Addressing problem

- MAC address for NIC - network interface card.
  - 48 bits
  - globally unique — controlled by IEEE.
    - unique to network interface card. i.e. where the frame will be sent to.
    - first 3 bytes = vendor. i.e. 8C EC 4B xx xx xx.
  - all 1s for broadcast.

physical / virtual → unique.

how to be unique
- Same MAC — both senders will receive
- Every node in a given subnet / LAN has to be unique.
- your responsibility to ensure 2 devices do not have the same MAC.

Ethernet — technology for LINK layer

- main wired internet technology.
  - cheap & fast.
- Frame

  preamble, dest addr, src addr, type, data, crc.

  - max 1500 bytes. → MTU
  - min 46 bytes. → ensure a collision will always be detected.
  - type: of upper layer → multiplexing. → multiple network protocols.
  - crc: error detection → drop if error.
  - guarantee collision ⇒ retrans CSMA/CD.
  - ensure packet move to higher layer is correct.
  - preamble
    - telling clock frequency

Shared Link.

- Coaxial bus — broadcast LAN — all nodes collide w/ each other.
  - Single point of failure
  - Very slow.

- Star topology — Hub — amplify bits received
  - simulate a bus.
  - cheap, hub is a single point of failure but easier to maintain.
  - slow, high collision, no CSMA\CD.
  - Switch
    - Link layer device. — can operate on frames.
    - no collision
    - store & forward - have buffer, won't overflow. (for all interfaces/ports.) — enables multiple transmission.
    - selectively forward frames.
    - transparent. — interface/port do not have their own MAC address.
    - No TTL → ∴ no loops in network. — spanning tree else buffer overflow.

TTL for router/hosts.

- Switch forwarding table.
  - records sender - location pair
  - Straight forward forwarding
  - If no entry, broadcast to all others. (avoid sending to existing interface)
  - Received a frame for a location that is the same as sender → dropped. (so duplicate packets won't be sent)
  - TTL for MAC - interface pairing.

↳ If you move, need to send a packet first to establish new address.

Full duplex cable - no collision from sending & receiving.

Ethernet no IP address.

- a way to convert using a table.
- ARP Table.

IP addr : MAC addr : TTL.

TTL: time after which will be forgotten.

- Create the frame for the next hop
  - ⇒ dest. mac addr for router etc.
  - ⇒ not invisible

VS IP addresses ⇒ end-to-end.

gateway?