Panel 1

Last Time:

Data link layer protocols:

simplex_duplex
simplex_slip_wait

postdiam. + retransmission (simplex)

sliding window protocol

Panel 2

The Network Layer
Panel 3

The Network Layer

Source to destination delivery of packets occurs across networks. (vs. data link - sends frames between 2 nodes)

Responsibilities:

- Addressing (logical)
- Routing: determine the path across the network of packets

Panel 4

Network layer has 2 competing ideas

- Unreliable, connection-less service: packets are routed individually and may/may not arrive
  - Internet - 30 years of experience
- Reliable, connection-oriented service: first establish a connection, exchange parameters, then send data without loss
  - Phone company - 100 years of experience

Unreliable + connection-oriented

Reliable + connection-less

[Centralized]/[decentralized] service

[elaborate]/[subtle] work

[done in the network]/[work is moved to host]
Panel 5

Primary job of Network Layer: Routing

Routing should be:

- simple
- robust: adjust to changes in topology
- stable: algorithm should establish
  routes that don’t change if
  network parameters don’t change
- fair: all routes are treated equal
- optimal: highest possible performance.

Panel 6

2 Types of Algorithms

- Static: routes are computed once, then
don’t change

- Adaptive: routes change if parameters of
  subnet change

desirable

Quiz on Monday
Panel 7

**Optimally Principle**

If router \( f \) is on the optimal path from router \( I \) to \( K \), then the optimal path from \( f \) to \( K \) falls along the same route.

Panel 8

**Shortest Path Routing (Dijkstra 1959)**

1. Each node gets a label indicating distance from source and best connection. Initially, all are \((0, -)\).
2. Start at \( A \), make that label permanent.
3. Find all adjacent nodes and add tentative labels.
4. Pick overall smallest, make it permanent, and continue from there!
Panel 9

Panel 10

"We did good!"
Panel 11

Panel 12

**Simple yet effective:** Flooding

Every incoming packet is sent to every outgoing line except the one it came on.

Add "hop count" that decrements each time and discard when zero.

⇒ Finds best path because it finds all paths

⇒ Useful for measurements against other algorithm

⇒ Used for military because it's very robust
Panel 13

<table>
<thead>
<tr>
<th>Adaptive Ranking</th>
<th>Distance Vector Ranking</th>
</tr>
</thead>
</table>

next time on Friday