

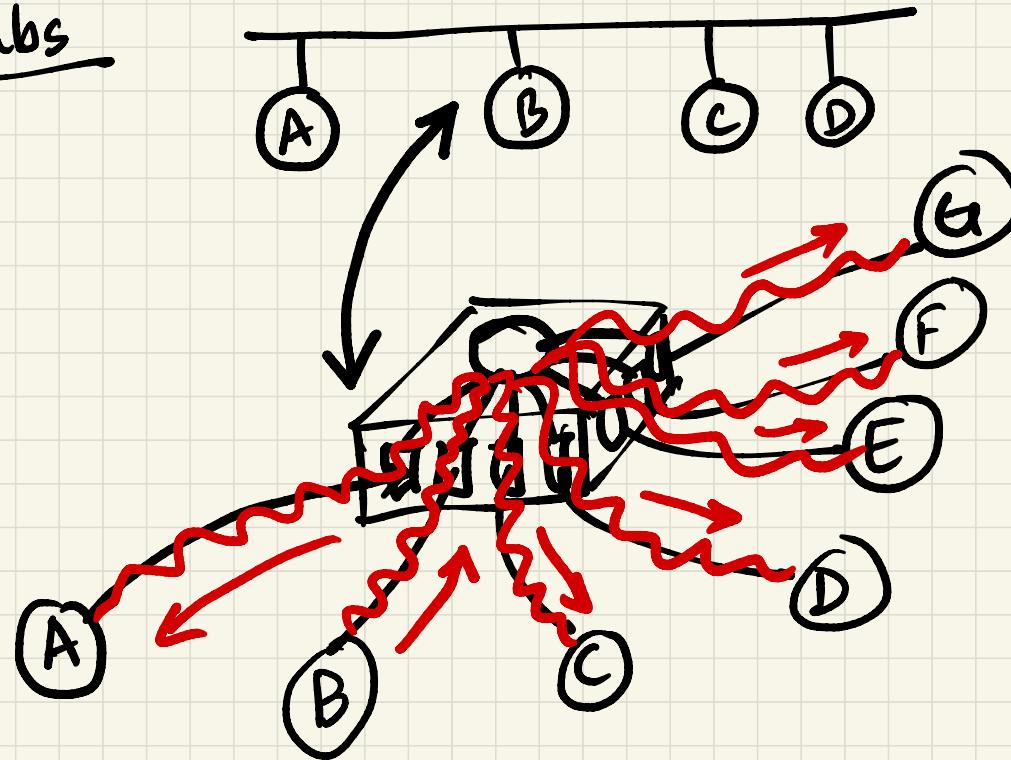
Lecture 25

- o Hubs
- o Switches
- o Wireless (CSMA/CA)
- o Wifi

Link Layer

- 5.1 Introduction and services
- 5.2 Error detection and correction
- 5.3 Multiple access protocols
- 5.4 Link-Layer Addressing
- 5.5 Ethernet
- 5.6 Interconnections: Hubs and switches

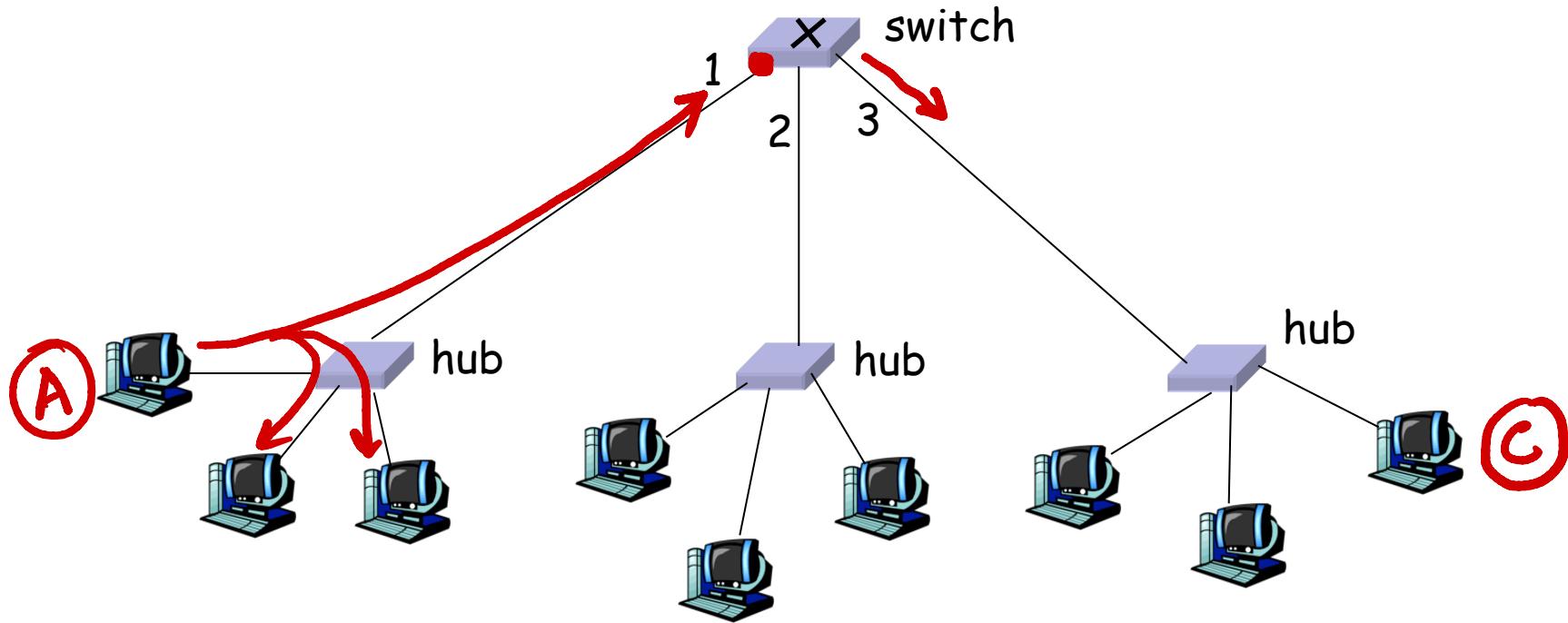
Hubs



Switch

- Link layer device
 - stores and forwards Ethernet frames
 - examines frame header and **selectively** forwards frame based on MAC dest address
 - when frame is to be forwarded on segment, uses CSMA/CD to access segment
- transparent
 - hosts are unaware of presence of switches
- plug-and-play, self-learning
 - switches do not need to be configured

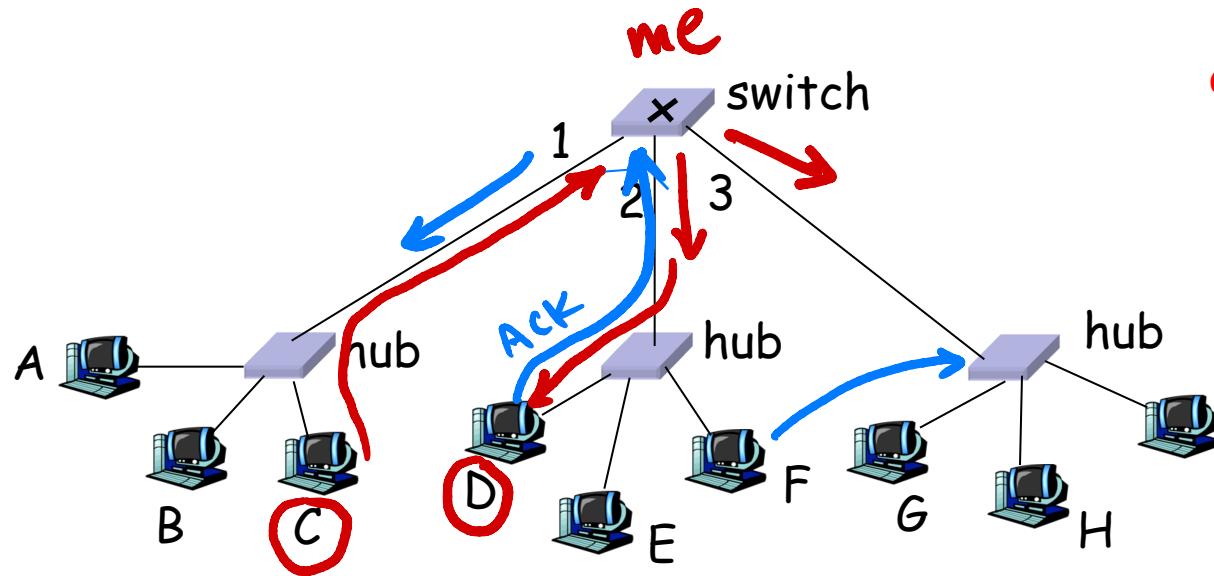
Forwarding



- How do determine onto which LAN segment to forward frame?
- Looks like a routing problem...

Switch example

Suppose C sends frame to D



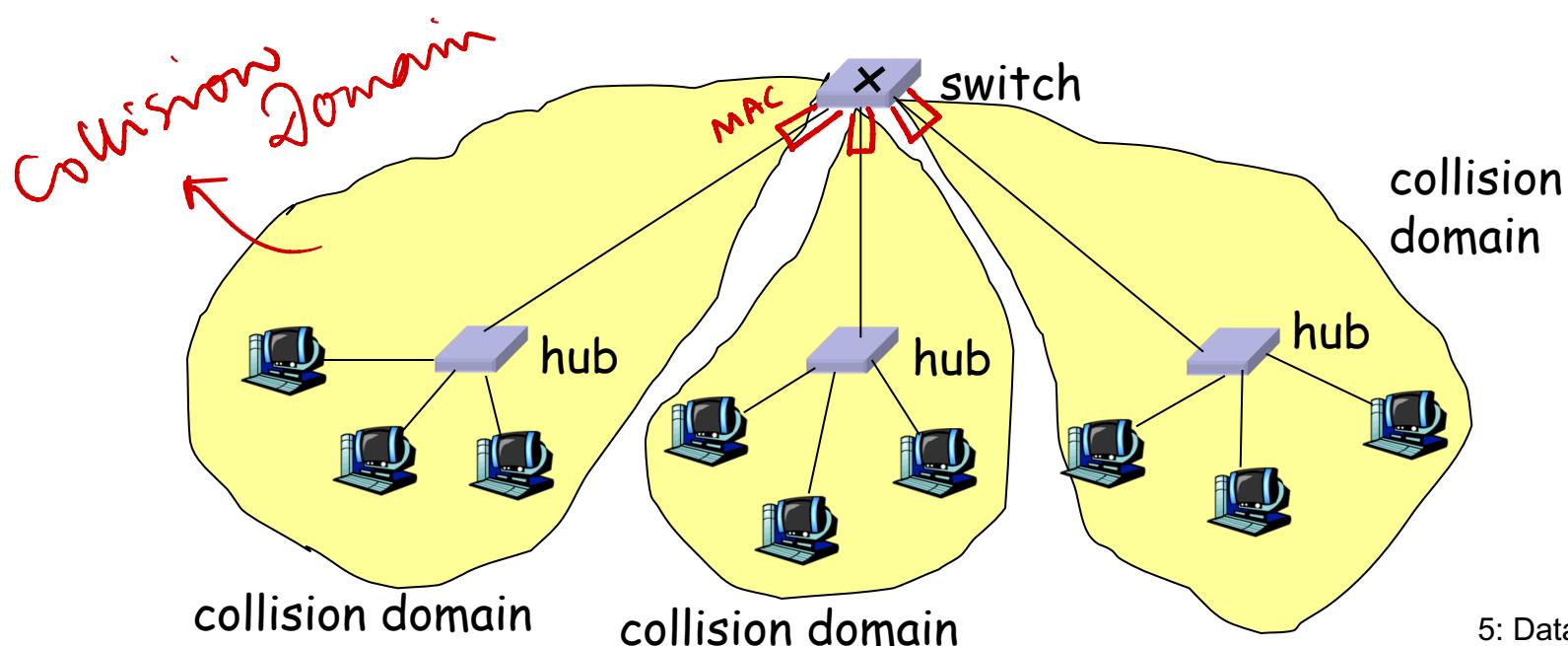
switching table

address	interface
A	1
B	1
E	2
G	3
C	I
D	2

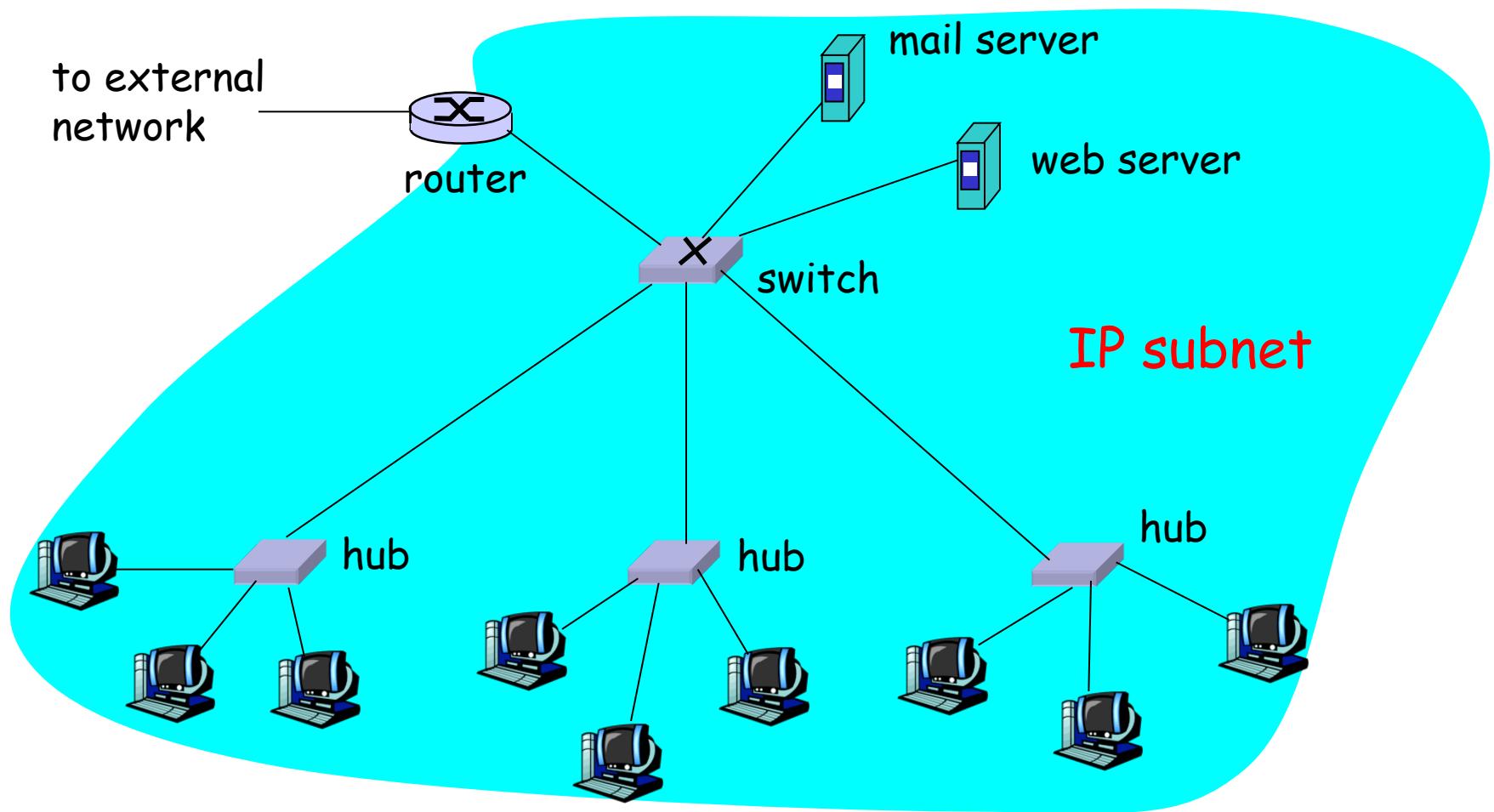
- Switch receives frame from C
 - notes in bridge table that C is on interface 1
 - because D is not in table, switch forwards frame into interfaces 2 and 3
- frame received by D

Switch: traffic isolation

- switch installation breaks subnet into LAN segments
- switch **filters** packets:
 - same-LAN-segment frames not usually forwarded onto other LAN segments
 - segments become separate **collision domains**



Institutional network

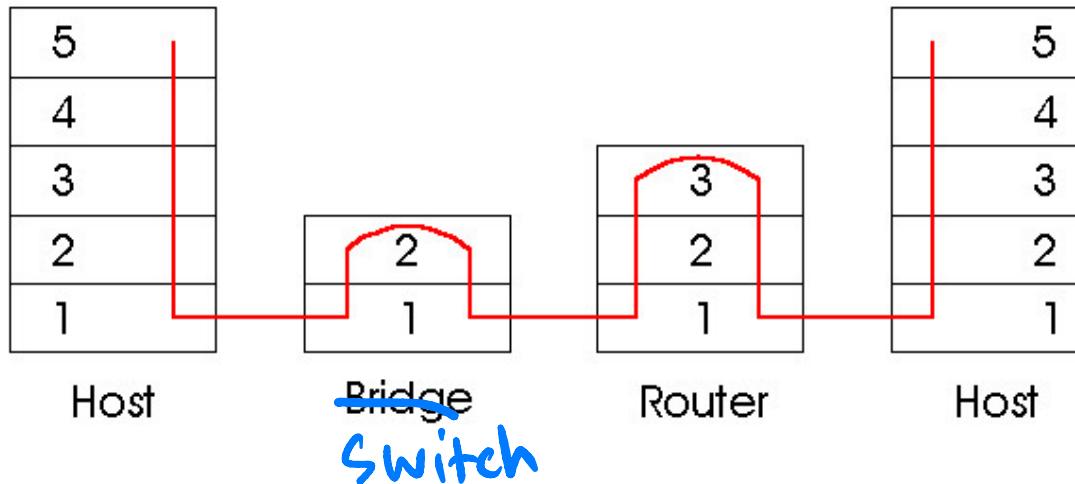


So ...

What's the difference between
switches and routers?

Switches vs. Routers

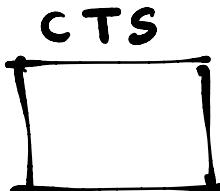
- both store-and-forward devices
 - routers: network layer devices (examine network layer headers)
 - switches are link layer devices
- routers maintain routing tables, implement routing algorithms
- switches maintain switch tables, implement filtering, learning algorithms



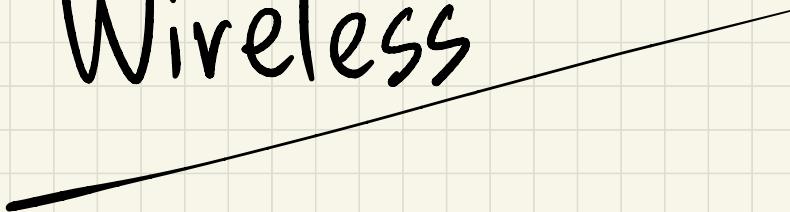
Summary comparison

	<u>hubs</u>	<u>routers</u>	<u>switches</u>
<i>traffic isolation</i>	no	yes	yes
<i>plug & play</i>	yes	no	yes
<i>optimal routing</i>	no	yes	no
<i>cut through</i>	yes	no	yes

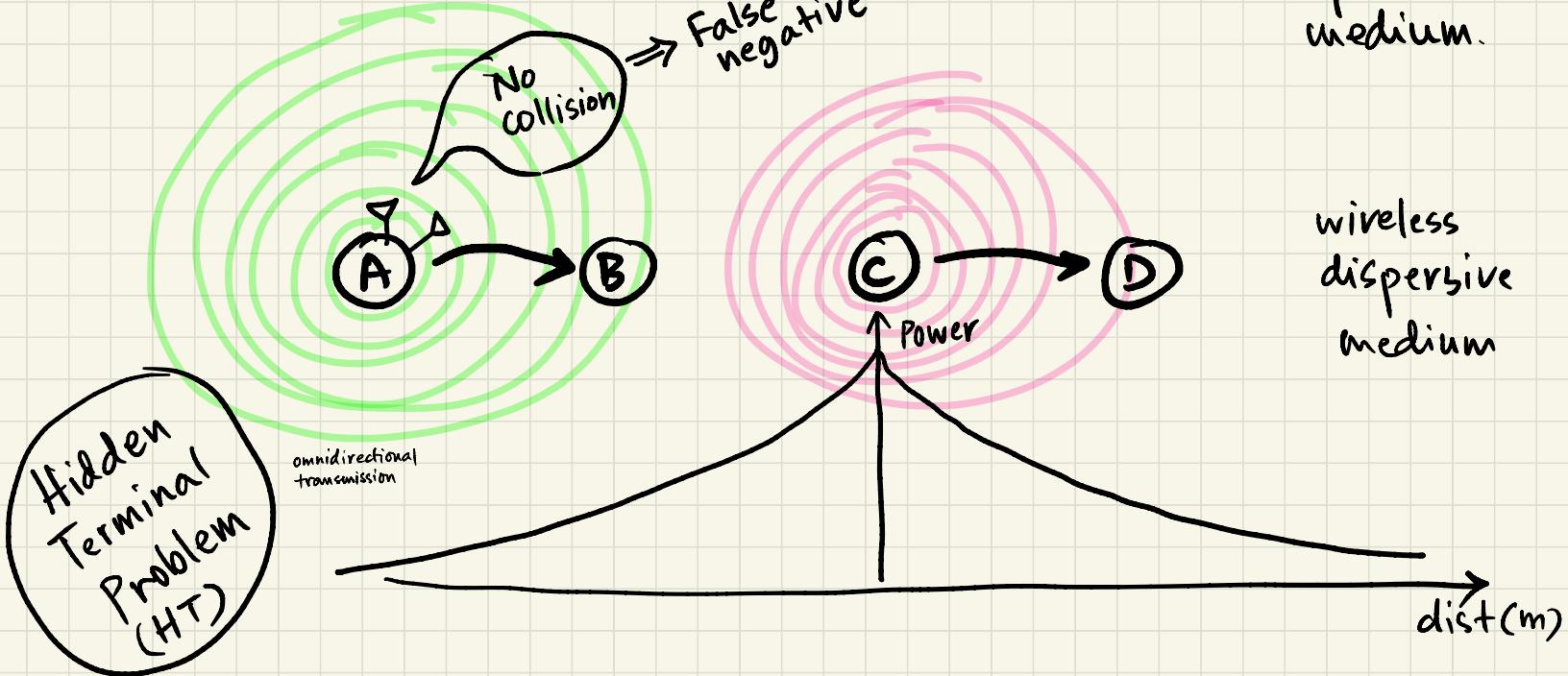
001001101



Wireless



$\text{CSMA/CD} \rightarrow \text{CSMA/CA}$.



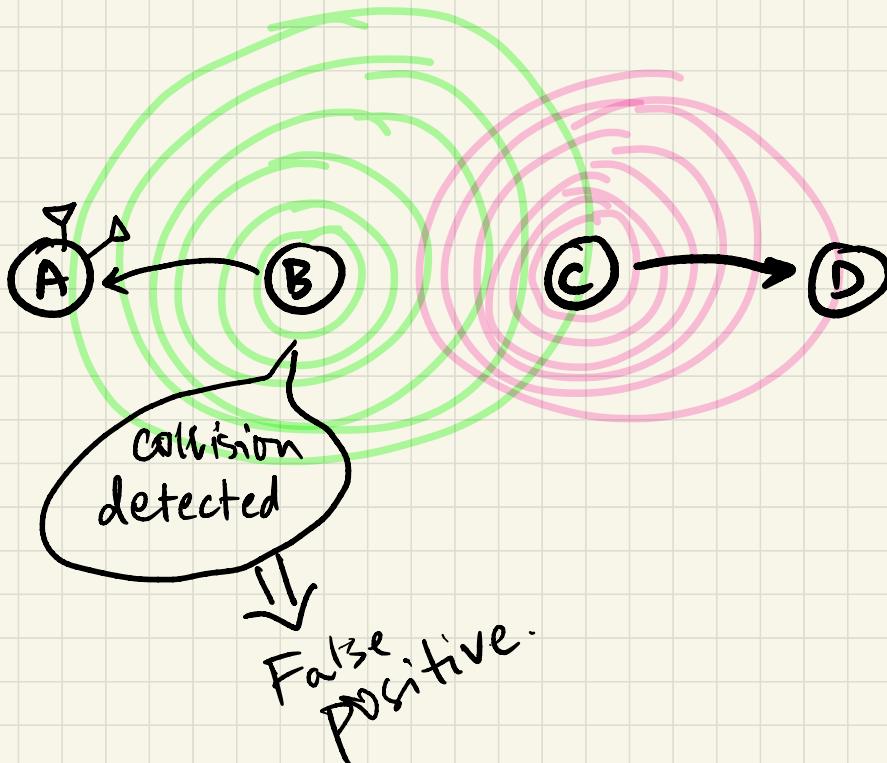
HT causes collision at B because SINR is lower than needed

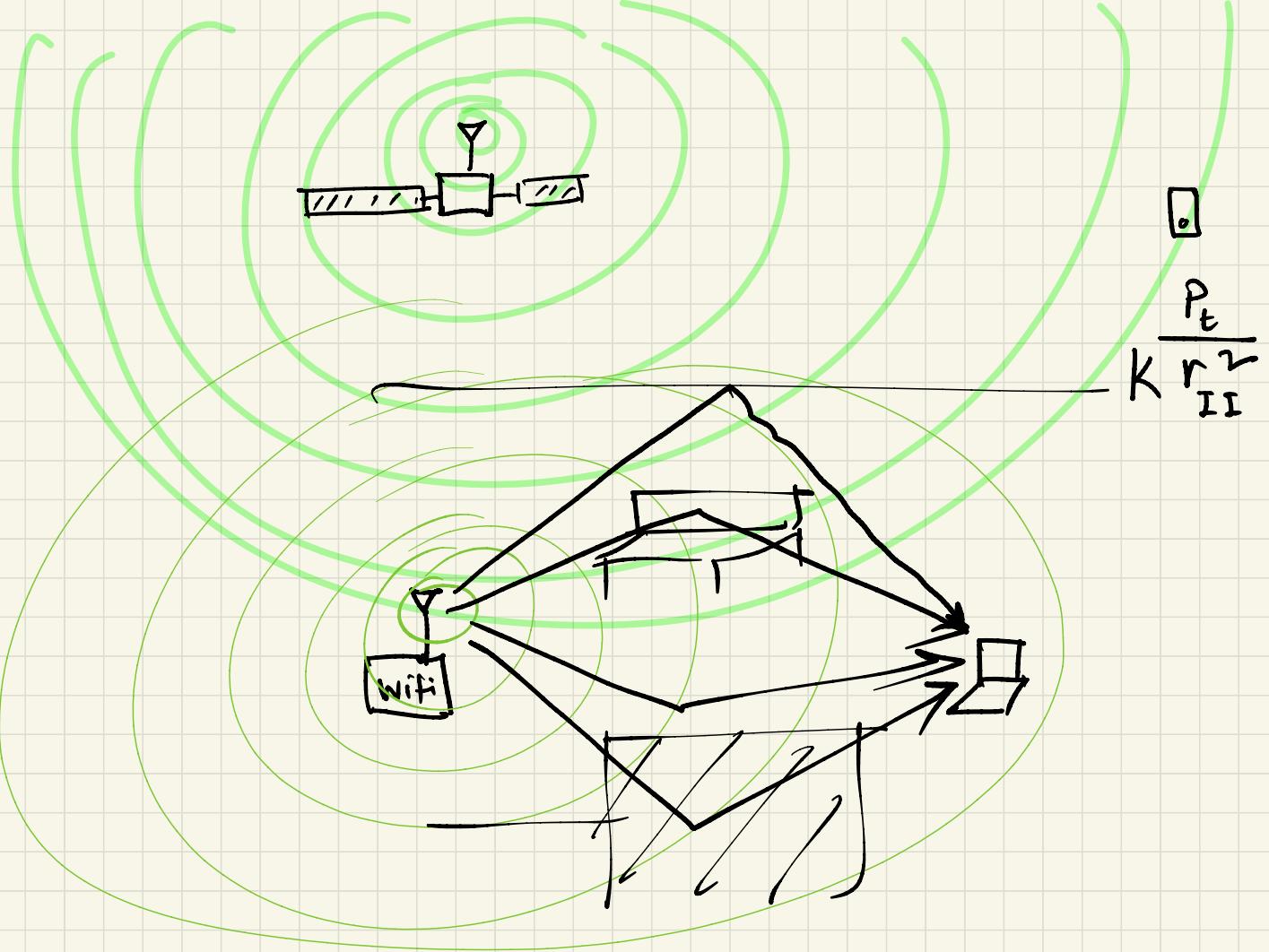
$$\text{SINR}_A^B = \frac{\text{Green power received at } B \text{ from } A (S)}{\text{Pink power received at } B \text{ from } C (I) + B's \text{ own hardware noise} (N)}$$

$$= \frac{P_t / r_{AB}^\alpha}{P_t / r_{CB}^\alpha + N} \geq T \quad \alpha > 2 \quad \alpha \approx 3.1$$

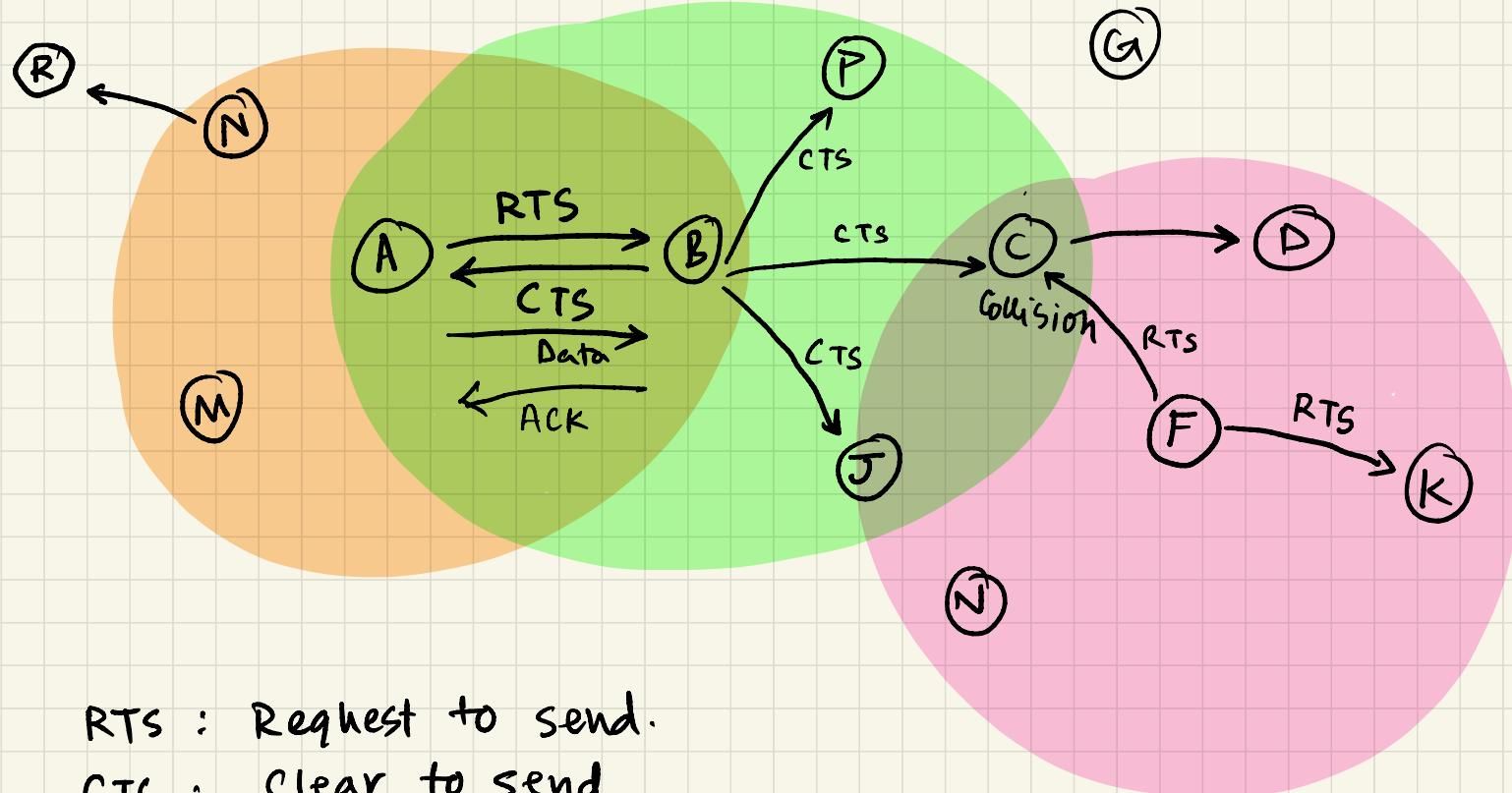
B should do CSMA/CD → what happens?

Exposed terminal problem (ET)



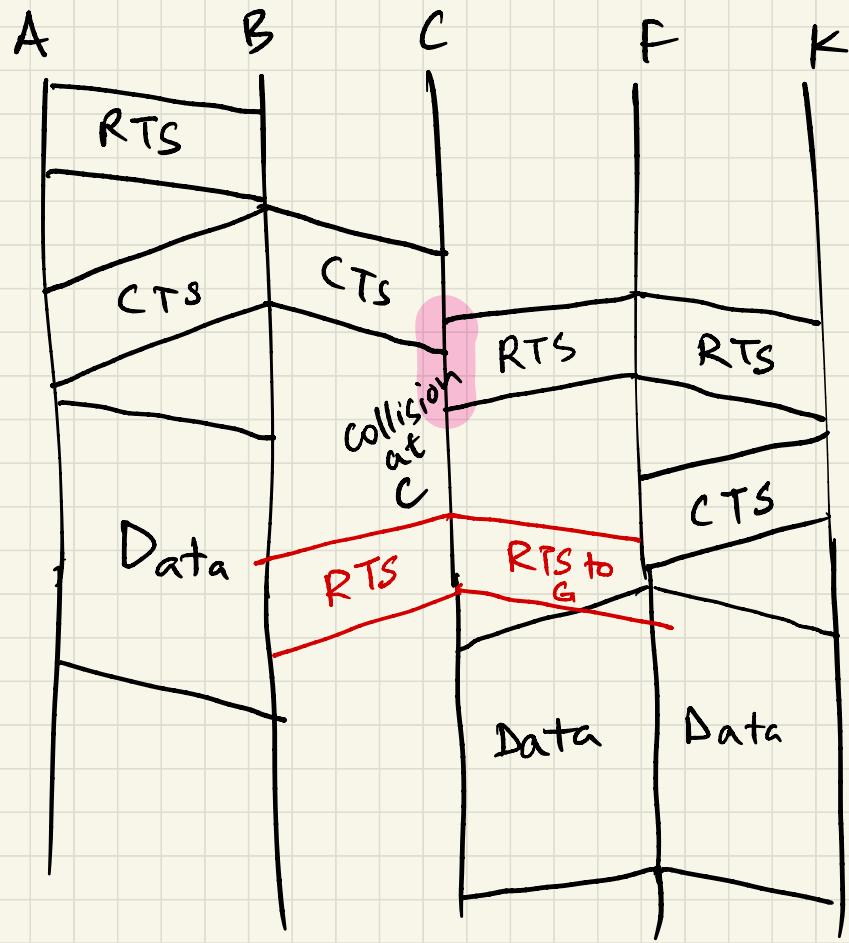


Wifi : CSMA / CA → Collision Avoidance



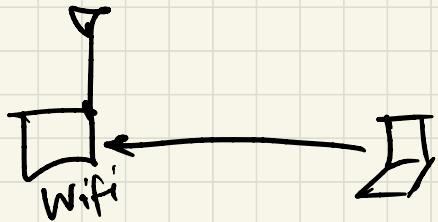
RTS : Request to send.

CTS : Clear to send

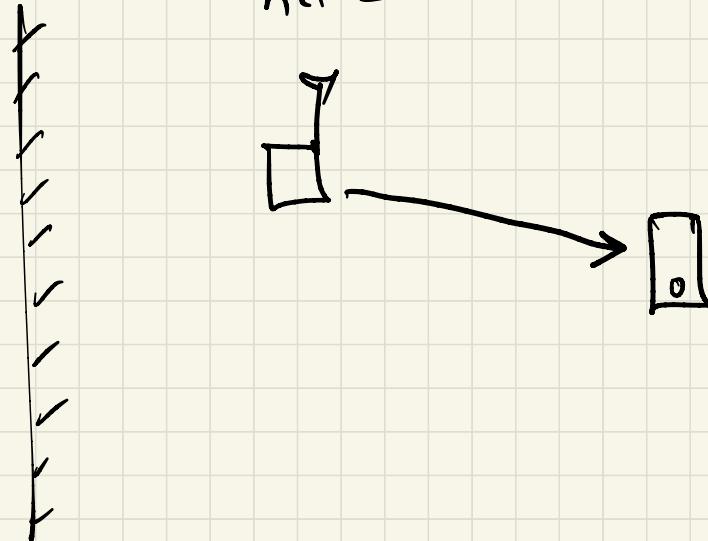


Wifi

Bob



Alice



Questions ?