IEEE 802.11 Wireless LAN

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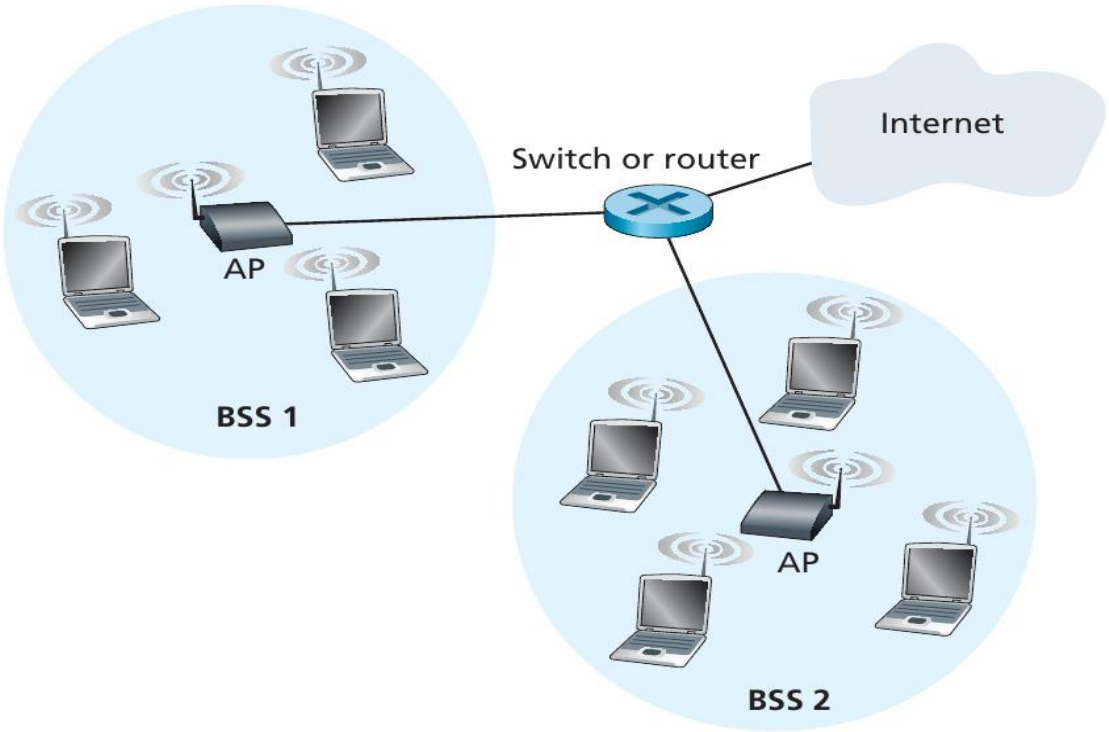
IEEE 802.11 Wireless LAN

- Also known as Wifi
- Several wireless standards: 802.11a, 802.11b, 802.11g, 802.11n, 802.11i

Standard	Frequency Range (United States)	Data Rate
802.11b	2.4–2.485 GHz	up to 11 Mbps
802.11a	5.1–5.8 GHz	up to 54 Mbps
802.11g	2.4–2.485 GHz	up to 54 Mbps

Architecture

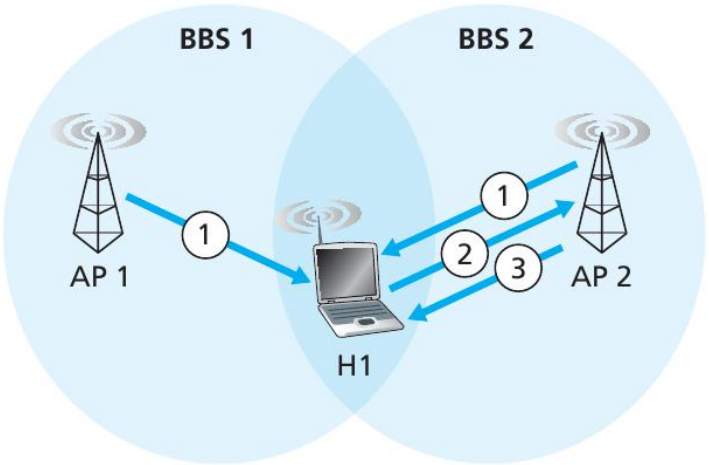
- Basic service set (BSS) also known as infrastructure LAN



Channels and Association

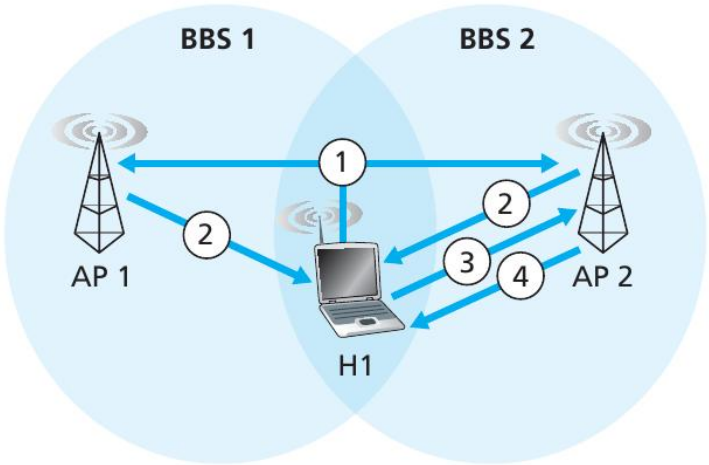
- Administrator assigns a Service Set Identifier (SSID) to the AP
- The 85MHz band (2.4GHz - 2.485GHz) is divided into 11 partially overlapped channels
- Any two non-overlapping channels are separated by at least four channels
- Administrator assigns a channel number to the AP
- How does a wireless station associate with an AP?
  - passive scanning
  - active scanning

Association



a. Passive scanning

1. Beacon frames sent from APs
2. Association Request frame sent: H1 to selected AP
3. Association Response frame sent: Selected AP to H1



a. Active scanning

1. Probe Request frame broadcast from H1
2. Probes Response frame sent from APs
3. Association Request frame sent: H1 to selected AP
4. Association Response frame sent: Selected AP to H1

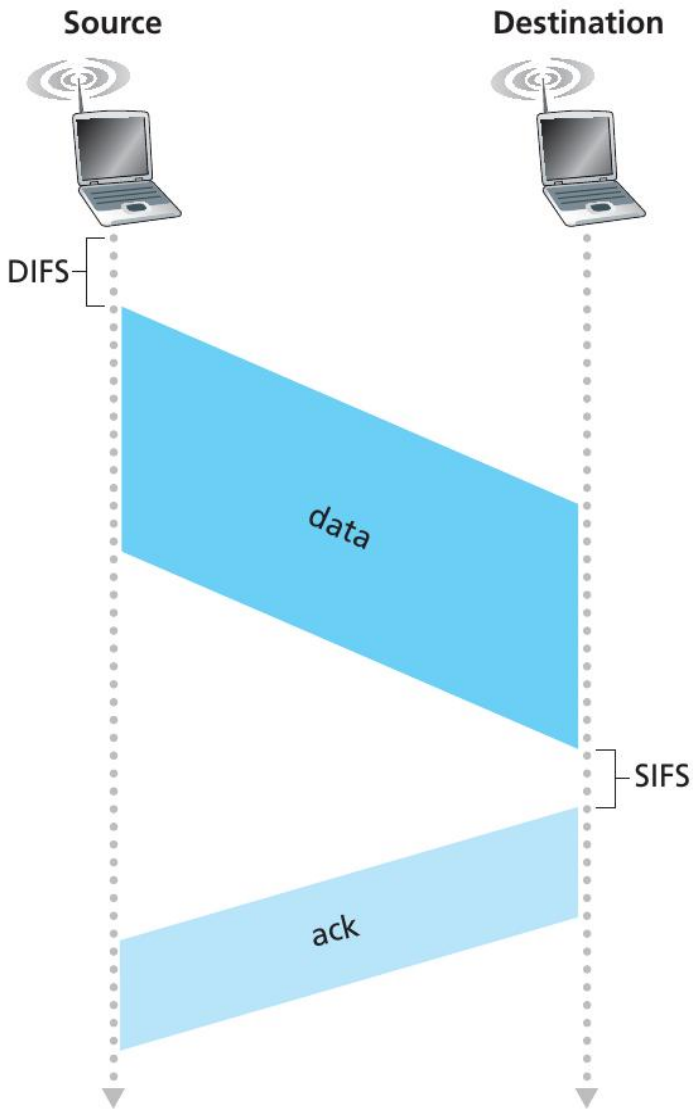
IEEE 802.11 MAC Protocol

- 802.11 uses CSMA with collision avoidance (CSMA/CA) rather than collision detection
- Why not CSMA/CD?
  - To detect collisions, APs should be able to receive while transmitting. costly!
  - All collisions are not detectable!
- If a wireless station starts transmitting a frame, it completes the transmission even if there is a collision
- Wireless stations will about a collision via acknowledgments

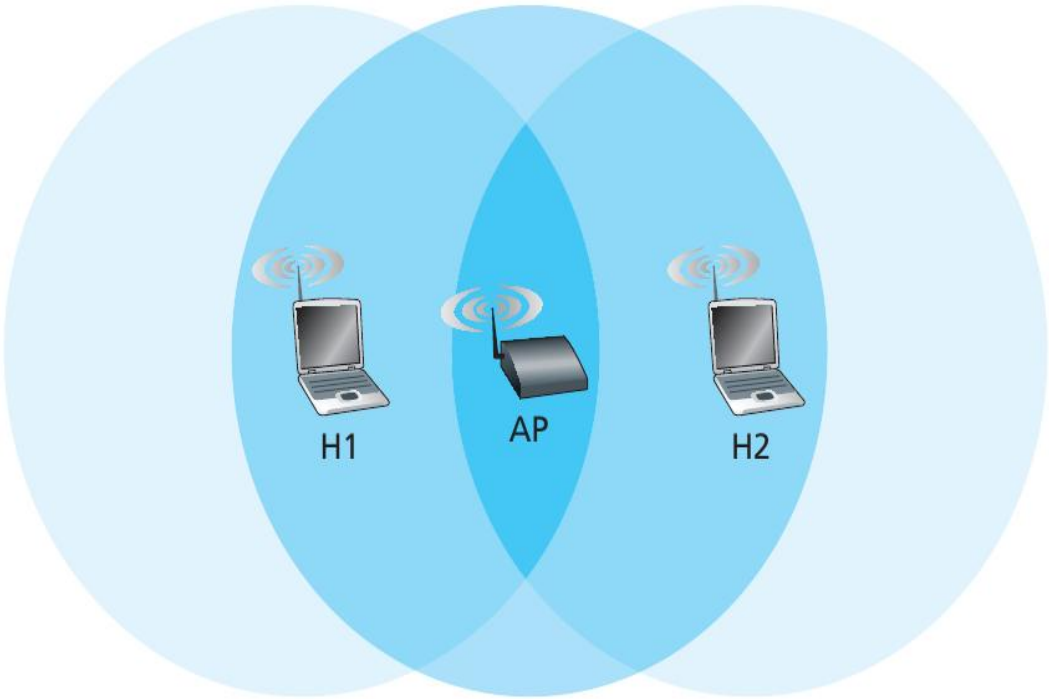
CSMA/CA Protocol

- If the channel is sensed idle for a short period of time Distributed Inter-frame Space (DIFS), then the station transmits a frame.
- If the channel is sensed busy, the wireless station chooses a random backoff using binary exponential backoff
  - counts down this value when the channel is sensed idle
  - the counter value remains frozen when the channel is sensed busy
- When the counter reaches zero, the station transmits entire frame and waits for an acknowledgment
- Receiver sends an acknowledgment after Short Inter-frame Spacing (SIFS) if the frame passes CRC
- If acknowledgment is received, the transmitter mark the frame as transmitted and transmit subsequent frames if any
- If the acknowledgment is not received, the transmitting station reenters backoff phase with larger interval

CSMA/CA



Hidden Node

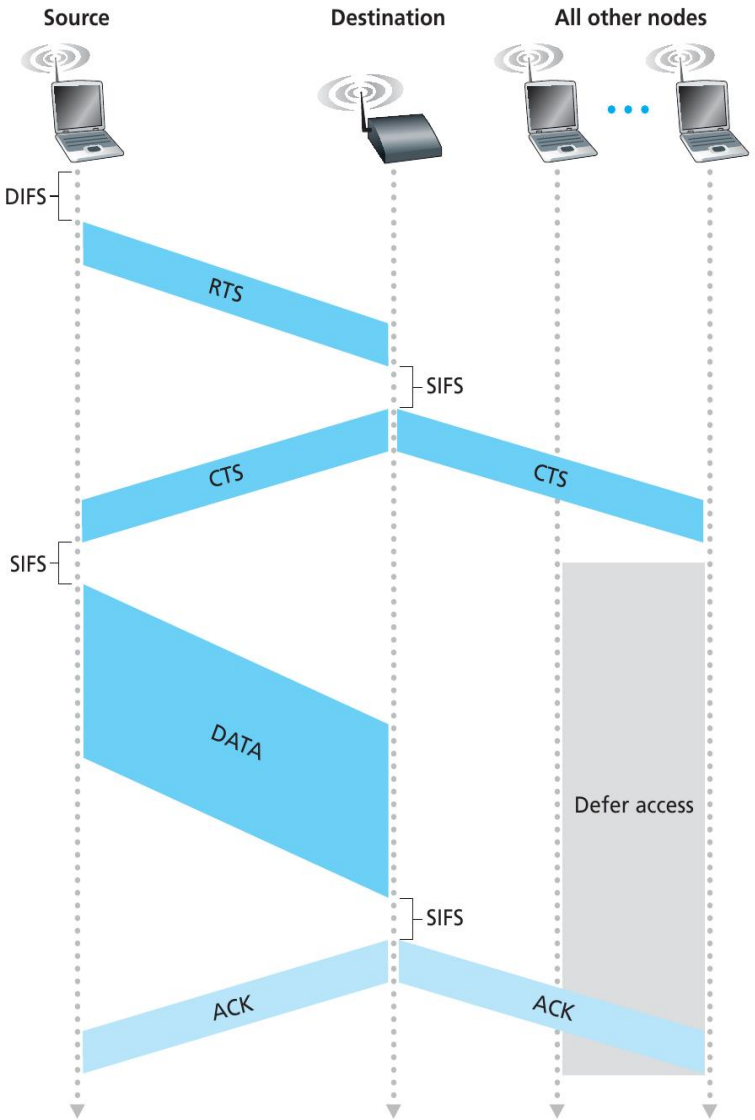


- H1 hidden from H2

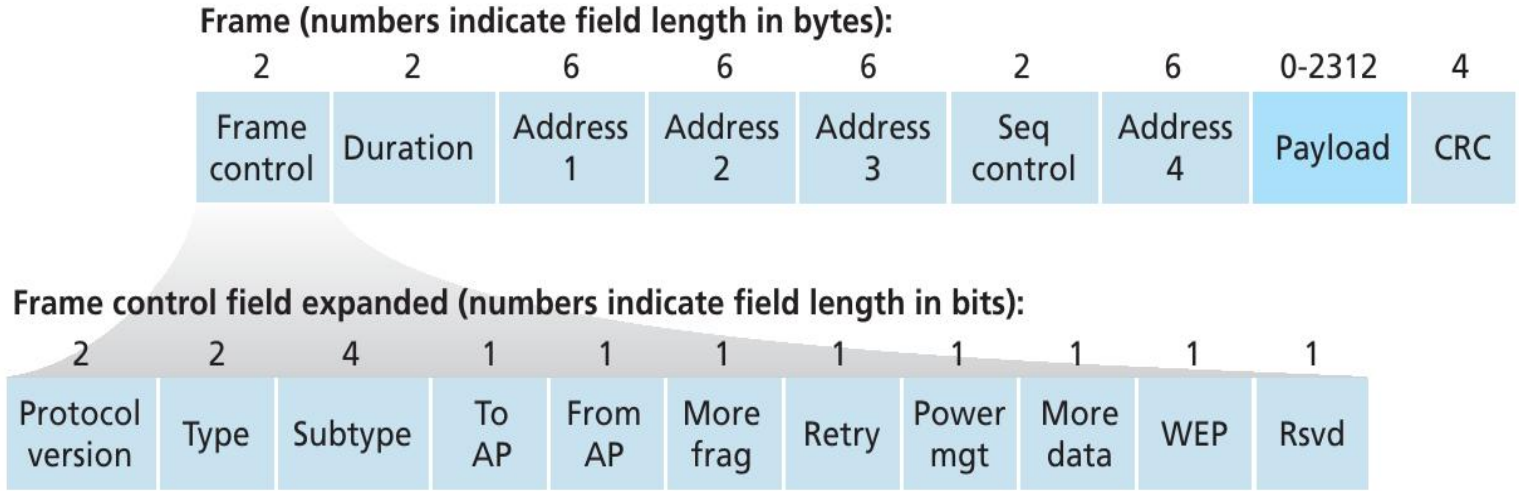
RTS and CTS

- When a sender wants to send a frame, it can first send a Request to Send (RTS) control frame.
- In RTS frame, sender indicates the total time required for to transmit frame and receive acknowledgment frame
- When AP receives RTS frame, it responds by broadcasting a Clear to Send (CTS) frame.
- CTS frame gives permission for the sender and also alerts other nodes not to send during the reserved time.

Collision Avoidance with RTS and CTS



IEEE 802.11 Frame



- Address 1 : Receiver's MAC address
- Address 2 : Transmitter's MAC address
- Address 3 : MAC address of router

Use of Three Address Fields