The Network Layer

What does the network layer do?

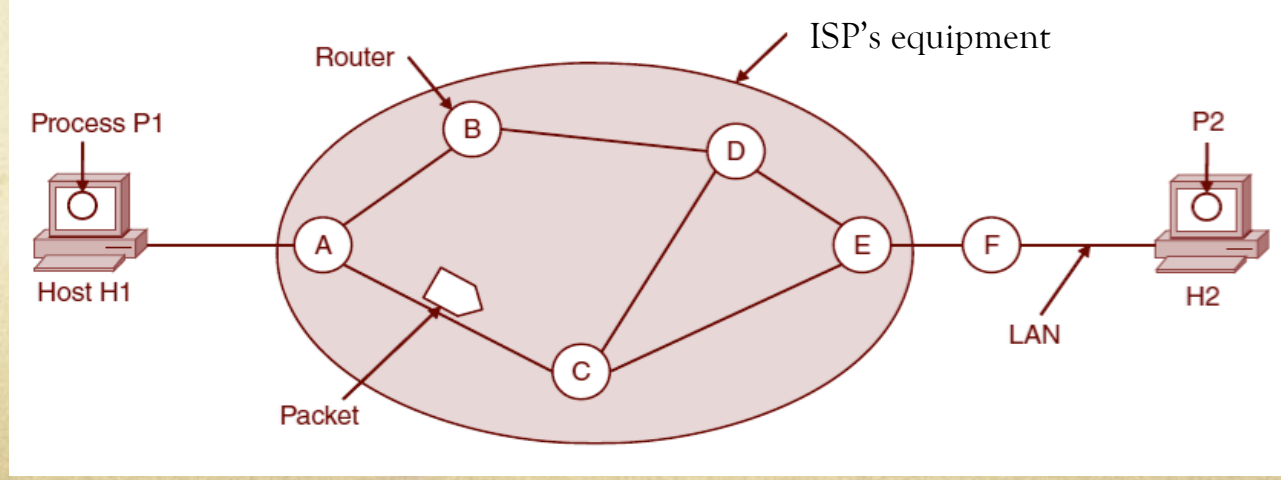
- *Goal*: Transfer packets b/w *endpoints* via multiple links
- *Routing & forwarding*
  - Find path from source to destination
  - Forward packets along path
- *Congestion control*
  - Must avoid/recover from network congestion

What does the network layer do?

- *Internetworking*
  - Must support *joining* of multiple networks into network of networks
  - Must provide *uniform addressing* across entire network of networks
  - Details of physical network, number/types of nodes & network topology, etc. must be *hidden* from transport layer

Routing basics

- Routing → identifying *path* between endpoints
- What happens along path?
  - *Store-and-forward* packet switching
    - Wait for full frame to arrive & *link* layer to verify frame
    - *Forwards* packet to next router along identified route
    - When destination reached, send packet up to *transport* layer



Routing goals

- Could have *multiple* possible routes between A & B
  - Need to make appropriate choice
- Goals of routing algorithm
  - Should deliver packets to their *intended* destination
  - Should have low overhead (*simplicity*)
  - Should be *efficient* (minimize delay, maximize throughput, …)
  - Should cope with changes in topology & traffic (*robustness*)
  - Should not take forever to converge to choice (*stability*)
  - Should treat different nodes *fairly*

Types of routing algorithms

- *Non-adaptive* or *static*
  - Routes fixed offline & simply stored in tables
  - Makes sense if there's only one clear choice
- *Adaptive* or *dynamic*
  - Routes changed to reflect changes in network state
    - E.g., topology, traffic changes
  - Have some optimization criteria

Routing algorithm examples

- Shortest path routing
- Flooding
- Distance vector routing
- Link state routing
- Hierarchical routing