IEEE 802.11
A technical Overview

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Introduction

- Overview of the Emerging 802.11 Standard
- Technical details
- Special areas of interest?

Why do we need a Standard?

- Multi-Vendors Compatibility
- Protects customers investment
- High Volumes reduce prices

Why Not Just use Wireless Ethernet?

- First Ethernet predecessor was Radio-Based (ALOHA)
- Ethernet is simple, cheap, widely accepted…
- But...

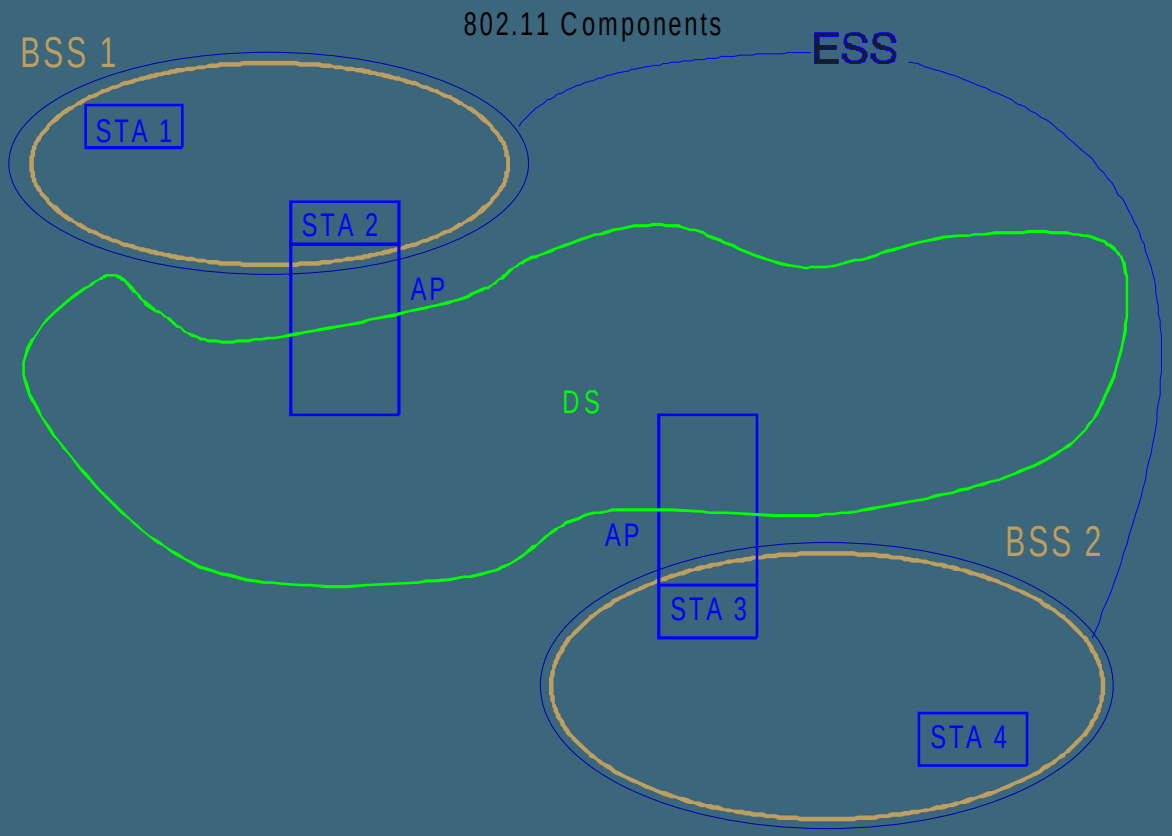
Ethernet could not do it.

- Collision Detection
  - Would require a Full-Duplex Radio
  - Wouldn’t help on recognizing collisions on the receiver end
- Carrier Sense
  - The fact that a station doesn’t sense traffic does not mean that the receiver side can receive (Hidden Stations)

Ethernet could not...

- The “Mall Problem”
  - How can you partition two collocated networks?
- Mobility and Roaming
- Security Issues
- Power Saving Requirements

Wireless LAN System



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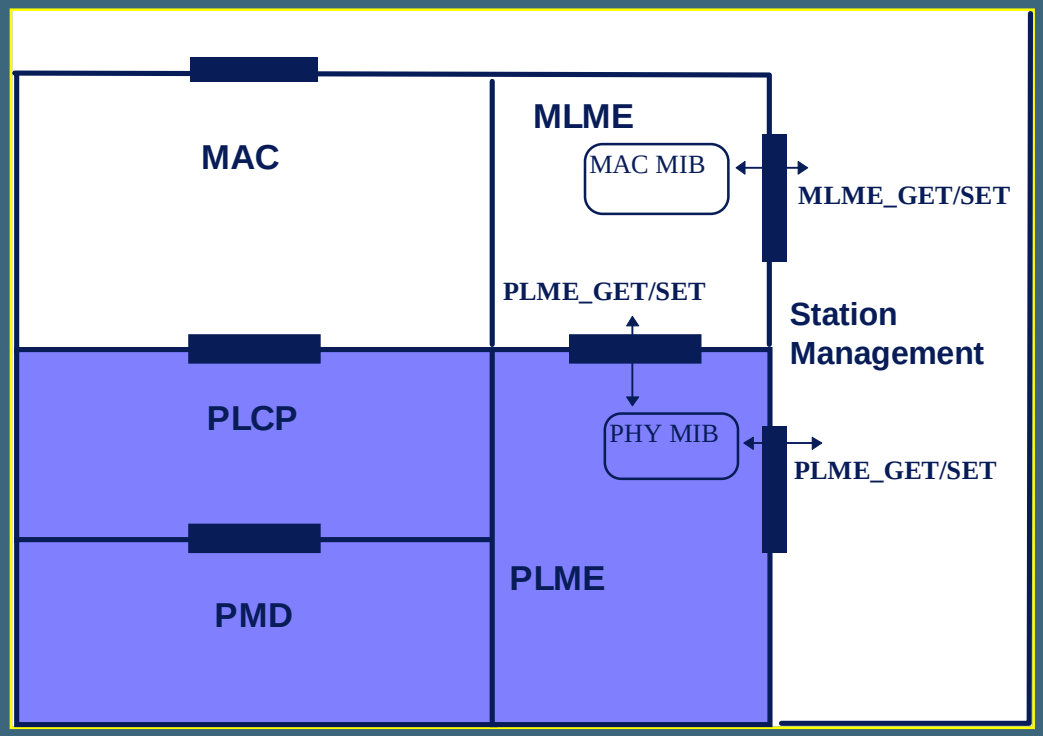
802.11 Architecture



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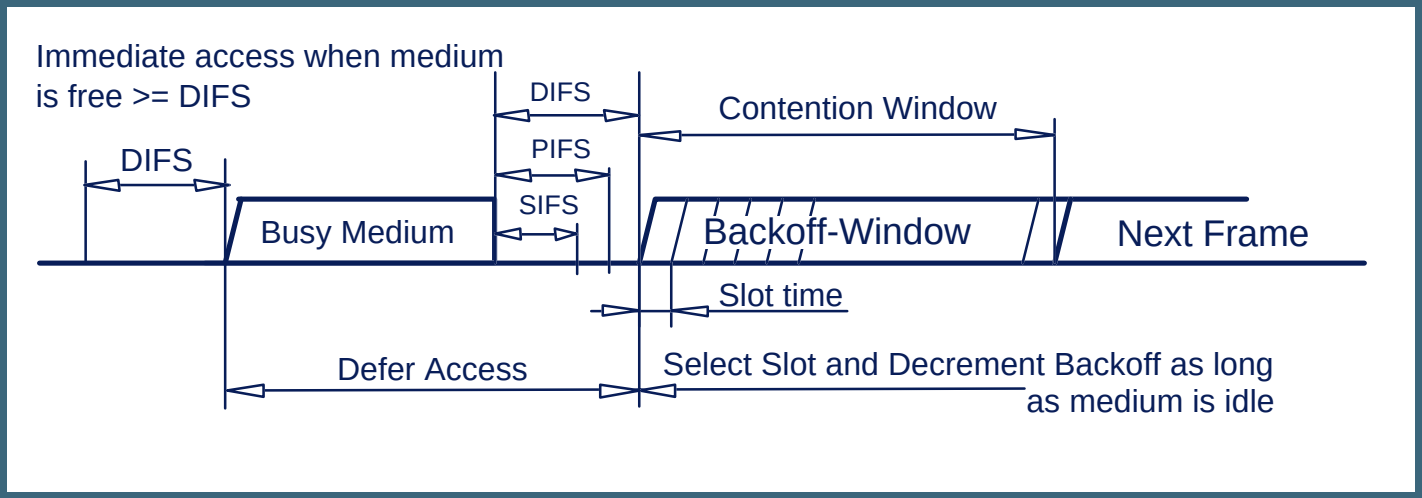
Basic Access Mechanism CSMA/CA

- Stations listen before transmission
- If medium free for more than DIFS: transmit
- If not, use backoff mechanism.



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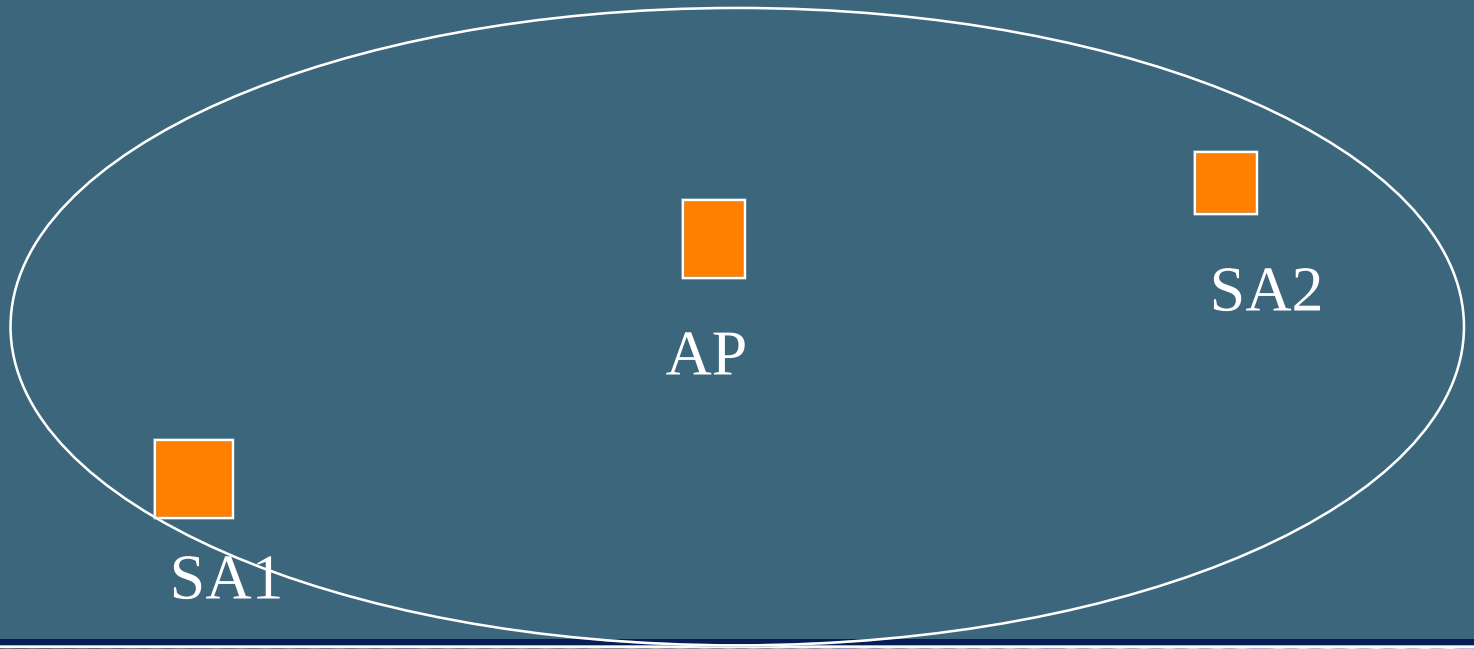
Other Collision Avoidance Mechanism: NAV

- Needed to handle Hidden Stations Problem



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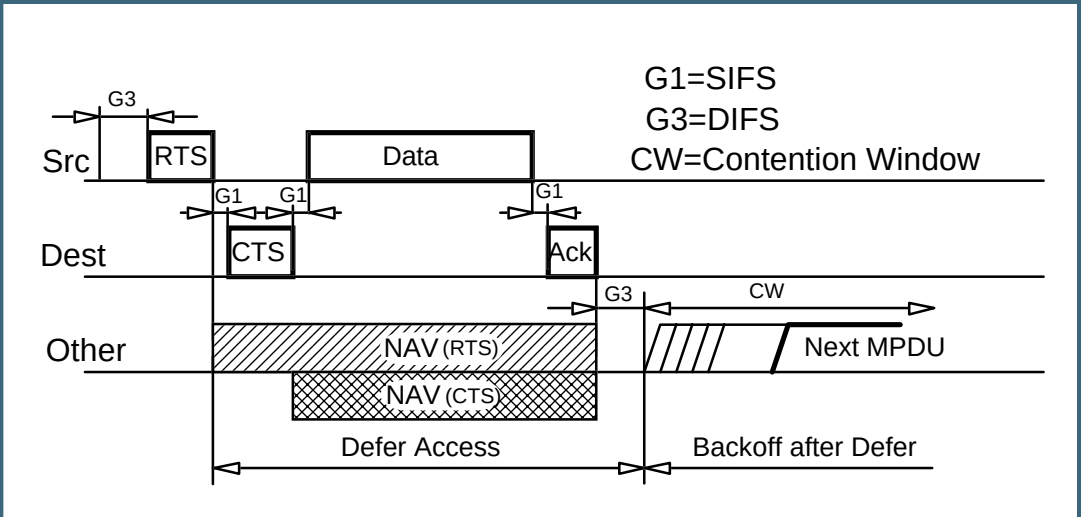
NAV Operation (RTS/CTS)

- Stations exchange Duration information using short frames (RTS/CTS), other stations, recognize the medium as busy for the said duration



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Collision "detection" mechanism

- Real Collision detection would require a full-duplex radio (high cost)
- Unable to recognize collisions at the receiving end
- Uses Positive Acknowledge (ACK)

Fragmentation

- Long fragments: higher probability of error
- Microwave ovens interference
  - (4ms noise, 4 ms clear)
- Collision recovery is less expensive if we use fragmentation

Frame format

FC	Duration ID	Addr 1	Addr2	Addr 3	Seq Nr	Addr 4	Data	CRC
2	2	6	6	6	2	6		4

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Frame Control Field

- Protocol Version (2 bits) = 0
- Type (6 bits)
- ToDS
- FromDS
- More Frag
- Retry
- Power Mgt
- More Data
- WEP

Beacon Frames

- Send Periodically by the AP
- Provide information for new stations
- Keeps Synchronization

Init Procedure

- Scanning
  - Passive
  - Active
- Authentication
- Association

Roaming Procedure

- Not defined in the standard, left as implementors decision

BreezeCom Patented Algorithm

- Designed for Rotterdam Port requirements.
- The AP sends periodic “Neighbor Beacons” when appearing as a regular station
- Stations receive Synch information, so learn how and when to join the new AP
- Stations compare Signals Strength, and make the decision

BreezeCom Algorithm (ctd...)

- Station knows which AP is it roaming to so lets both APs (new and old) know about that.
- New AP starts accepting frames addressed to the roaming station, buffers stations as regular “Power Saving” mode
- Old AP inserts “Jump Message” for synch the actual roaming.

BreezeCom Algorithm (ctd...)

- Stations waits for “Jump” message, and roams when received.
- Station Associates with new AP, and then receives buffered packets.

How do APs know about Neighbors?

- Automatically, first station that roams “the hard way” lets AP Know about the neighboring relationship

Load Balancing

- Currently no provisions on 802.11
- Need a “Load” parameter in beacon frames
- Needs special BreezeCom SNAP formatted beacon (same format as Neighbor Beacon)
- BreezeCom will disclose both algorithms to PCMCIA “partners”
- Use of Exponential Random Backoff procedure to prevent stations from bouncing

Load Balancing (ctd...)

- AP may use the “Jump” frame to cause a specific station to join a different AP.

Power Saving Mechanisms

- Power Saving Stations Notify the AP
- AP buffers frames for Power Saving Stations, and broadcast/multicast frames
- AP sends TIM (Traffic Information Map) on Beacon Frames
- Some Beacons contain DTIM (Delivery TIM)

Power Saving Mech (ctd...)

- Power Saving Stations may poll the AP for the buffered frames using PS-POLL frames
- The AP will send mcast/bcast frames immediately after the DTIM
- The AP will send unicast buffered frames immediately after the mcast/bcast frames after the DTIM.

802.11 Status

- Draft 5.0 in Sponsor Ballot
- Approval expected Q1 97.

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802.11 Status (ctd...)

- First interoperability tests performed with 4 PCMCIA vendors
- Results very promising, beyond expectations

BreezeCom @ 802.11

- 4 Voting members
- 2 Highly Contributing members
  - Naftali Chayat (BreezeCom Chief Scientist)
    - Author of the 2 MBit/s FH original proposal
    - Presented 3 MBit/s proposal
    - Chairman of the “FH Higher Rates interest group”
  - Pablo Brenner (BreezeCom Director of Engineering)
    - Author of several proposals (MultiRate Support)