Multiple Access Protocols

ALOHA
CSMA
Collision Free
Limited
WDMA
Wireless

- Aloha
- CSMA Protocols
- Collision Free Protocols
- Limited Contention Protocols
- Wavelength Division Multiple Access Protocols
- Wireless LAN Protocols

Pure ALOHA

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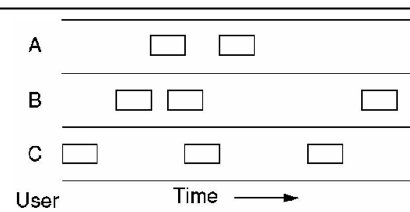
- Dynamic Allocation
  - Stations transmit ____________________ on a ____________________.
- Therefore there is contention for the channel
  - And this results in ____________
  - Stations listen to ____________________ and then ____________________________________



Pure ALOHA (2)

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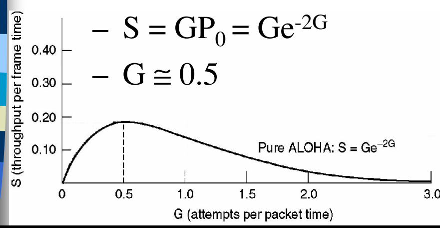
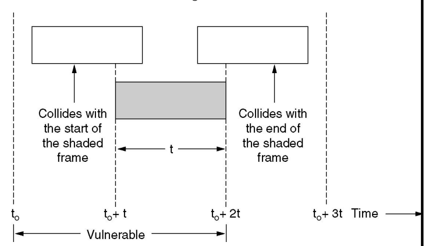
- We must consider the efficiency of this
  - N: ______________________________ where $(0 < N < 1)$
  - G: ______________________________ where $G >= N$
  - $Pr(k) = (G^k e^{-G}) / k!$ This is the probability that ____ ____
  - The vulnerable period for a frame is ______________
  - So the probability of no other traffic is $P_0 = e^{-2G}$
- Throughput
  - $S = GP_0 = Ge^{-2G}$
  - $G \cong 0.5$





Slotted ALOHA

ALOHA
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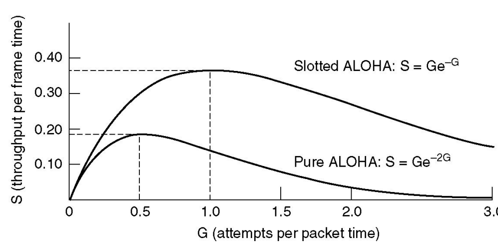
- Intended to ______________________________
- Transmission restricted to ____________________
- Frames have the same probability of arriving
  - $Pr(k) = (G^k e^{-G}) / k!$
- However the ____________________________________
  - $P_0 = e^{-G}$
- Throughput
  - $S = GP_0 = Ge^{-G}$
  - $G \cong 1.0$

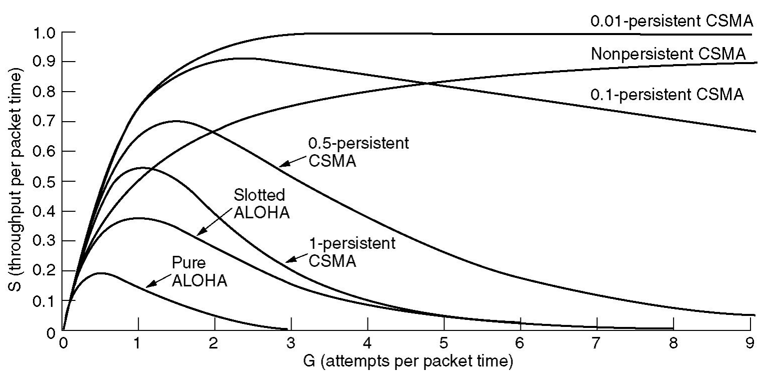


CSMA: ______________________

- Stations can ______________________
- 1-persistent CSMA
  - Stations sense the medium and begin transmitting ______ ______________________________________
  - If a collision occurs ______________________
- Nonpersistent CSMA
  - If the line is busy ______________________
- p-persistent CSMA
  - Applies to ______________________
  - If the line is idle ______________________
- Performance

CSMA

- Performance
  - Only considering ______________________
  - What about ______________________



ALOHA
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CSMA / CD: ______________

- Should be able to detect a collision almost immediately so ______________________
- The line can be in one of 3 states:
  - Idle: ______________________
  - Transmission: ______________________
  - Contention: ______________________
- How long does it take to detect a collision?
  - The minimum time to detect a transmission is ________ ______________________
  - The contention period though is ______________ as ______________________
  - To place an upper bound on the contention period we must ______________________
  - This also means imposing ______________

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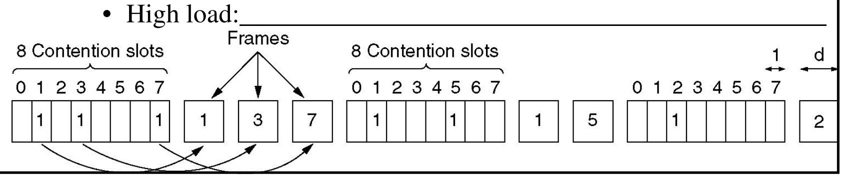
Collision-Free

- There are also protocols which ____________
- Assume N stations each with an address (0..N-1)
- Basic bit map method:
  - N contention slots (______________)
  - If a station wants to transmit ______________ ______________________
  - The stations then ______________________
  - Performance
    - Low load: ______________________
    - High load: ______________________



Collision-Free (2)

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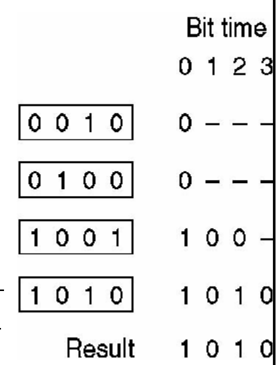
- Length of contention periods: ____________ ____
- Binary countdown method:
  - Assume N stations with __________________________
  - Use _____________________
  - If a station wants to transmit, _____ _____________________
  - If a stations sees a higher number _____________________
- Performance:
  - Low load: _____________________
  - High load:_____________________



MAC Sublayer, Topic 8.[2,3], Multiple Access Protocols

Limited-Contention

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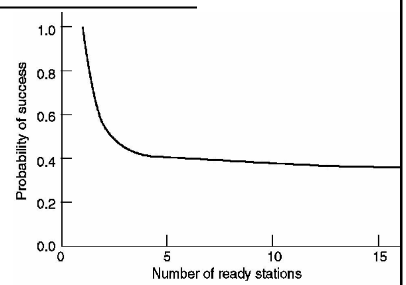
- Symmetric protocols
  - Each station has the same probability of transmitting
  - p: ____
  - k: ____
  - $kp(1-p)^{k-1}$: ____________________________________
  - The best result for p is _________
  - Probability of success is ______________
- Performance
  - To improve probability of success ________________ _____________________



Limited-Contention (2)

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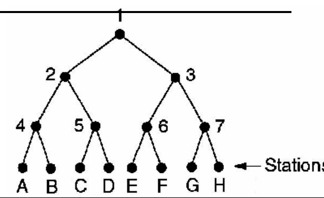
- Adaptive Tree Walk Protocol
  - Start with a single contention slot ________________
  - If there is a collision ___________________________
    which any station _____________________________
  - If successful then ____________________________
  - This is done until ____________________________
  - Next time done the tree ________________________
  - Under a heavy load the ________________________
    ____



WDMA: ___________________

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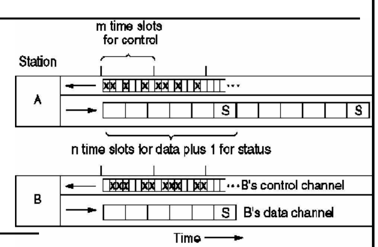
- Available bandwidth is divided into ________________ (where N is the no. of stations). Each station is allocated
  - A Control channel so that ________________________
  - A Data channel so it ___________________________
    - n slots & 1 status slot



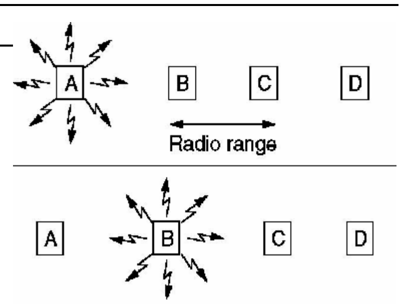
- Each station needs
  - Fixed transmitter: __________
  - Fixed receiver: ____________________________
  - Tunable receiver: ___________________________
  - Tunable transmitter: _________________________

WDMA

- To set up a connection oriented connection
  - Sense the status slot ________________________
  - Make a connection request using ________________
  - Sense the status slot to ______________ and to ______________________
  - Two way communications requires ______________
  - Fixed data rate can be achieved by _______________
- Datagram communication (____________________)
  - Indicate "Data in Slot" using __________________
  - Problem if two stations ______________________

Wireless LAN

- Problems for wireless networks:
  - Hidden Station Problem: ____________________
    - Result: ________________
  - Exposed Station Problem: ____________________
    - Result: ________________
- The root of the problem is that the Sender can only detect ___________________________________ ____________________



MAC Sublayer, Topic 8.[2,3], Multiple Access Protocols

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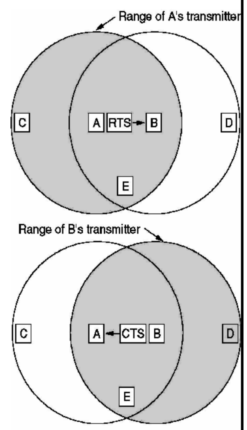
Wireless LAN (2)

- MACA: ______________________
  - Station broadcasts a RTS (____________________)
    - Include the length ____________
  - Recipient responds with CTS (_______________)
  - Other stations
    - If they hear a RTS then __________
    - If they hear a CTS then __________
    - If no CTS then _______________
  - Collisions ?
    - Obviously two _______________



MAC Sublayer, Topic 8.[2,3], Multiple Access Protocols

Wireless LAN (3)

- MACA vs. MACA for Wireless
  - In MACA, there were problems without data link layer acknowledgements. MACAW added ____________________
  - MACAW also added ________________
  - The back-off algorithm was run separately for each data stream (source-destination pair, rather than ____________________
  - Congestion control was also added in MACAW.