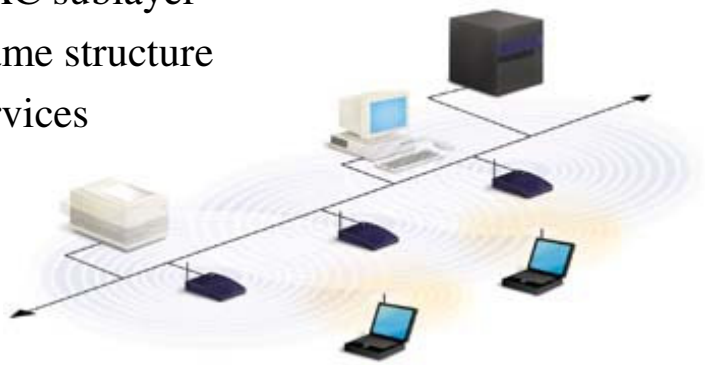
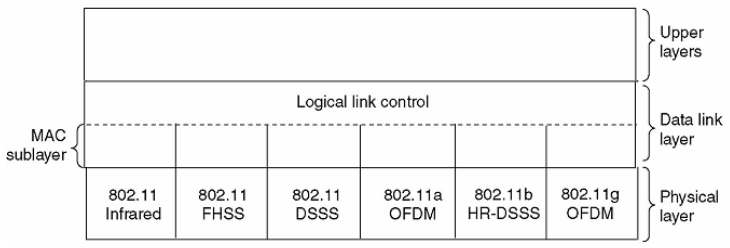
Wireless LANs

- Protocol Stack
- Physical Layer
- MAC sublayer
- Frame structure
- Services



802.11 Protocol Stack

- LLC: Intended to hide the differences between different 802 standards
- MAC & Physical: 802.11 allows for 6 options
  - 3 low speed: 1 infrared and 2 for short range radio
  - 3 high speed: all radio based

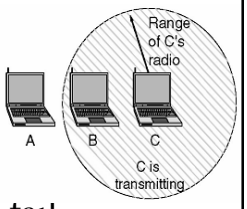


802.11 Physical Layer

802.11 Infrared	Infrared	1Mbps or 2Mbps	Gray code
802.11 FHSS	2.4GHz ISM band	1.6Mbps	79*1MHz channels
802.11 DSSS	2.4GHz ISM band	1Mbps or 2Mbps	1Mbaud at 1/2 bits/baud
802.11a OFDM	5GHz ISM band	54Mbps	52 frequencies
802.11b HR-DSSS	2.4GHz ISM band	11Mbps	1.375Mbaud at 1/2 bits/baud
802.11g OFDM	2.4GHz ISM band	54Mbps	

Wireless Problems

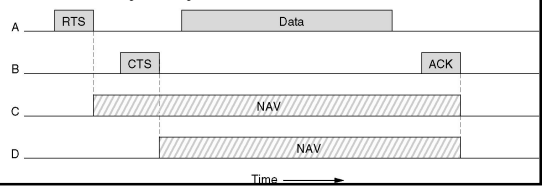
- Hidden station: A wants to send to B, but can't sense that B is receiving
- Exposed Station: B wants to transmit to A but thinks that the transmission will fail
- Half Duplex: most radios are half-duplex, cannot listen and transmit at the same time



- 802.11 Modes of Operation
  - DCF
  - PCF

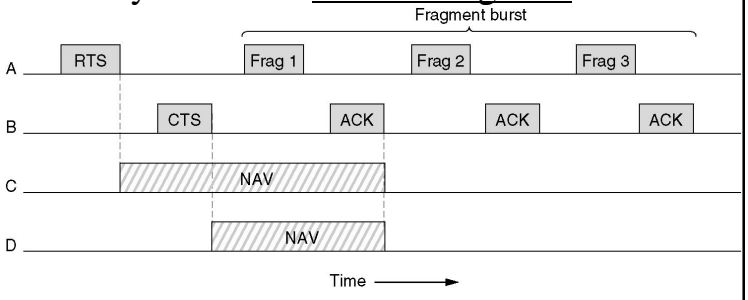
DCF: Distributed Coordination Function

- CSMA/CA
  1. Sense the line
     - If Idle then transmit
     - If Busy then wait until idle before transmitting
     - If Collision then use the backoff algorithm
  2. MACAW: Multiple Access with Collision Avoidance for Wireless
     - RTS & CTS: Sender sends an RTS and receiver replies with CTS
     - May need to estimate ACK and when it occurs
     - NAV: Network Allocation Vector – indicates to a station that the channel is virtually busy



Fragmented frames

- Wireless networks are noisy and unreliable
  - Smaller units have a greater chance of success
    - 802.11 allows frames to be broken into multiple fragments which are individually numbered Transmitted using a stop-and-wait protocol
  - NAV only works for the first fragment

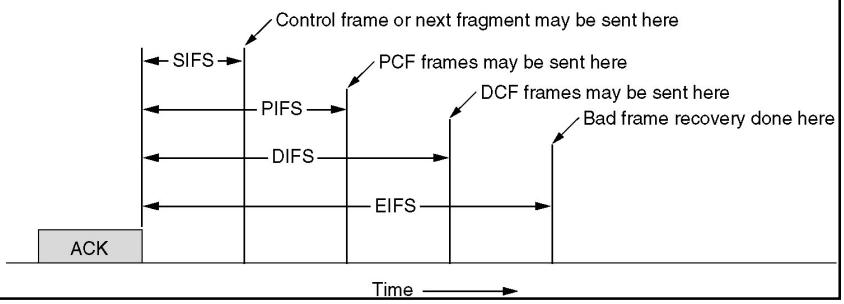


PCF: Point Coordination Function

- Base station polls the stations asking them if they have frames to send
  - Since order is controlled no collisions occur
- Polling mechanism is specified but not the frequency, order or even whether all stations get an equal service
- For new stations the base station issues a beacon 10 to 100 times per second with system parameter and a join invitation

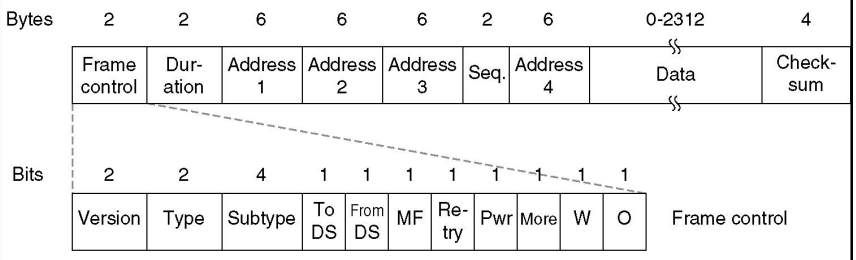
Combined PCF & DCF

- Time after a frame
  - SIFS: Short InterFrame Spacing
  - PIFS: PCF InterFrame Spacing
  - DIFS: DCF InterFrame Spacing
  - EIFS: Extended InterFrame Spacing



Frame Structure

- Data frames:



- Management frames: similar to data frames, except they have 1 BS address as they are restricted to a single cell
- Control frames: Shorter, 1-2 addresses, no Data and Seq. fields. Subtype field important (RTS,CTS,ACK, etc.)

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Distribution Services

- Association: Used by mobile stations to connect to a cell,
- Disassociation: Either the station or the BS may break the association,
- Reassociation: Changes the preferred BS
- Distribution: How to route frames sent to the base station,
- Integration: Translation services for non 802.11 network frames

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Intracell Services

- Authentication: Challenge from the BS responded to by an encrypted version of the challenge using a secret key,
- Deauthentication: When an authenticated station wants to leave the network
- Privacy: Encryption and Decryption services
- Data Delivery: Tx and Rx of data