

CS603 Mobile Computing

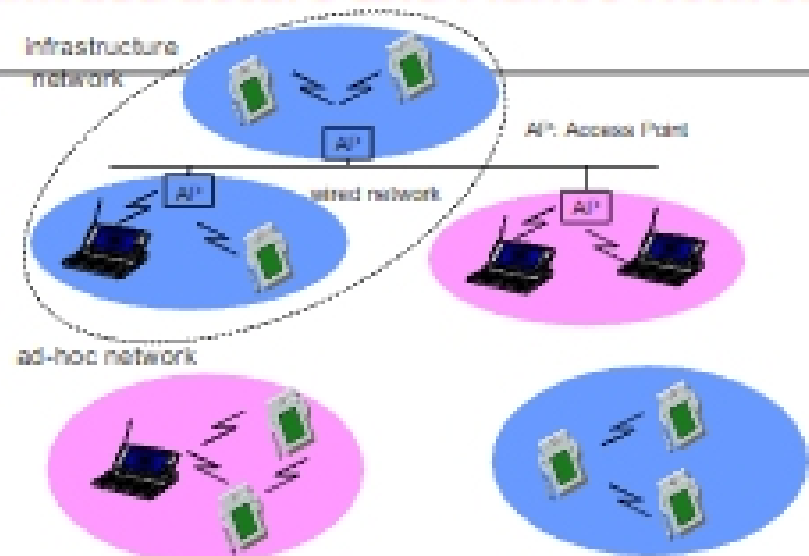
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Wireless LANs: IEEE 802.11

Wireless LANs: Characteristics

- **Advantages**
 - Flexible deployment; Minimal wiring problems
 - More robust against disasters
 - Historic buildings, conferences, ...
- **Disadvantages**
 - Low bandwidth compared to wired networks
 - Need to follow wireless spectrum regulations

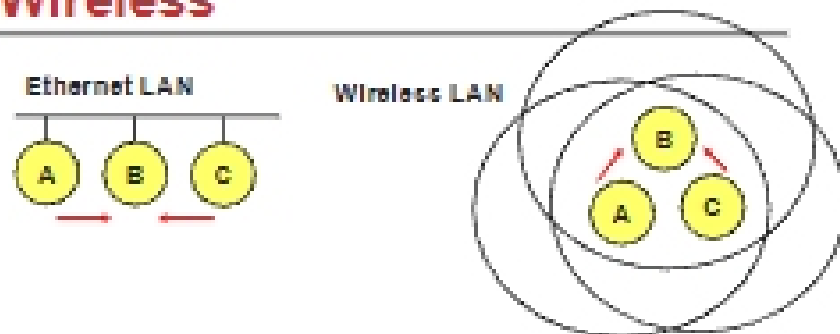
Infrastructure and Adhoc Networks



Wireless LANs are different...

- Destination address does not equal destination location
- The media impacts the design
 - wireless LANs intended to cover reasonable geographic distances and must be built from basic coverage blocks
- Impact of handling mobile (portable) stations
 - Propagation effects
 - Mobility management
 - power management

Difference Between Wired and Wireless



- If both A and C sense the channel to be idle at the same time, they send at the same time.
- Collision can be detected **at sender** in Ethernet.

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Wireless MAC: Motivation

- Can we apply media access methods from fixed networks?
- Example CSMA/CD
 - **Carrier Sense Multiple Access with Collision Detection**
 - send as soon as the medium is free, listen into the medium if a collision occurs (original method in IEEE 802.3)

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Wireless MAC

- signal strength decreases proportional to the square of the distance
- sender would apply CS and CD, but the collisions happen at the receiver
- sender may not “hear” the collision, i.e., CD does not work
- CS might not work, e.g. if a terminal is “hidden”

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Wireless PHY

- Medium has neither absolute nor readily observable boundaries outside which stations are unable to receive frames
- Are unprotected from outside signals and are significantly less reliable than wired PHYs
- Have time varying and asymmetric propagation properties
- Lack full connectivity
 - » the assumption that every station (STA) can hear every other STA is invalid

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Hidden Terminal Problem

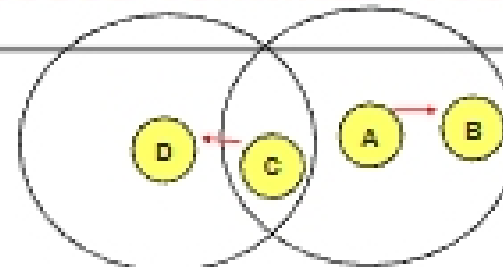


- A and C cannot hear each other.
- A sends to B, C cannot receive A.
- C wants to send to B, C senses a "free" medium (**CS fails**)
- Collision occurs at B.
- A cannot receive the collision (**CD fails**).
- A is "hidden" for C.

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Exposed Terminal Problem



- A starts sending to B.
- C senses carrier, finds medium in use and has to wait for A->B to end.
- D is outside the range of A, therefore waiting is not necessary.

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Solution for Hidden Terminals

- A first sends a *Request-to-Send (RTS)* to B
- On receiving *RTS*, B responds *Clear-to-Send (CTS)*
- Hidden node C overhears *CTS* and keeps quiet
 - Transfer duration is included in both *RTS* and *CTS*
- Exposed node overhears a *RTS* but not the *CTS*
 - D's transmission cannot interfere at B



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IEEE 802.11

- Wireless LAN standard defined in the unlicensed spectrum (2.4 GHz and 5 GHz U-NII bands)

Region	Allocated Spectrum
US	2.400 - 2.483 GHz
Europe	2.400 - 2.483 GHz
Japan	2.471 - 2.487 GHz
France	2.465 - 2.483 GHz
Spain	2.415 - 2.475 GHz

Table 1 Global Spectrum Allocation at 2.4 GHz

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