Link layer: introduction

terminology:

- hosts, routers: nodes

- communication channels that connect adjacent nodes along communication path: links
  - wired , wireless
  - LANs

- layer-2 packet: *frame*, encapsulates datagram

link layer has responsibility of transferring datagram from one node to *physically adjacent* node over a link

mobile network

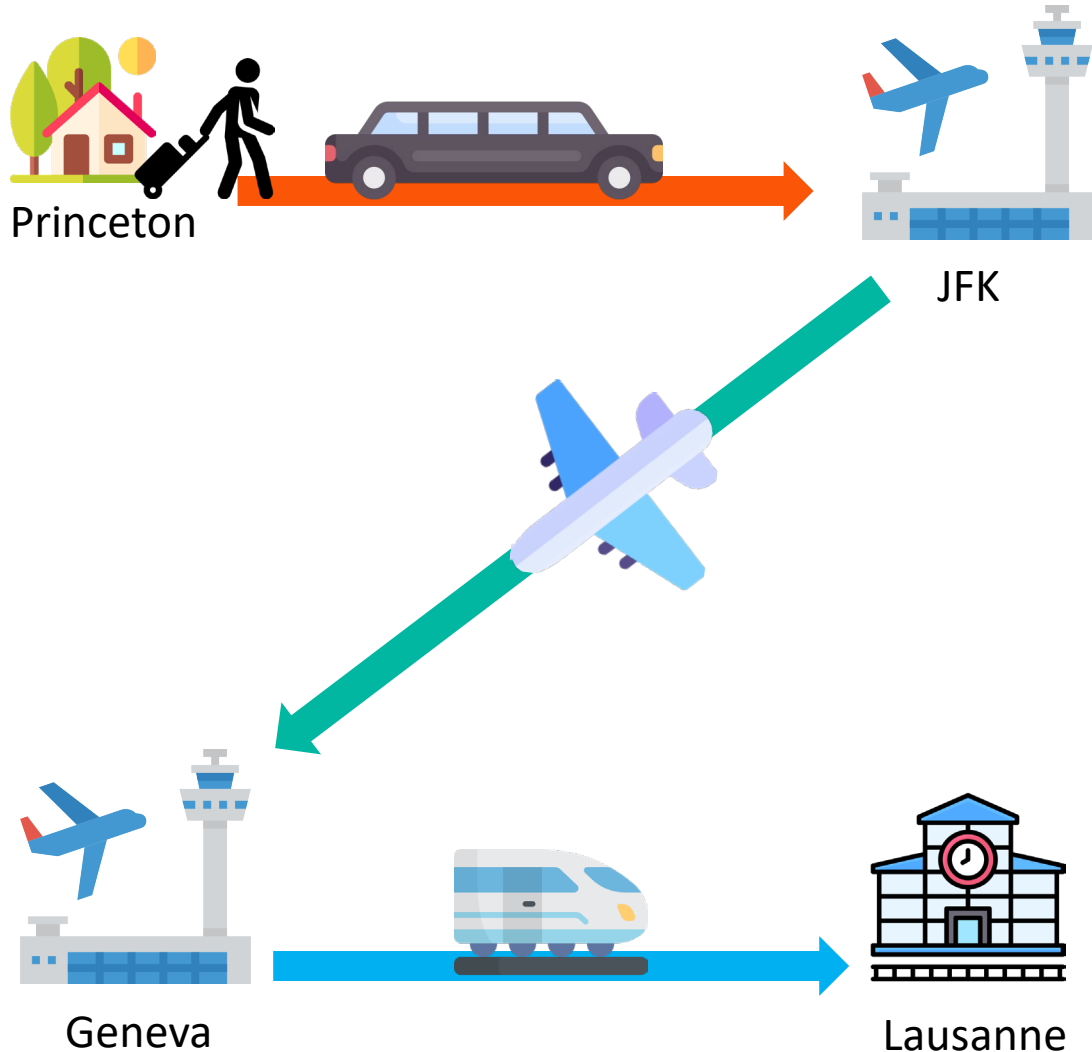national or global ISP

datacenter network

enterprise network
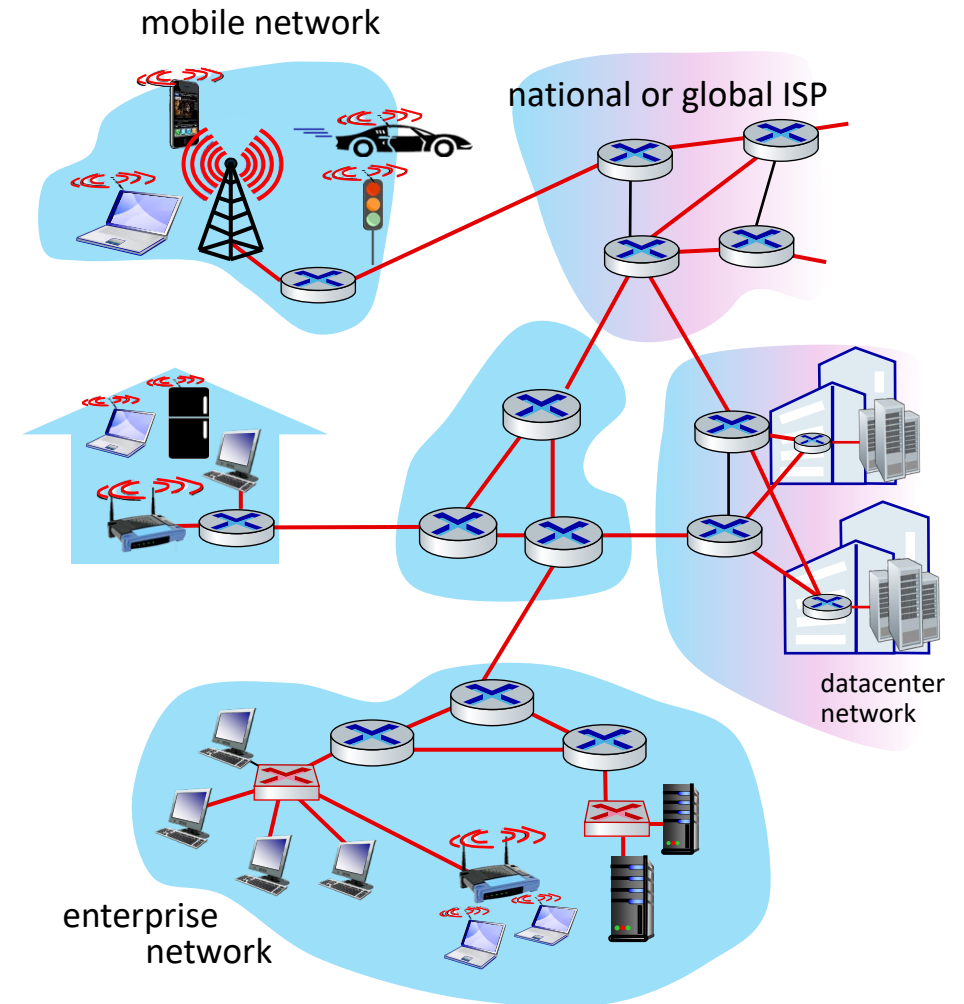
Link layer: context

- datagram transferred by different link protocols over different links:
  - e.g., WiFi on first link, Ethernet on next link

- each link protocol provides different services
  - e.g., may or may not provide reliable data transfer over link
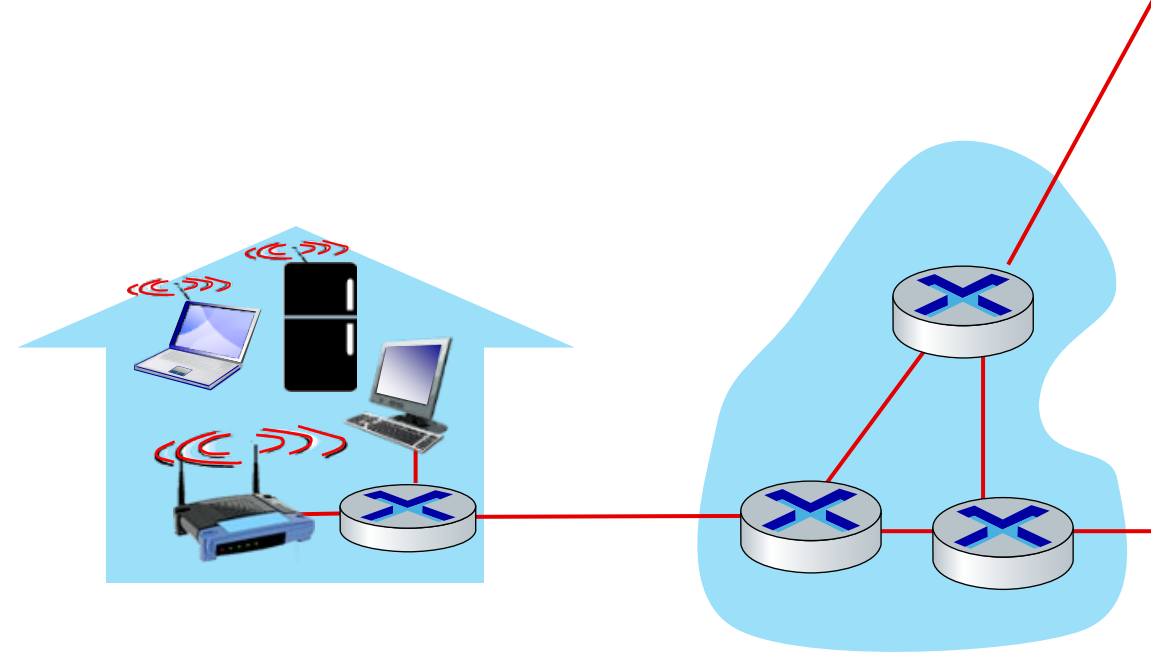
Transportation analogy

transportation analogy:

- trip from Princeton to Lausanne
  - limo: Princeton to JFK
  - plane: JFK to Geneva
  - train: Geneva to Lausanne

- tourist = datagram

- transport segment = communication link

- transportation mode = link-layer protocol

- travel agent = routing algorithm

Link layer: services

- **framing, link access:**
  - encapsulate datagram into frame, adding header, trailer
  - channel access if shared medium
  - "MAC" addresses in frame headers identify source, destination (different from IP address!)

- **reliable delivery between adjacent nodes**
  - we already know how to do this!
  - seldom used on low bit-error links
  - wireless links: high error rates
    - _Q:_ **why both link-level and end-end reliability?**

Cable access

cellular

Ethernet LANs

WiFi
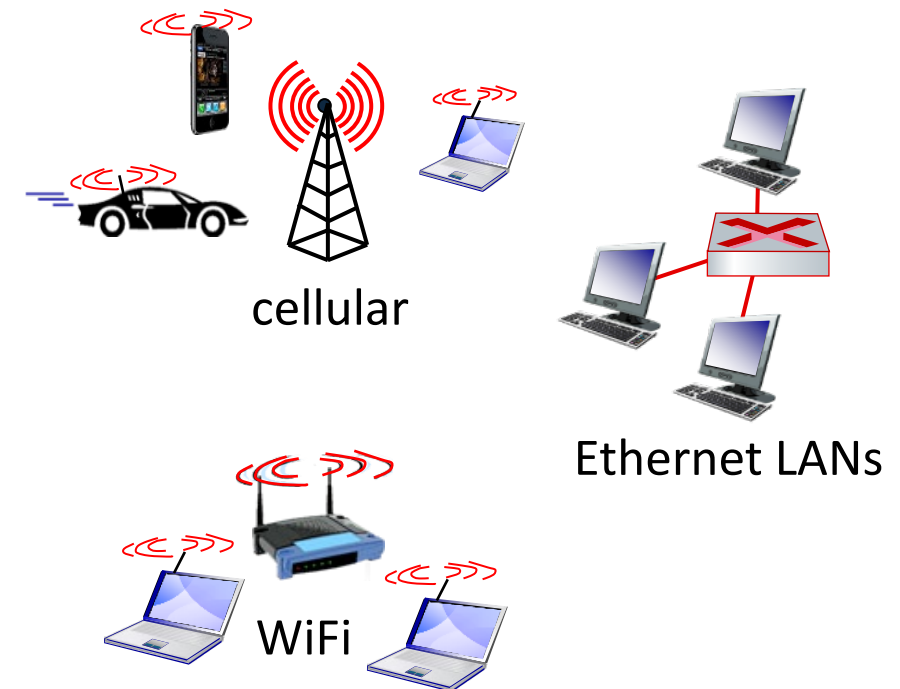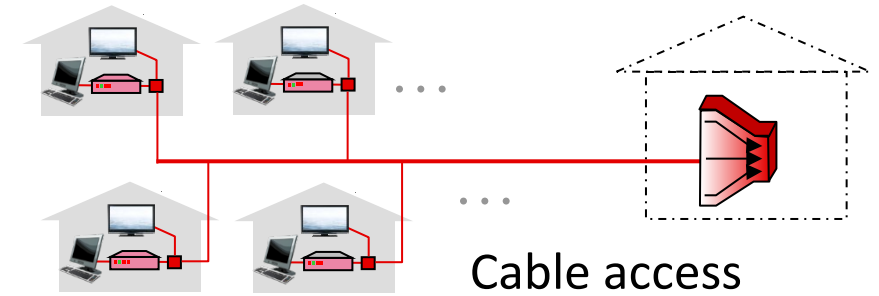
Link layer: services (more)

- **flow control:**
  - pacing between adjacent sending and receiving nodes
- **error detection:**
  - errors caused by signal attenuation, noise.
  - receiver detects errors, signals retransmission, or drops frame
- **error correction:**
  - receiver identifies *and corrects* bit error(s) without retransmission
- **half-duplex and full-duplex:**
  - with half duplex, nodes at both ends of link can transmit, but not at same time

Cable access

cellular

Ethernet LANs

WiFi