Wireless
- A talks to B
- C senses the channel
  - C does not hear A’s transmission
- C talks to B
- Signals from A and B collide
- Carrier Sense will be *ineffective* – need to sense at *receiver*
Exposed Terminals

- B talks to A
- C wants to talk to D
- C senses the channel and finds it busy
- C remains quiet (when it could have transmitted)
- Carrier sense would prevent a successful transmission
  - But we do carrier sense anyway (why?)
Key Points

• No concept of a global collision
  – Different receivers hear different signals
  – Different senders reach different receivers

• Collisions are at receiver, not sender
  – Only care if receiver can hear the sender clearly
  – It does not matter if sender can hear someone else
  – As long as that signal does not interfere with receiver

• Goal of protocol:
  – Detect if receiver can hear sender
  – Tell senders who might interfere with receiver to shut up
MA with Collision Avoidance (MACA)

• Before every data transmission
  – Sender sends a Request to Send (RTS) frame containing the length of the transmission
  – Receiver responds with a Clear to Send (CTS) frame
  – Sender transmits
  – Receiver sends an ACK; now another sender can send data
• When sender doesn’t get a CTS back, it assumes collision
• When you hear a CTS, you keep quiet until scheduled transmission is over (hear ACK)
MACA, con’t

• If other nodes hear RTS, but not CTS: *send*
  – Presumably, destination for first sender is out of node’s range
  – Can cause problems when a CTS is *lost*
Hidden Terminals

- A sends RTS
- B sends CTS
- C also hears CTS
  - C doesn’t transmit

• **Collision avoided!**
Exposed Terminals

- B sends RTS to A
- C gets this RTS as well
- C cannot hear A’s CTS
- **C can also transmit!!**
Problem 2
Cheating

Can C improve its performance by “cheating” and ignoring the CTS messages exchanged between A and B?
Can D improve it’s performance by “cheating” and ignoring the CTS messages exchanged between A and B?
Problem 3: (a)

Gagged Station:

A → B: RTS (1), CTS (2)
B → C: CTS (2) for A
C → D: RTS (3)

Transmission Not done
Problem 3: (b)

Masked Station:

C doesn’t get to know that A and B are communicating

A can’t hear this

C is now masked
Problem 3: (c)

Fairness?
Starvation?
Problem 4: Frame Sizing

• Too small frames
• Comparable to size of RTS / CTS messages
• Large overhead!