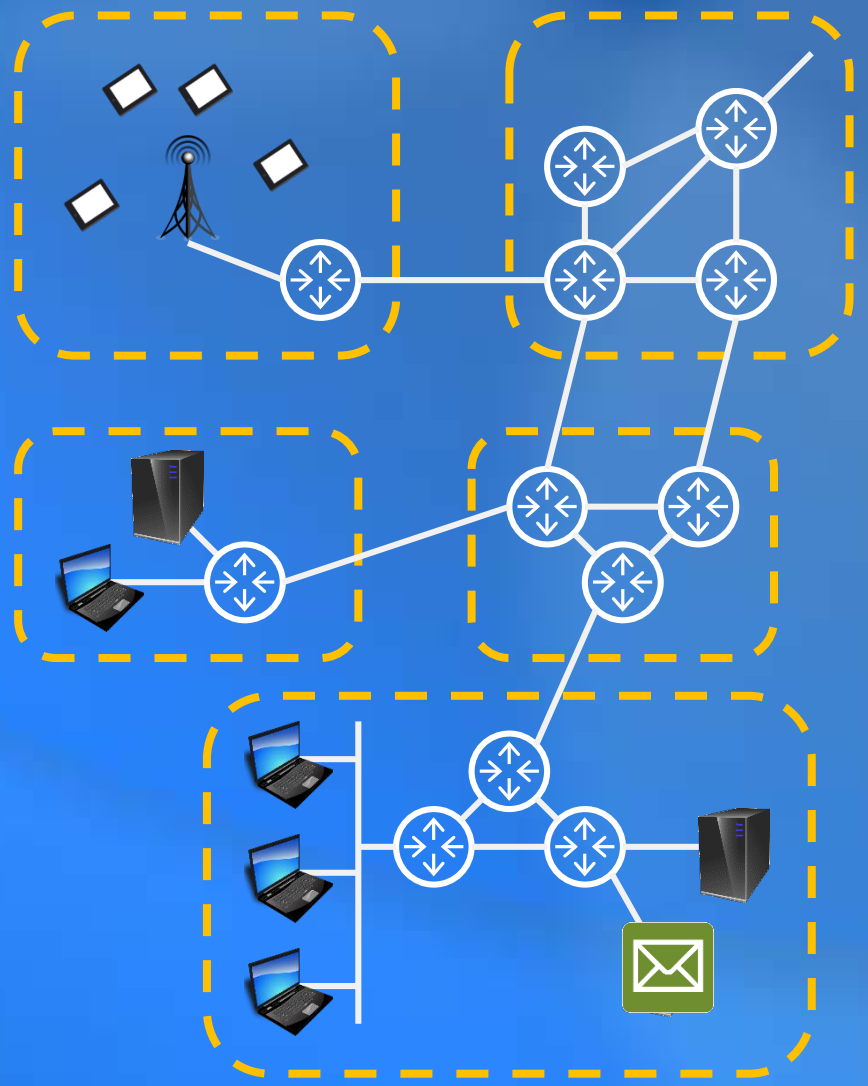
# Packet Switching

# Connecting Hosts



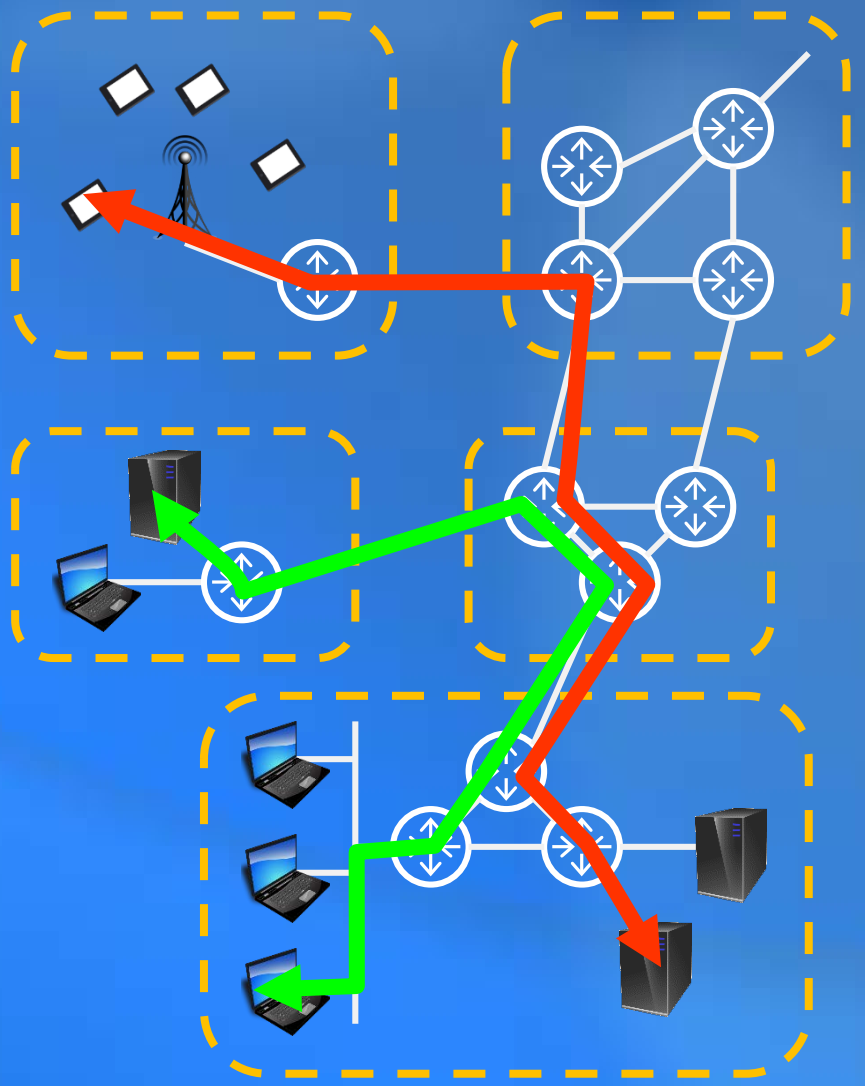
**circuit switching**

- dedicated circuit per connection
- e.g. old telephone network

**packet-switching**

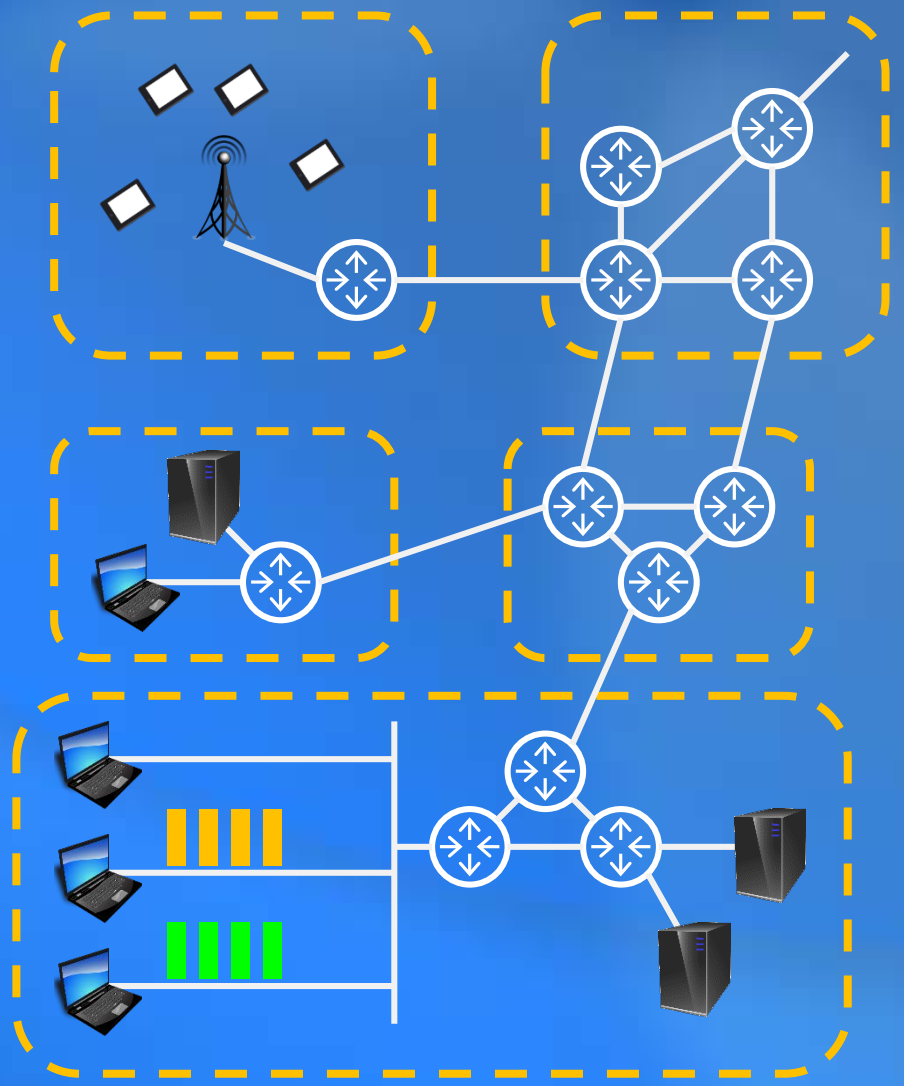
- data sent thru net in discrete “chunks”, called packets
- e.g. most modern networks

# Circuit Switching



- End-end resources reserved for connection
- Requires connection setup in advance
- network resources (e.g., bandwidth) divided into “pieces”
  - e.g. frequency division multiplexing (FDM)
- Guaranteed performance, but no sharing of resources

# Packet Switching



- End-end data stream divided into packets
- Users share network resources via statistical multiplexing
  - transmit as needed
  - traffic assumed random
- When transmitting, each packet occupies full link bandwidth
- No guaranteed performance, but better sharing of resources

# Packet Switching

Advantages

- No division of bandwidth into pieces
- No dedicated allocation
- No resource reservation

Issues

- resource contention: users may request simultaneous link access or exceed link resources
- queuing required as packets wait for link use

# Packet vs. circuit switching

Assume

- a 1 Mb/s link shared by N users
- each user requires 100kb/s when “active”
- users are randomly active 10% of the time

For circuit-switching:

- N is limited to 10 users (1Mb/s divided by 100kb/s)

For packet switching:

- If N=35 users, link overloaded with probability $\sum_{n=11}^{35} \binom{35}{n} p^n (1-p)^{35-n} \leq 0.0004$

If occasional overloading can be handled, packet switching allows for more users!