Computer Networks

IP Forwarding (§5.6.1-5.6.2)

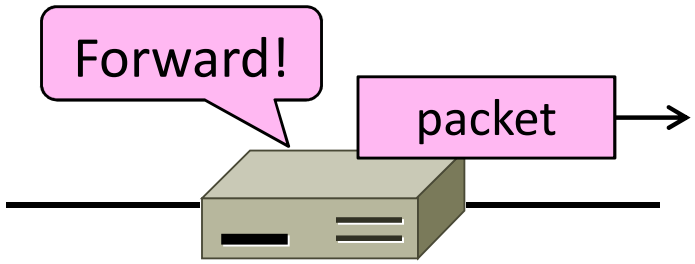
David Wetherall (djw@uw.edu)
Professor of Computer Science & Engineering
UNIVERSITY of WASHINGTON

Topic

- How do routers forward packets?

→ We'll look at how IP does it

→ (We'll cover routing later)



Recap

- We want the network layer to:
  - Scale to large networks
    - Using addresses with hierarchy
  - Support diverse technologies
    - Internetworking with IP
  - Use link bandwidth well
    - Lowest-cost routing

This lecture

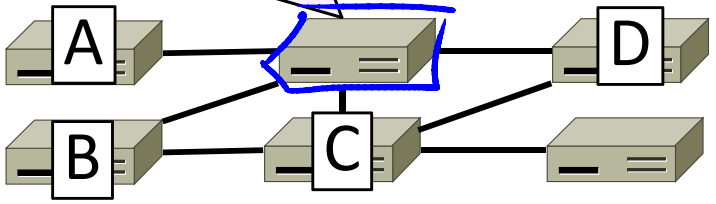
More later

Next time

IP Forwarding

- IP addresses on one network belong to the same prefix
- Node uses a table that lists the next hop for IP prefixes

Prefix	Next Hop
192.24.0.0/18	D
192.24.12.0/22	B



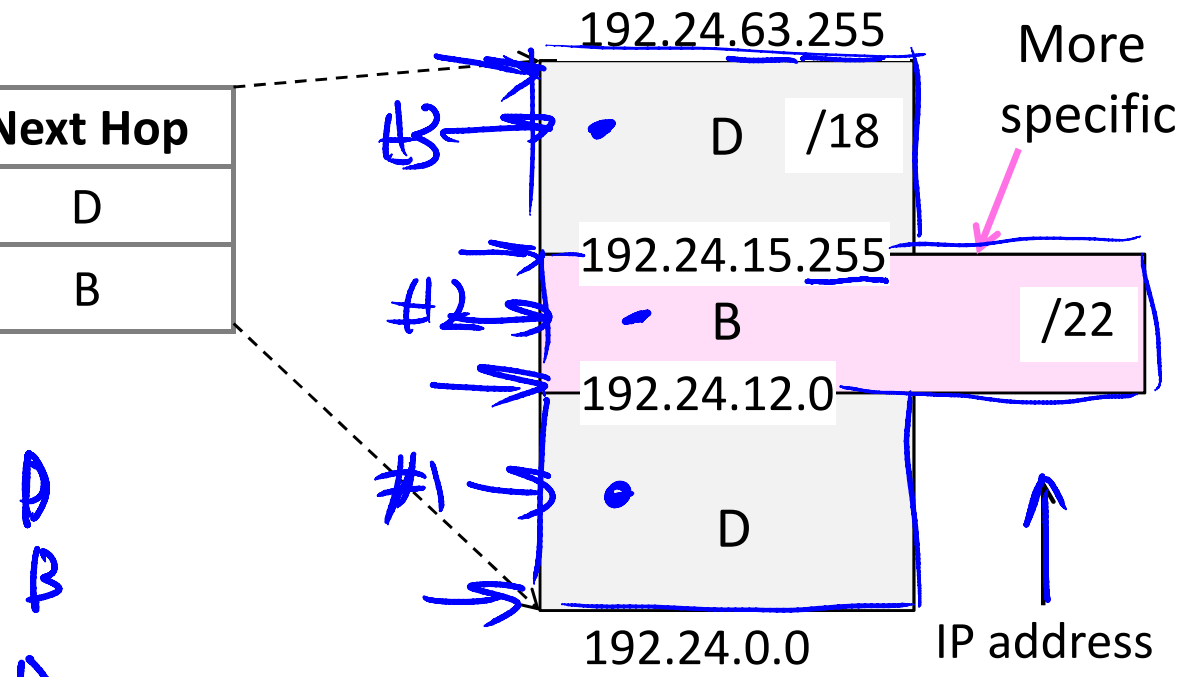
Longest Matching Prefix

- Prefixes in the table might overlap!
  - Combines hierarchy with flexibility

- Longest matching prefix forwarding rule:
  - For each packet, find the longest prefix that contains the destination address, i.e., the most specific entry
  - Forward the packet to the next hop router for that prefix

Longest Matching Prefix (2)

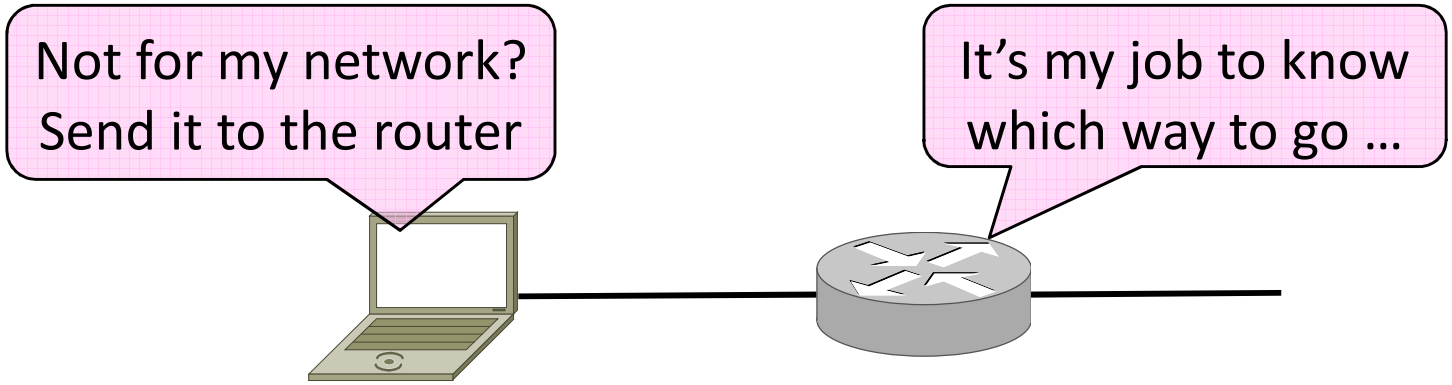
Prefix	Next Hop
192.24.0.0/18	D
192.24.12.0/22	B



#1 192.24.6.0 → D
#2 192.24.14.32 → B
#3 192.24.54.0 → D

Host/Router Distinction

- In the Internet:
  - Routers do the routing, know which way to all destinations
  - Hosts send remote traffic (out of prefix) to nearest router



Host Forwarding Table

- Give using longest matching prefix
  - 0.0.0.0/0 is a default route that catches all IP addresses

Prefix	Next Hop
My network prefix	Send direct to that IP
0.0.0.0/0	Send to my router

Flexibility of Longest Matching Prefix

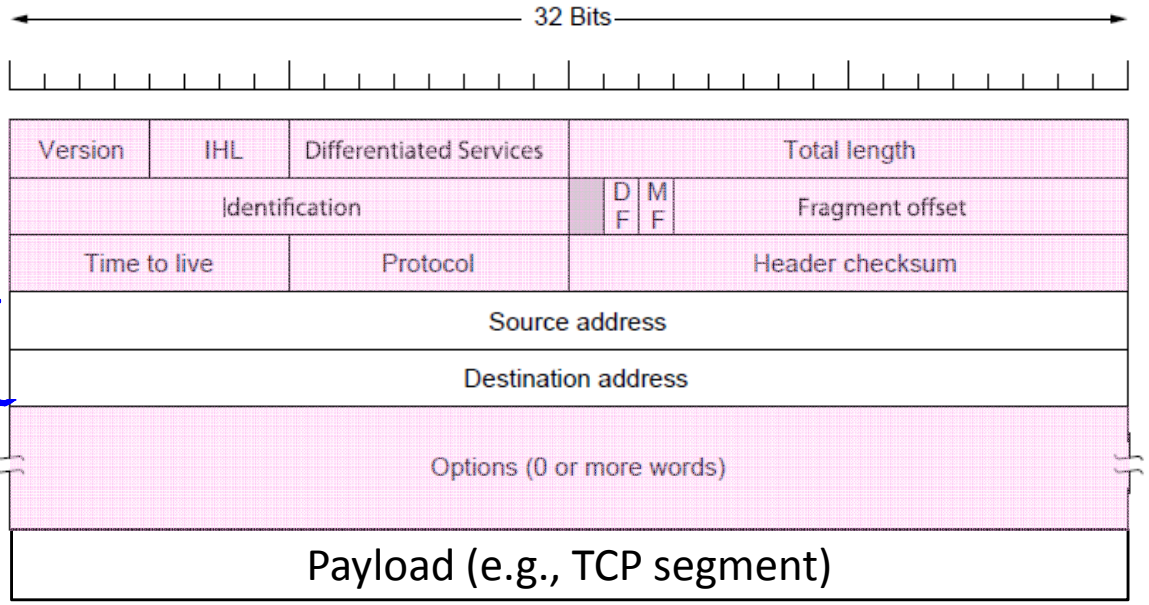
- Can provide default behavior, with less specific prefixes
  - To send traffic going outside an organization to a border router
- Can special case behavior, with more specific prefixes
  - For performance, economics, security, …

Performance of Longest Matching Prefix

- Uses hierarchy for a compact table
  - Benefits from less specific prefixes
- Lookup more complex than table
  - Was a concern for fast routers, but not an issue in practice these days

Other Aspects of Forwarding

- It's not all about addresses …



Other Aspects (2)

- Decrement TTL value
  - Protects against loops
- Checks header checksum
  - To add reliability
- Fragment large packets
  - Split to fit it on next link
- Send congestion signals
  - Warns hosts of congestion
- Generates error messages
  - To help mange network
- Handle various options

Coming later

END