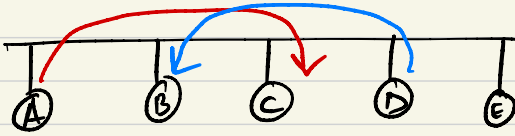
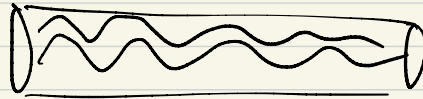


Wireless:



CSMA/CD
 \downarrow Sensing Channel
 \downarrow Collision Detection

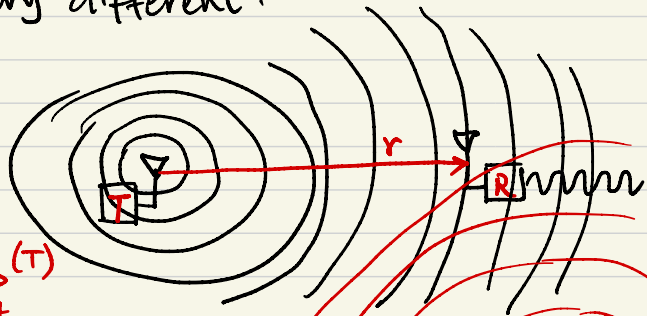
Wired channel:



confined

Wireless Channel very different:

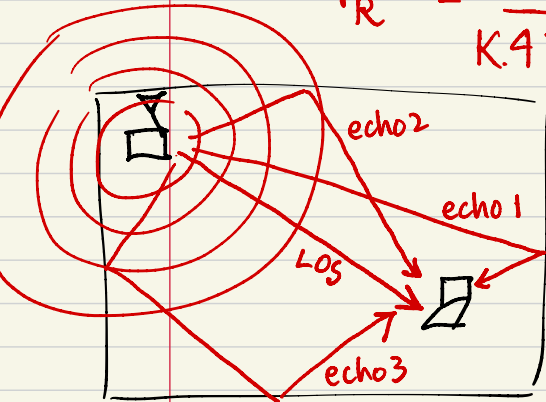
- 1 Dispersive
- 2 Interference
- 3 Multipath.



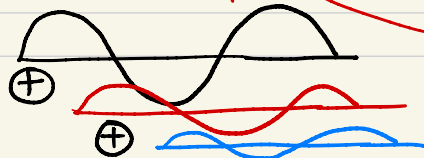
Watt

$$P_R^{(T)} = \frac{P_t^{(T)}}{4\pi r_{RT}^2}$$

$$P_R^{(I)} = \frac{P_t^{(I)}}{K \cdot 4\pi d_{IR}^2}$$



echos \equiv Multipaths



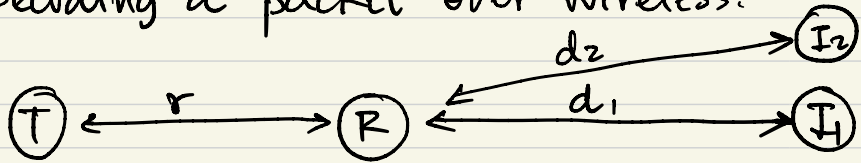
$$P_R = \frac{P_t^{(T)}}{4\pi r_{TR}^\alpha} \quad 2 \leq \alpha \leq 4$$

$$\alpha \approx 3.2$$

$$\alpha \approx 3.8$$

$$\alpha \approx 2.2$$

- Decoding a packet over wireless.



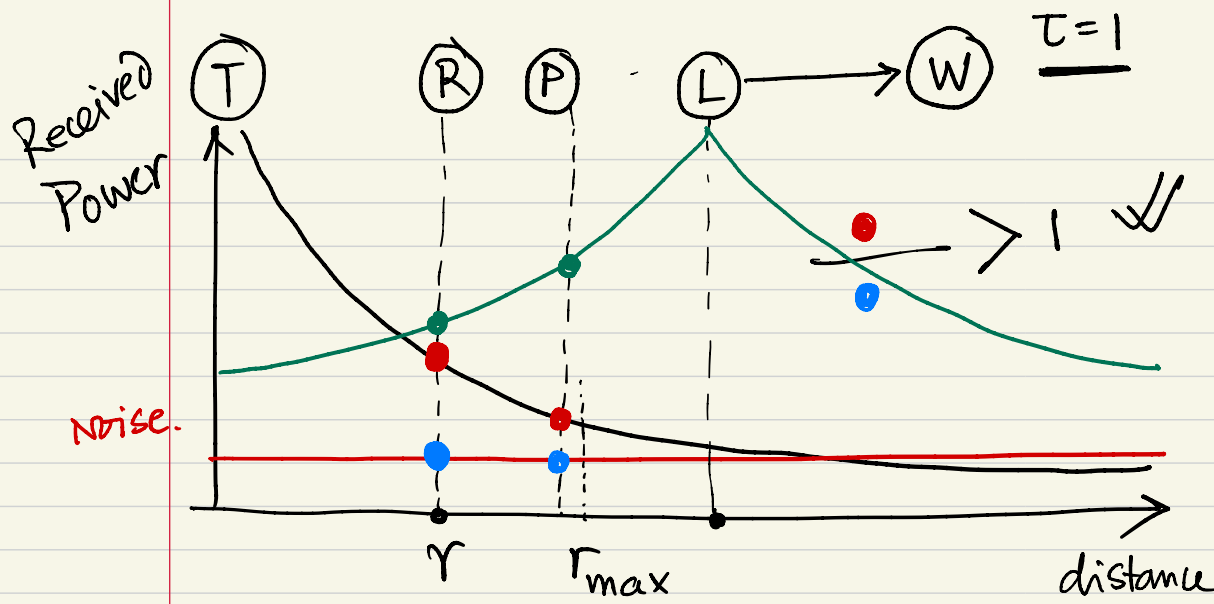
$$\text{SINR} = \frac{\text{Power received from intended Tx}}{\text{Hardware noise} + \sum (\text{Power from interferers})}$$

$$\text{SINR}^{(R)} = \frac{P_t^{(T)}}{4\pi k \cdot r^\alpha} \frac{1}{P_{\text{Noise}} + \sum_{j=1}^n \frac{P_t^{(I_j)}}{4\pi k d_j^\alpha}}$$

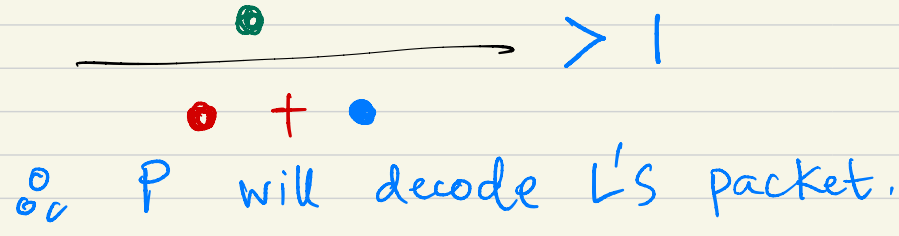
For packet to get correctly decoded

$$\text{SINR} > \tau$$

$$\tau = 3 \text{ dB.}$$



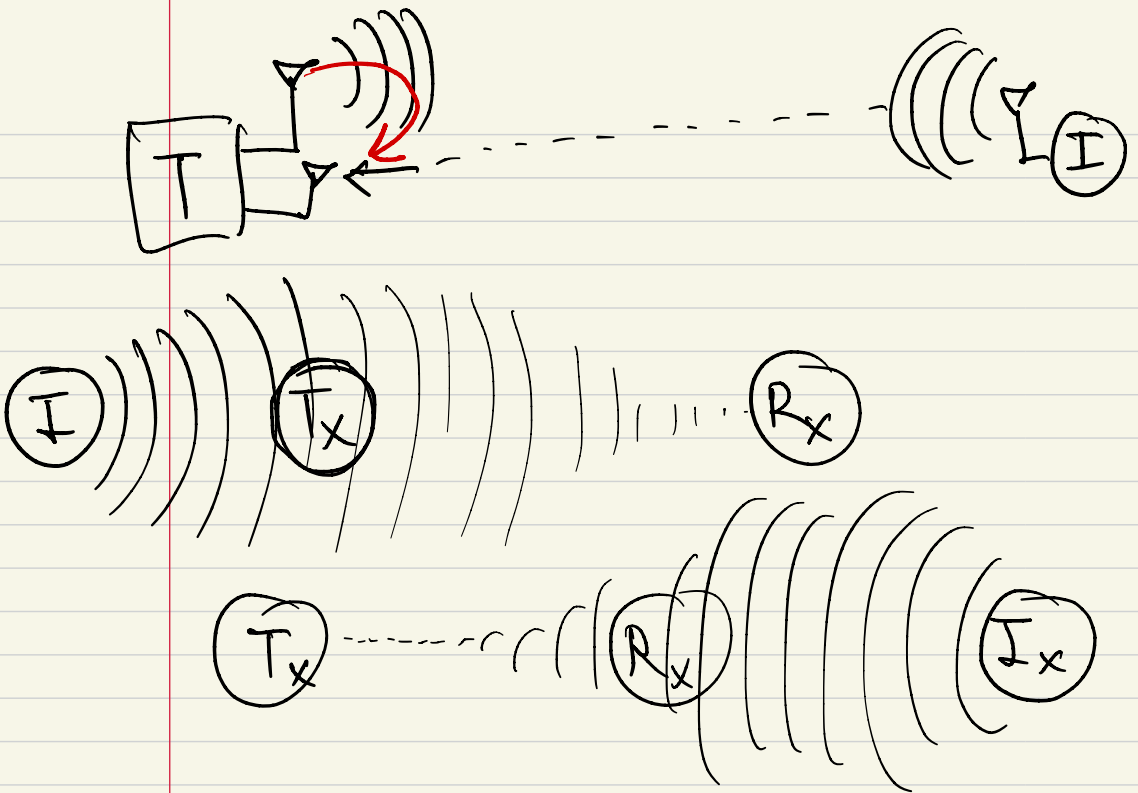
R will not receive T's message nor L's message.



Can CSMA/CD apply to wireless?

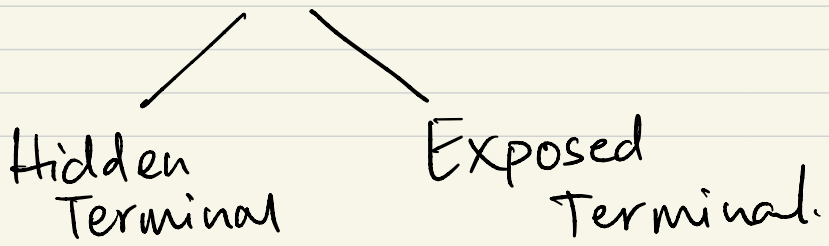
Tx can tx and listen

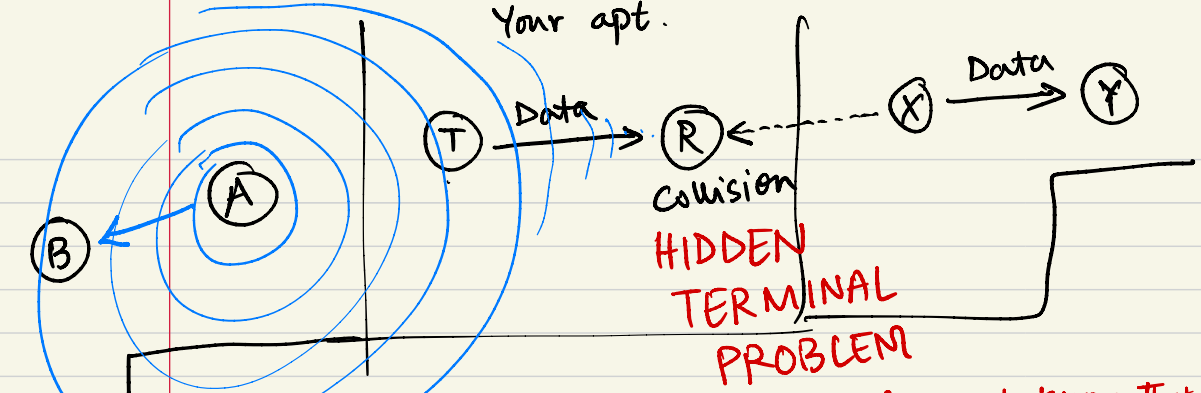
Tx inferred that Rx has experienced collision.



CSMA/CD does not apply to wireless

- ① Interferer could be too far from Tx for Tx to carrier sense
- ② Interferer very close to Tx but far from Rx implying no collision at Rx.





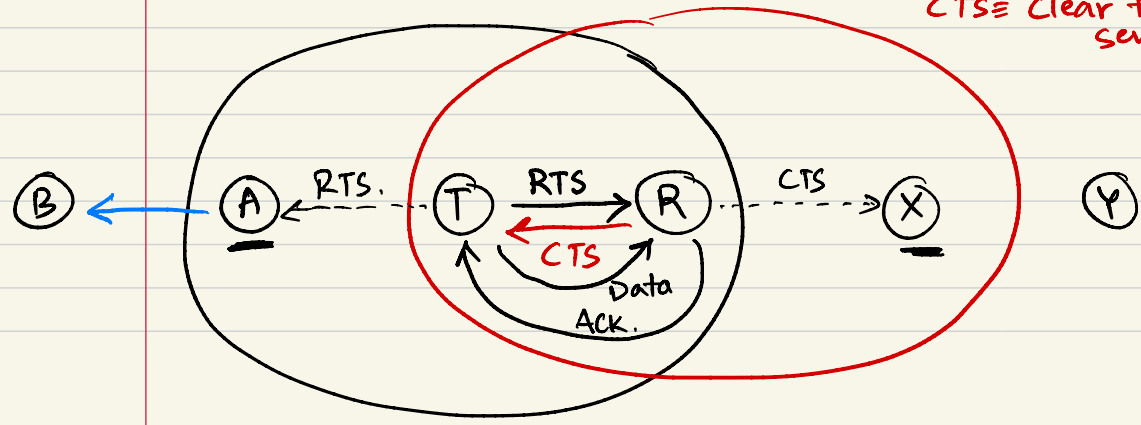
EXPOSED →
TERMINAL
PROBLE

T does not know if its transmission to R would be interfered by A's transmission AND if its transmission will interfere at A's receiver (B).
So, it does not risk a parallel transmission alongside A's transmission to B.

↳ T does not know that R is experiencing interference from X because T does not carrier sense X.

- So what do we do? RTS ≡ Req. to send.

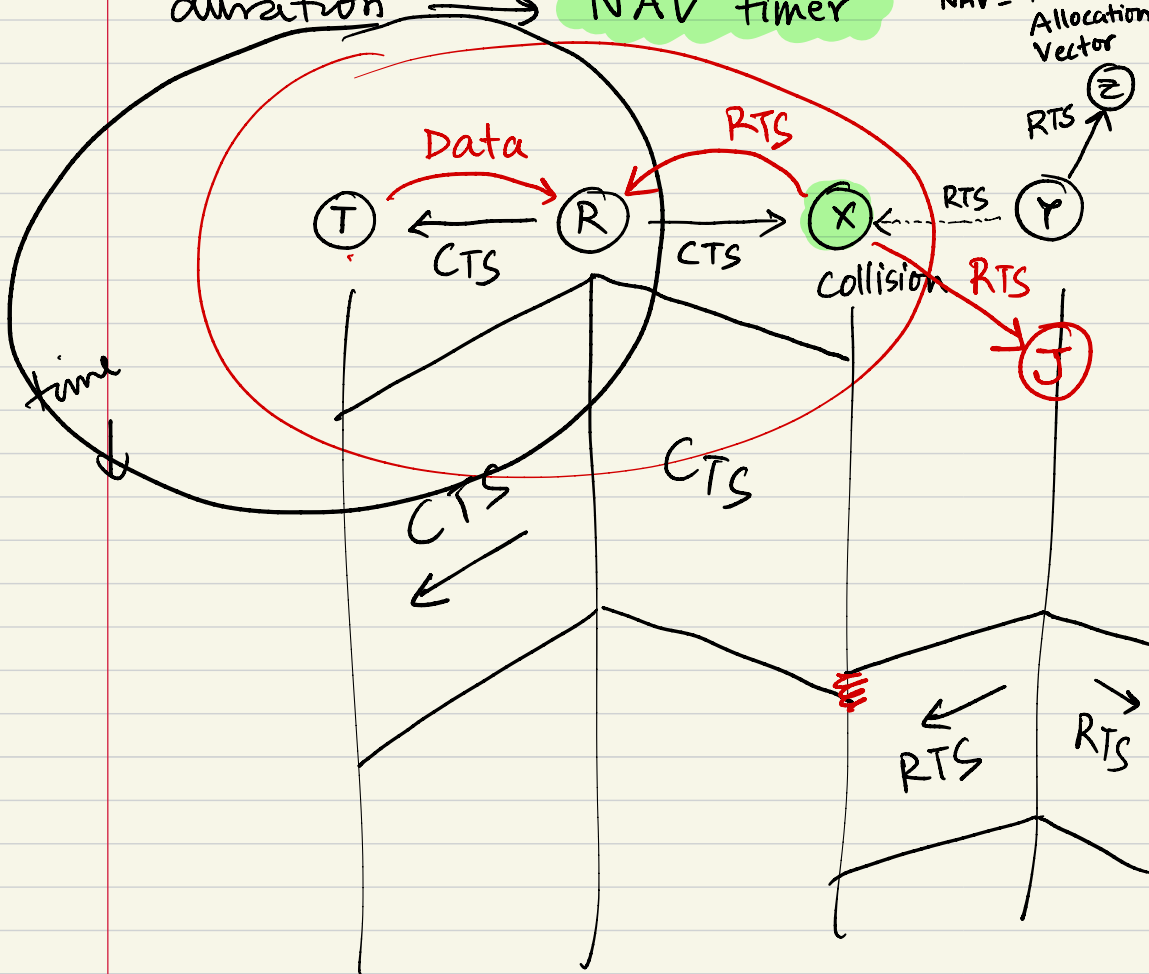
CTS ≡ Clear to send.

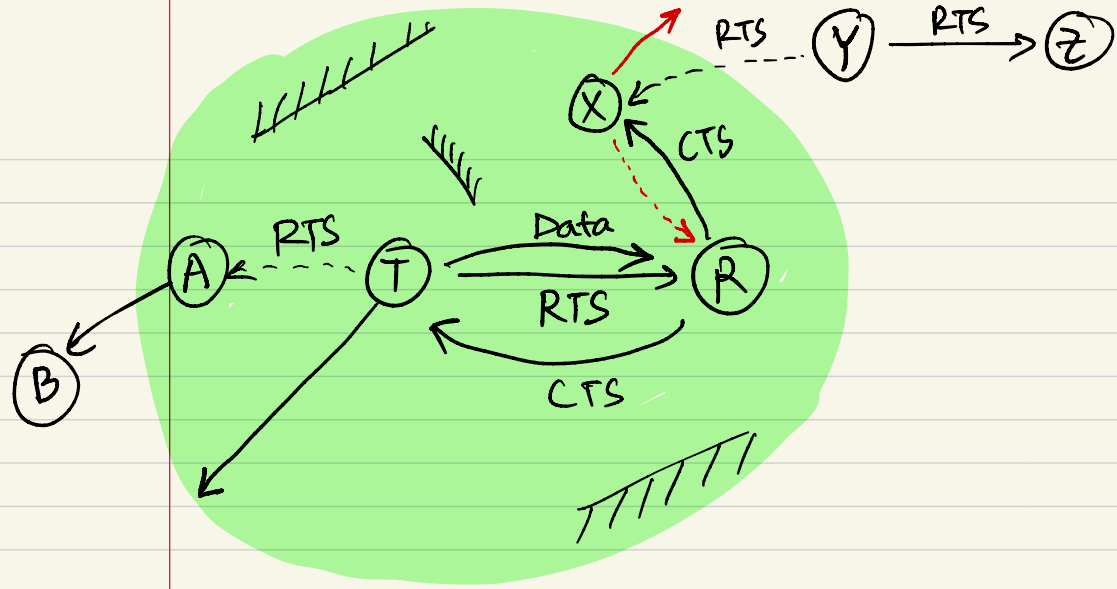


Collision only at Rx.

When A, X receive RTS or CTS, they silence themselves for Data/ACK duration → NAV timer

NAV = Network Allocation Vector





- Wifi today uses RTS/CTS.
 - ↳ But does not solve HTP / ETP completely.
 - ↳ Only alleviates it.

