

# Computer Networks

## IP Forwarding (§5.6.1-5.6.2)



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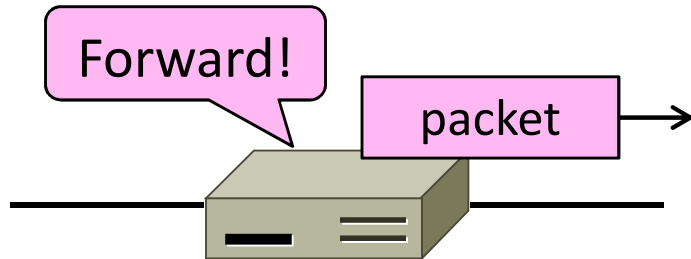
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# Topic

- 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

} This  
lecture

- ⇒ Support diverse technologies

- Internetworking with IP

} More  
later

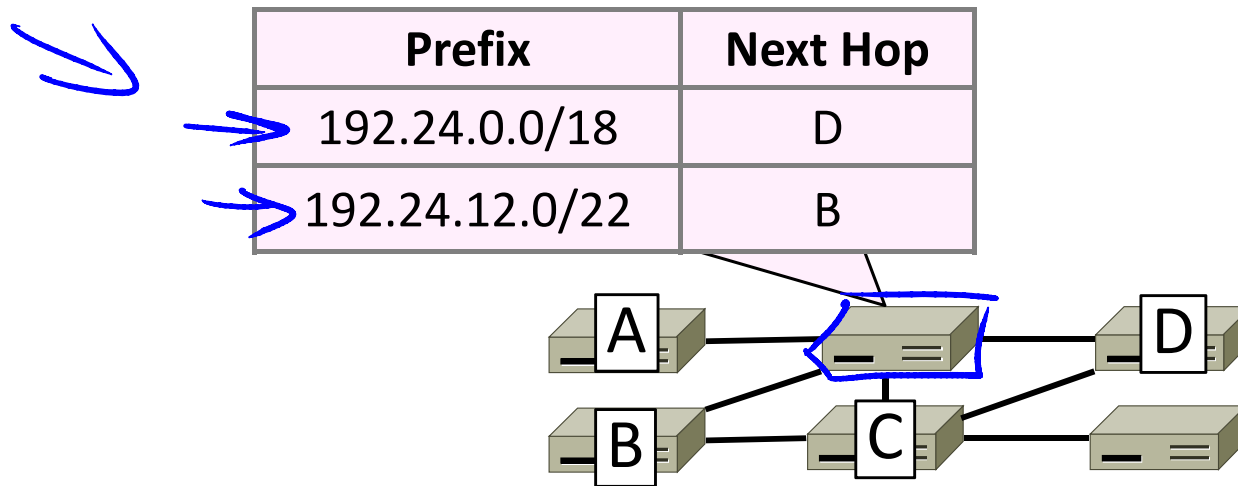
- ⇒ Use link bandwidth well

- Lowest-cost routing

} 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



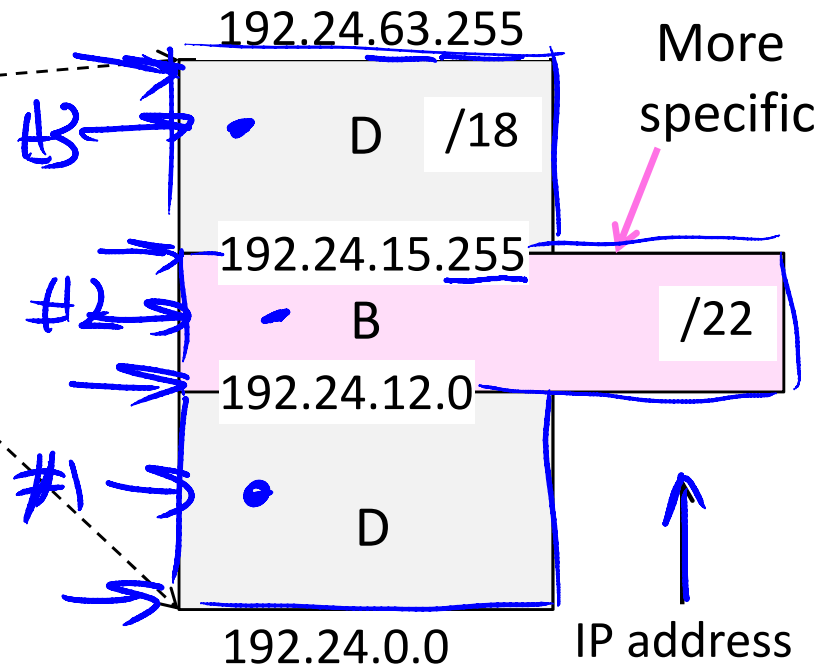
# Longest Matching Prefix

- 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)

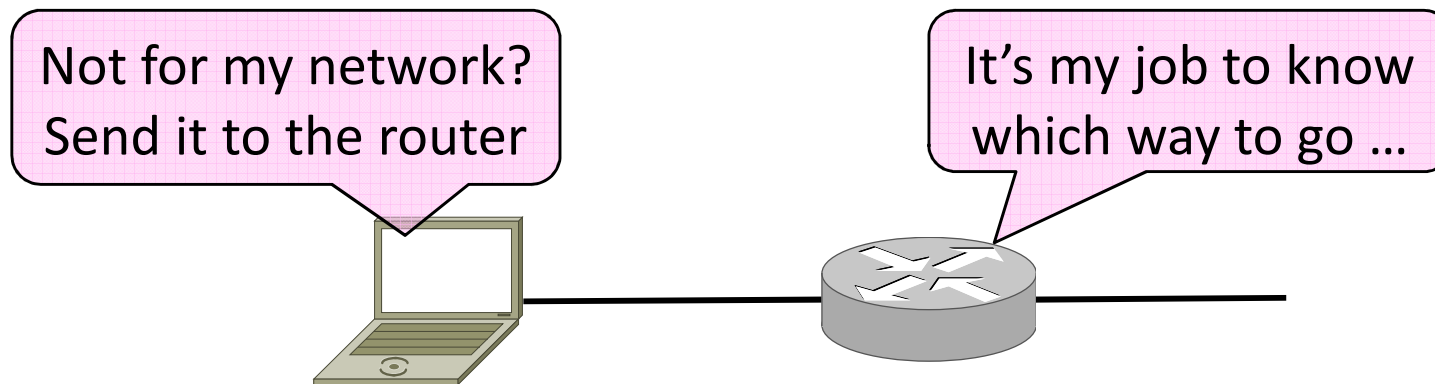
Prefix	Next Hop
192.24.0.0/18	D
192.24.12.0/22	B

#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

all IP



# Flexibility of Longest Matching Prefix

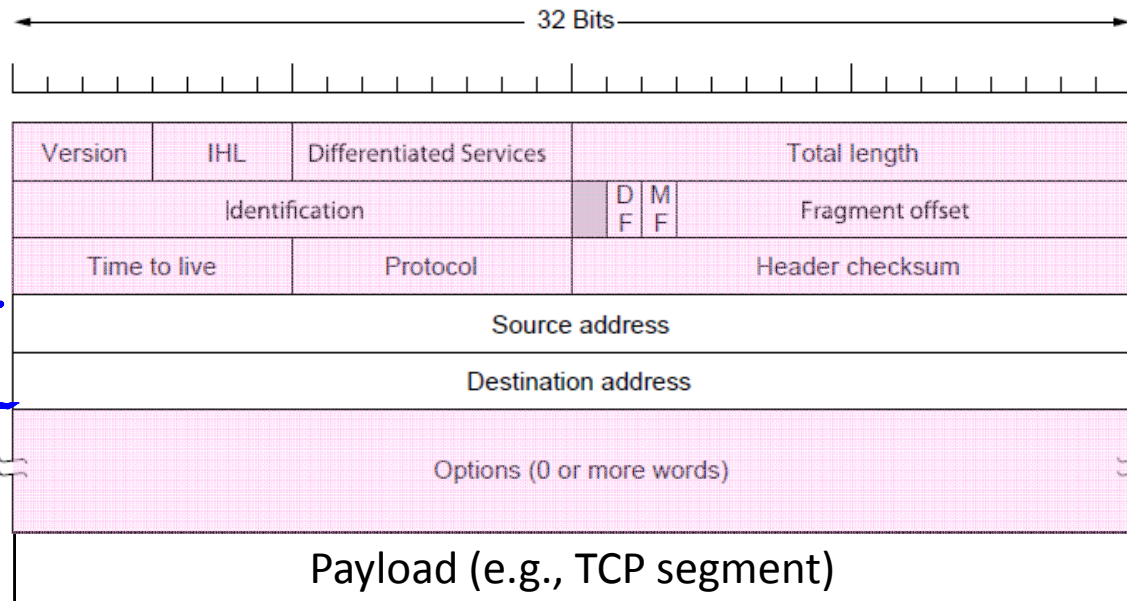
- Can provide default behavior, with less specific prefixes
  - ➔ To send traffic going outside an organization to a border router
- Can special case behavior, with more specific prefixes
  - ➔ For performance, economics, security, ...

# 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 manage network
- Handle various options

Coming  
later

# END

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