Unit-1
Medium Access Control

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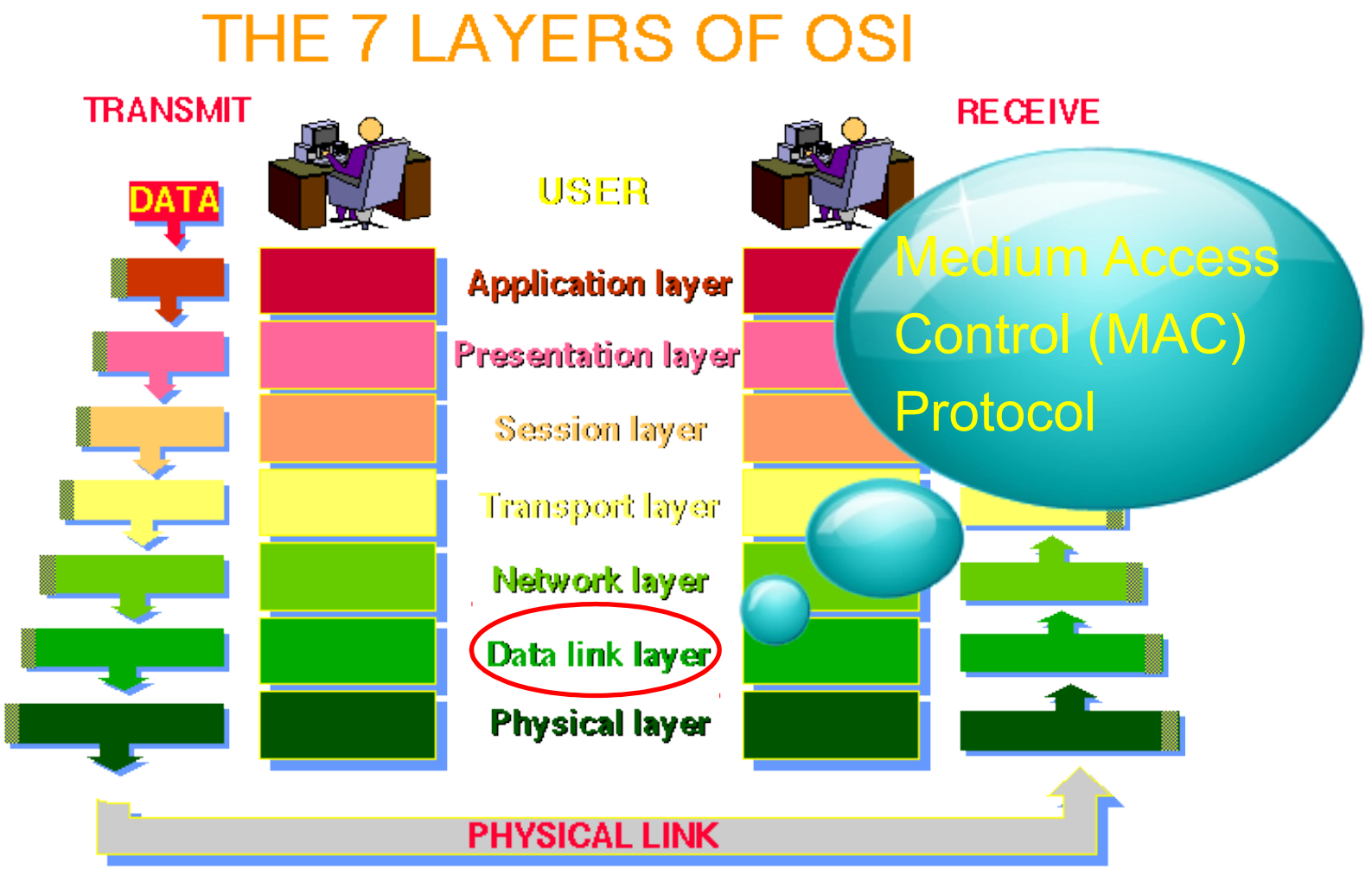
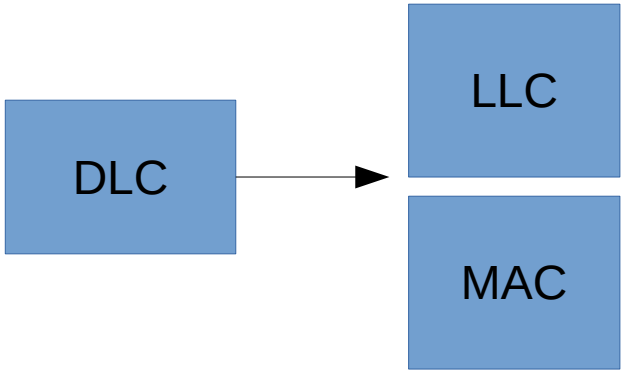
Networking basics



MAC Layer

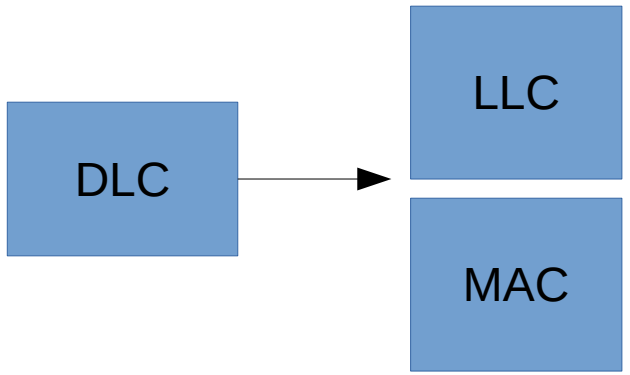
MAC layer belongs to layer 2, the data link control layer.

Layer 2 is sub divided into logical link control (LLC) and MAC layer



Work of DLC Layer

The task of DLC is to establish a reliable point to point or point to multipoint communication between different devices over a wired a medium or wireless medium.



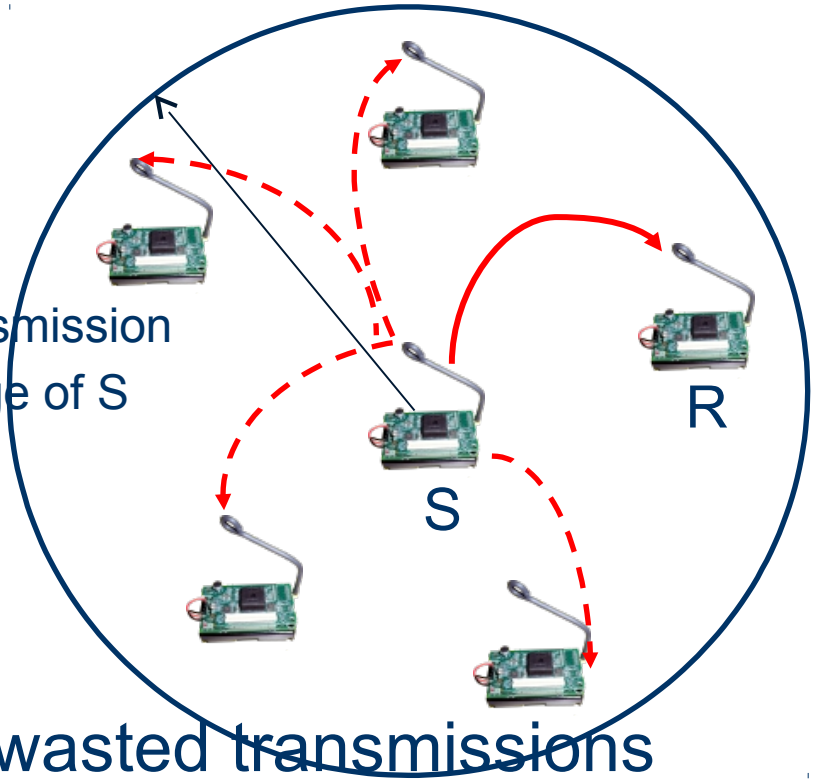
Motivation for specialised MAC

- CSMA/CD: Carrier Sense Multiple Access with Collision Detection

- A sender senses the medium (a wire or coaxial cable) to see if it is free.
- If the medium is busy, the sender waits until it is free.
- If the medium is free, the sender starts transmitting data and continues to listen into the medium.
- If the sender detects a collision while sending, its stops at once and sends a jamming signal.

Why does this scheme fails in Wireless Medium

- Collision detection is easy in wired networks but difficult in wireless medium.



- Collision avoidance to reduce wasted transmissions

Why does this scheme fails in Wireless Medium

- CSMA/CD is not really interested in collisions at the sender, but rather in those at the receiver.
- The signal should reach the receiver without collisions.
- But the sender is the one detecting collisions.
- This is not a problem using wire, as more or less the same signal strength can be assumed over the wire.
- If collision occurs somewhere in the wire everybody will notice it.

Why does this scheme fails in Wireless Medium

- The situation is different in wireless networks.
- The strength of the signal decreases proportionally to the square of the distance to the sender.
- The sender may now apply carrier sense and detect an idle medium.
- The sender starts sending-but a collision happens at the receiver due to second sender.
- Gives hidden terminal problem

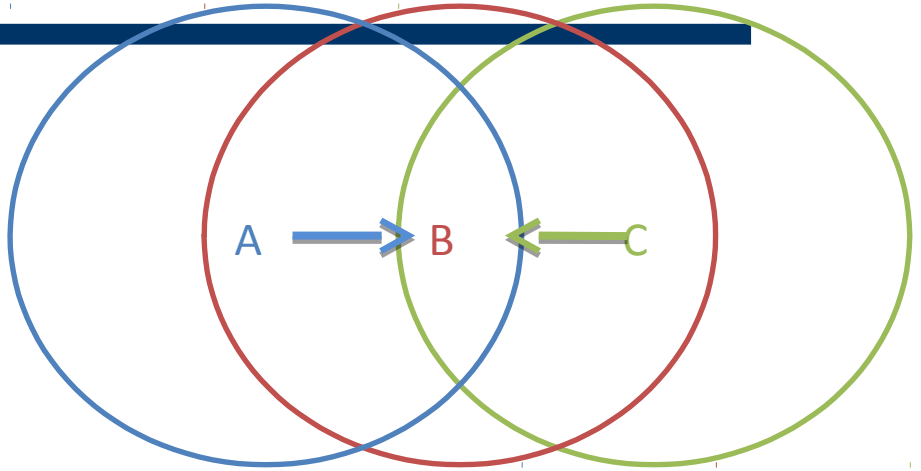
Why does this scheme fails in Wireless Medium

- With only one antenna/radio, nodes can only listen or send.

Full duplex radios are extremely expensive.

CSMA gives rise to hidden terminal and exposed terminal problems.

Hidden Terminal Problem

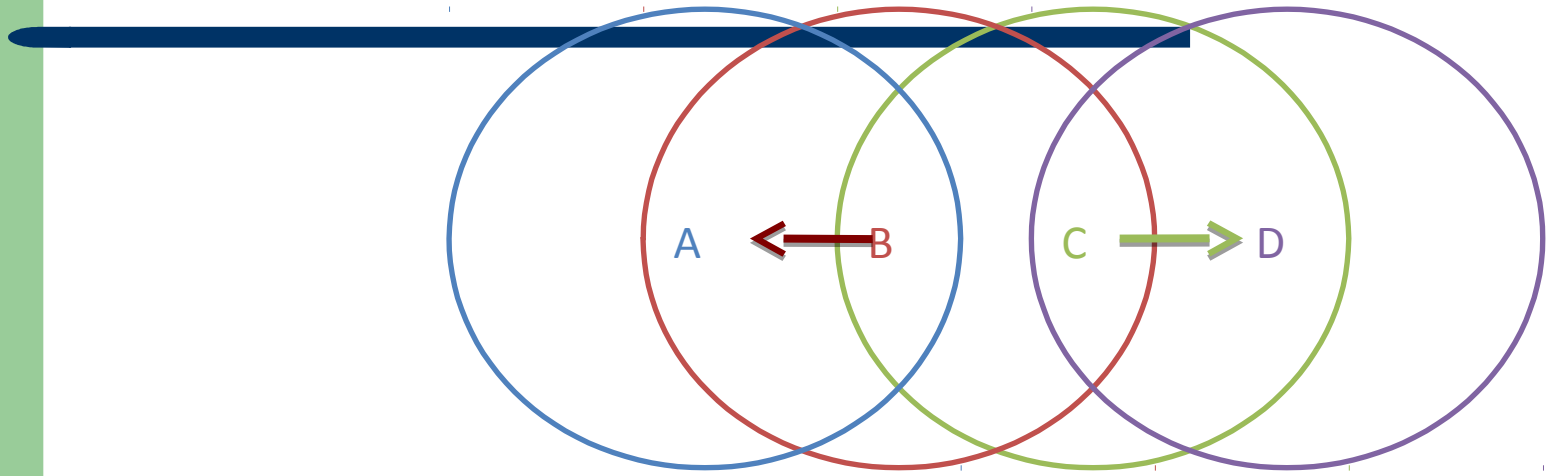


- The transmission range of A reaches B, but not c.
- The transmission range of C reaches B, but not A.
- Finally transmission range of B reaches A and B.

  A starts sending to B, C does not receive this information. C also wants to send something to B and sense the medium. The medium appears to be free, the carrier sense fails. C also start sending causing a collision at B. But A cannot detect this collision at B and continues with its transmission. A is hidden for C.

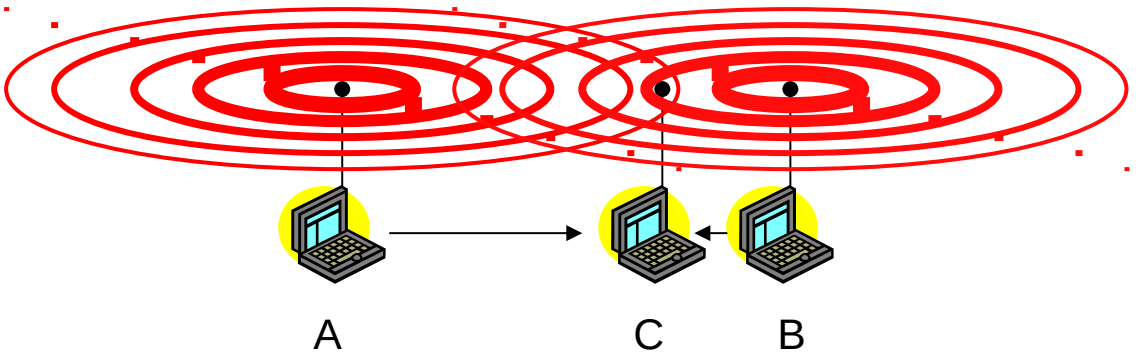
- RTS/CTS can help
  - Both A and C would send RTS that B would see first
  - B only responds with one CTS (say, echoing A's RTS)
  - C detects that CTS doesn't match and wont send

Exposed Terminal Problem



- B sending to A, C wants to send to D
- As C receives packets, carrier sense would prevent it from sending to D, even though wouldn't interfere
- RTS/CTS can help
  - C hears RTS from B, but not CTS from A
  - C knows its transmission will not interfere at B's receiver
  - C is safe to transmit to D

The Near and Far Terminal Problem



- A and B send to C
- Friis Law (power decay proportional to distance square)
- B drowns out A's signal (at the physical layer), so C cannot receive A