Wireless LANs

- Infrared, radio
  - Within room → Satellite communication
- IEEE 802.11
  - Limited geography
  - Primary challenge
   - Mediate access to a shared medium

Physical Properties

- Three different mechanisms
- Two based on spread spectrum
  - Up to 2 Mbps
- One – on diffused infrared
  - ½ Mbps

Transmission in Wireless Media

- Spread spectrum:
  - frequency hopping (randomly choose frequencies)
  - direct sequence

- Direct sequence:
  - represent each bit by multiple bits in the transmitted signal

n-Bit Chipping sequence based transmission

1   0   1   0

random sequence
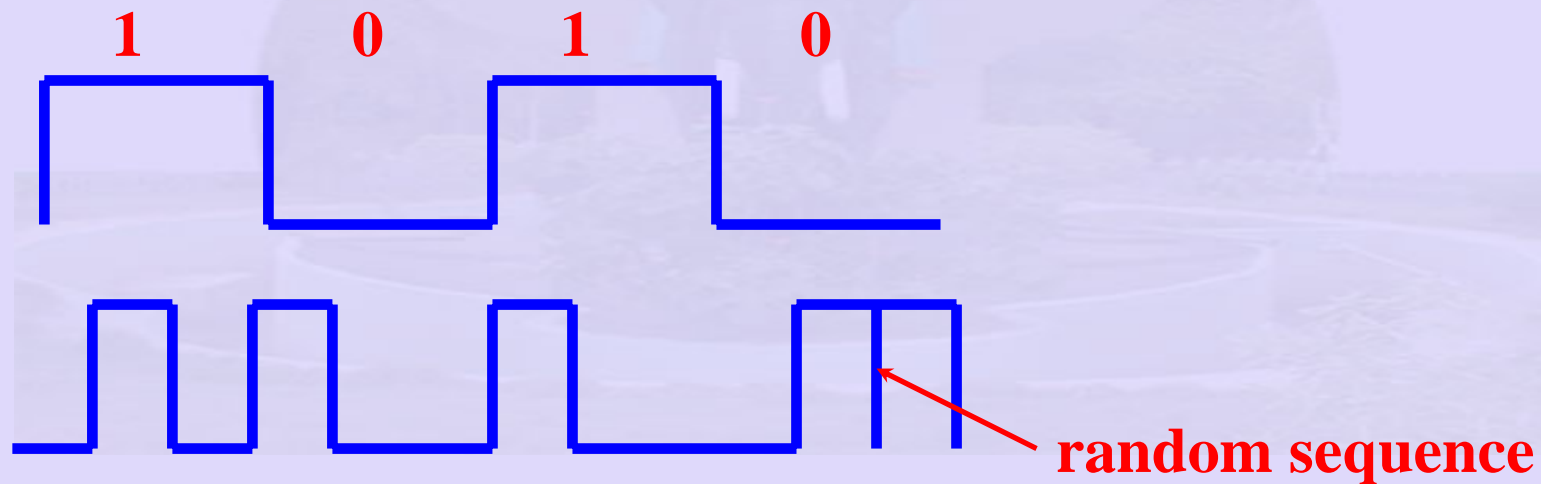
1 0 1 1 0 0 1 0 0 0 1 1

XOR of sequence

n-Bit Chipping Sequence

- n – bit chipping code spreads the signal across frequency band

- that is n time 3 bit chipping sequence.

- 802.11: 79 MHz wide frequency bandwidths
  - 2.4 GHz frequency range
  - 11 bit chipping sequence

- Collision Avoidance in 802.11
  - similar to Ethernet problem

Hidden Nodes

A   B   C   D
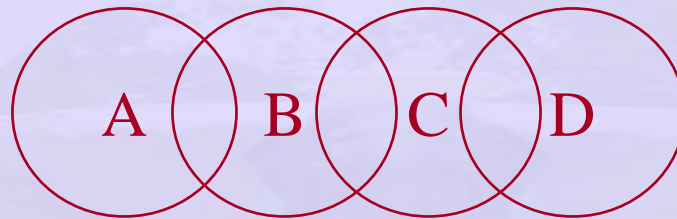
- Each node has a finite range
- A can reach B, C can also reach B
- A and C want to communicate with B
- A and B are unaware of each other
- Collision can happen at B
- A and C are hidden nodes

Exposed Nodes

- Transmission from B to A
  - C is aware of this
    - Since C in the range of B
  - But C can transmit to D

Multiple Access Collision Avoidance

- Sender and receiver exchange control frames:

- Request to Send (RTS) – Sender → Receiver

  – (includes the time for which it wants to hold the medium)

- Clear to Send (CTS) – Receiver → Sender

  – (echoes length field back)

- Any node sees CTS

  – close to Receiver therefore cannot access medium for time = length of frame

Multiple Access Collision Avoidance

- Node sees RTS but not CTS
  - It is not close to receiver
  - It can transmit to some other node
- Two or more nodes send RTS, donot hear CTS
  - Collision, therefore backoff
- Include Ack (MACAW)
  - Receiver to sender after frame successfully received
- Issues: Nodes mobile – require a distributed system
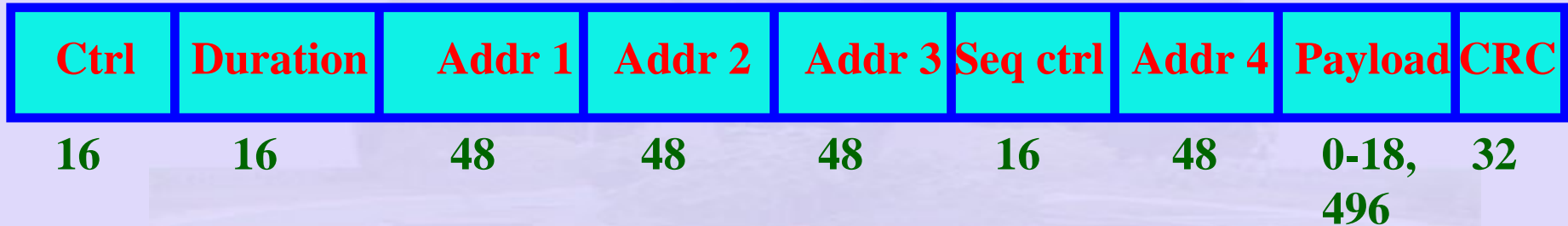
Distributed System

- Problem of mobility

  – Some nodes are mobile, some are connected to a wired infrastructure

    - Access points (AP)

    - Each AP connected to a distribution system

    - Each node selects its own AP
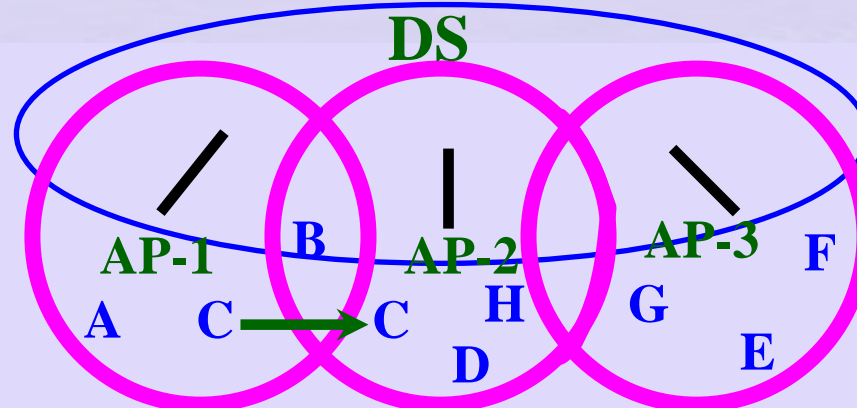
Scanning for AP

- Node sends a Probe frame
- All APs nodes within reach reply with a probe response frame
- Node selects one and sends that AP an associate request
- AP responds with association response
- Node uses this when it moves / changes
- New AP notifies old AP
- Nodes scan APs and APs also send Beacon frames

Frame Format

Ctrl	Duration	Addr 1	Addr 2	Addr 3	Seq ctrl	Addr 4	Payload	CRC
16	16	48	48	48	16	48	0-18, 496	32

- •Addr1 – destination AP
- •Addr 2 – destination address
- •Addr 3 – source AP
- •Addr 4 – source address

- •Ctrl
  - •Type - 6 bit (CTS, RTS, Scanning)
  - •ToDS - 1 bit
  - •From DS – 1bit