

CPS 422  
Computer Networks

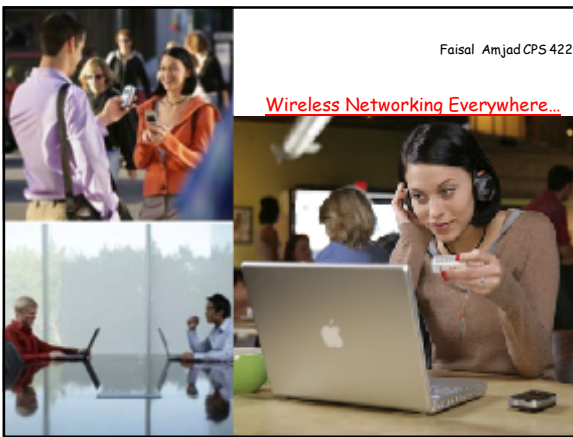
DATA LINK LAYER  
WIRELESS LANs

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Wireless Networking

- % One of the fastest growing technologies
- % Demand for connecting devices without cables is increasing everywhere
- % Wireless LANs connect roaming devices to the Internet in campuses, offices and public places



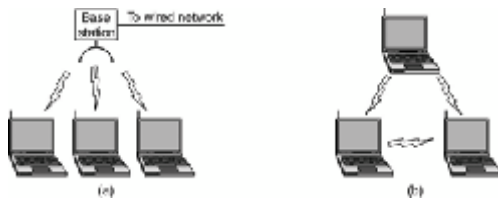
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Wireless Networking Configurations

- % The most common configuration is a building with base stations strategically placed to cover the desired areas
- % Another configuration is an Ad Hoc Network in which there is no central access point. All the mobile stations cooperatively form a network for sharing data

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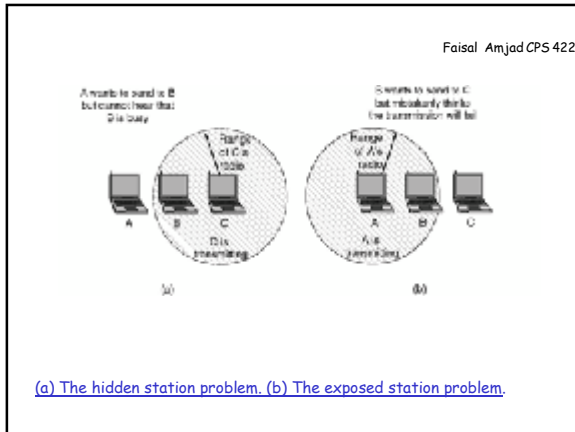
Common Wireless Networking Configurations



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MAC in Wireless Networking

- % An approach could be to use CSMA in wireless LAN
- % Listen for other transmissions and transmit only if no one else is doing so
- % Two problems arise out of carrier sensing
  - o Hidden Terminal Problem
  - o Exposed terminal Problem



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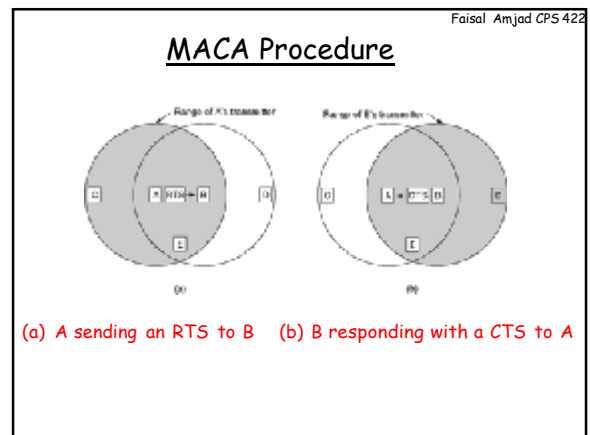
### MAC in Wireless Networking-The Problem

- % CSMA merely tells whether or not there is activity around the station sensing the carrier
- % The problem is that a station really wants to know whether or not there is activity around the receiver
- % With a wire, all signals propagate to all the stations, so only one transmission can take place at a time
- % In a system based on short-range radio, multiple transmissions can occur simultaneously, provided the source-destination pairs are different and out of the range of each other

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### MAC in Wireless Networking-The Solution

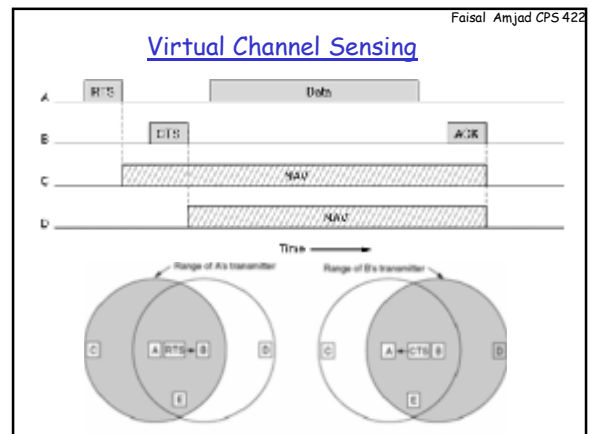
- % Multiple Access with Collision Avoidance (MACA) was introduced for wireless LANs in 1990.
- % It was the basis for IEEE 802.11 wireless LAN standard
- % Basic idea: sender sends a short frame (called Request To Send or RTS) indicating its intention of starting a transmission.
- % All nearby stations (within sender's range) avoid transmitting their frames for the duration mentioned in RTS frame
- % If the intended destination is free to receive frames, it will send another short frame (called the Clear To Send or CTS)
- % All stations in the destinations vicinity also come to know that a transmission is about to start for it, and suspend their transmission for duration mentioned in the CTS frame.

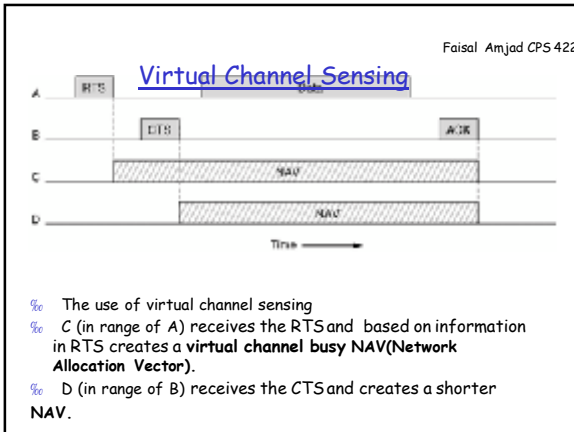


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### Virtual Channel Sensing

- % Pending of transmissions (because the stations know the carrier will be busy) for a known period of time is virtual channel sensing
- % The duration for which stations in the range of both the sender and the receiver, suspend their transmission, is through the time period mentioned in RTS and CTS frames
- % This time period is called the Network Allocation Vector or NAV
- % NAV is different for stations in the range of sender and receiver





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### Improvements in MACA

- % **MACAW** was introduced (W stands for Wireless)
- % Introduced an **ACK** frame after each successful data frame
- % **CSMA** was included so that simultaneous RTS frame transmissions are avoided
- % Backoff algorithm was run separately for each data stream, rather than each source destination pair