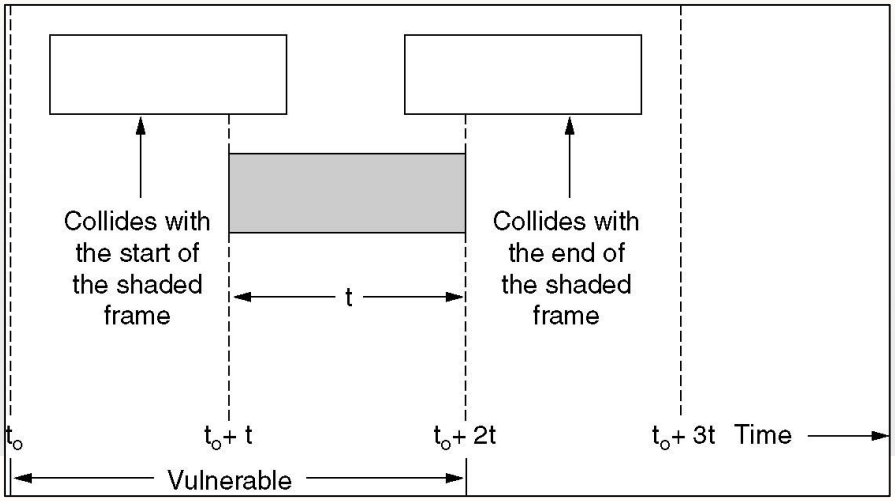
- ALOHA
- 1970s at the university of Hawaii
- Two variations
  - Pure ALOHA
    - Time is continuous
  - Slotted ALOHA
    - Time is slotted

Multiple Access Protocols

- Pure ALOHA
- Simple idea
  - User transmits whenever they want
  - Collision ? Wait random amount of time and re-send
- Stations must be able to detect collision
  - LANs is fast.. Others there is a delay
- If they cannot ACK must be used

Multiple Access Protocols



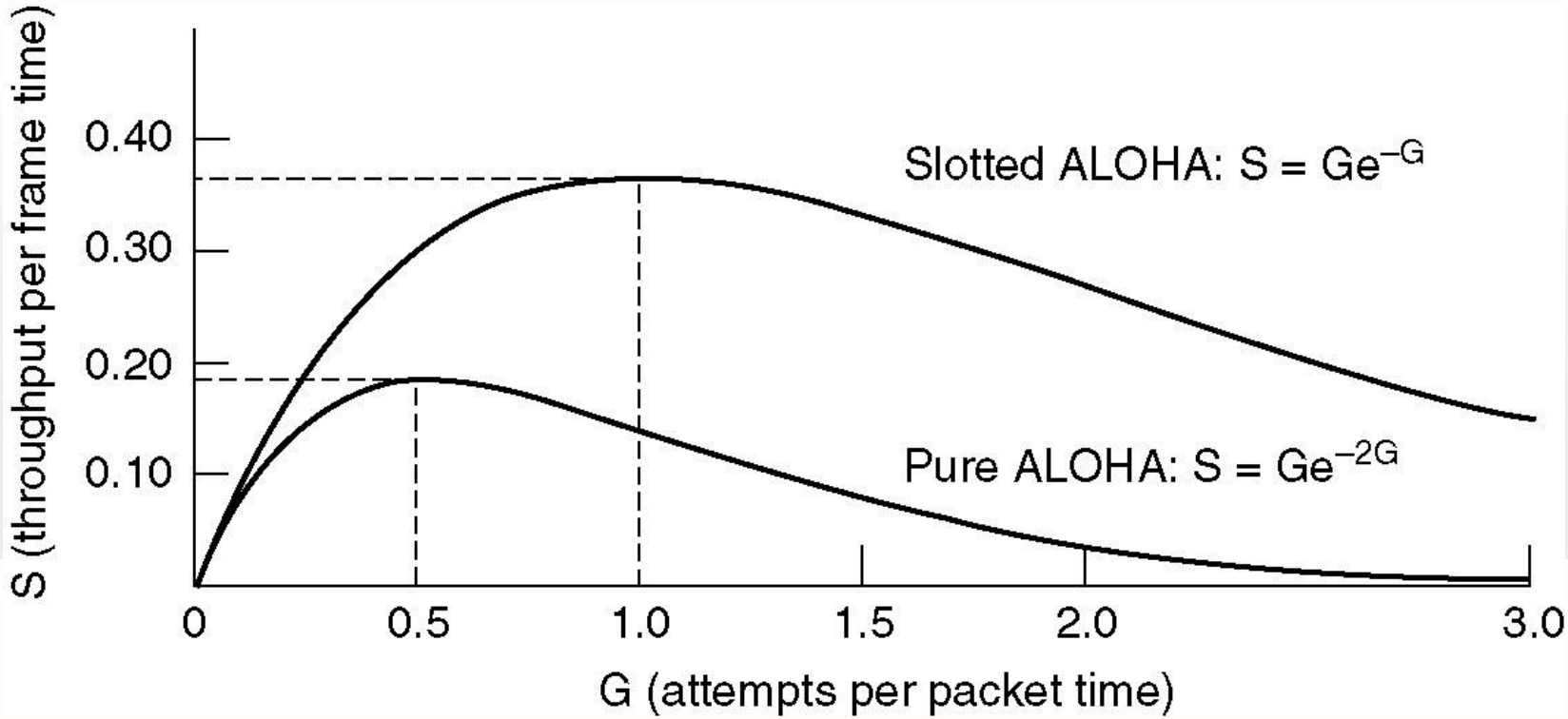


Vulnerable period for the shaded frame.

Multiple Access Protocols

- Slotted Aloha
- Divide time into slots.. Stations must agree one slot boundaries
- Same as Pure Aloha except that:
  - Stations only send at the beginning of a slot

Multiple Access Protocols



Throughput versus offered traffic for ALOHA systems.

Multiple Access Protocols

- Carrier Sense Multiple Access Protocols
- ALOHA does not provide good throughput
  - Lots of bandwidth is wasted on collisions and retransmissions
- In LANs, stations can “sense” if the channel is busy

Multiple Access Protocols

- Persistent and non-persistent CSMA
- 1-persistent CSMA
  - Before sending “sense” if the channel is busy
  - If it is busy.. Wait till it is idle then send
  - Collisions ? Wait random time then resend
- Called 1-persistent because when the channel is idle you send with probability=1

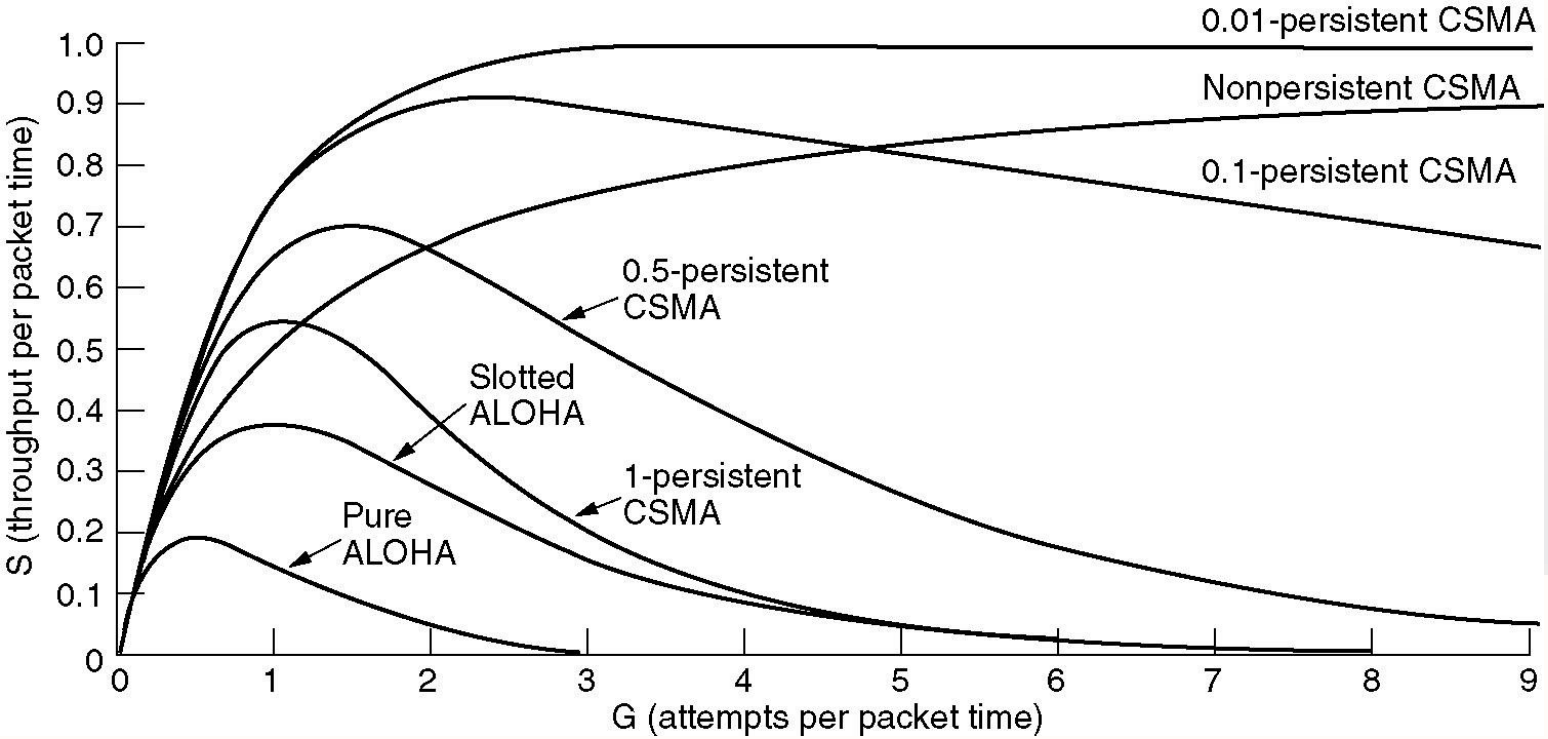
Multiple Access Protocols

- Propagation delay is important!
  - What if a stations begins sending and another one senses idle channel at the same time ?
    - Collisions
  - Collisions could occur even if propagation delay is zero ! (two are waiting for the third to finish sending)
- Even though it is way better than ALOHA

Multiple Access Protocols

- Non-persistent CSMA
  - Sense the channel
  - Busy ? Do not keep sensing .. Instead wait a random amount of time and sense again
- P-persistent CSMA
  - Same, but if the channel is free send with probability q=1-p or wait random amount of time and repeat
  - Works with slotted time.

Multiple Access Protocols



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

Multiple Access Protocols

- CSMA with Collision Detection (CD)
- Persistent and non-persistent provide improvement over ALOHA
  - Still when collision occur they keep sending the WHOLE frame
  - CD enables the station to abort as soon as collision is detected

THANK YOU!

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