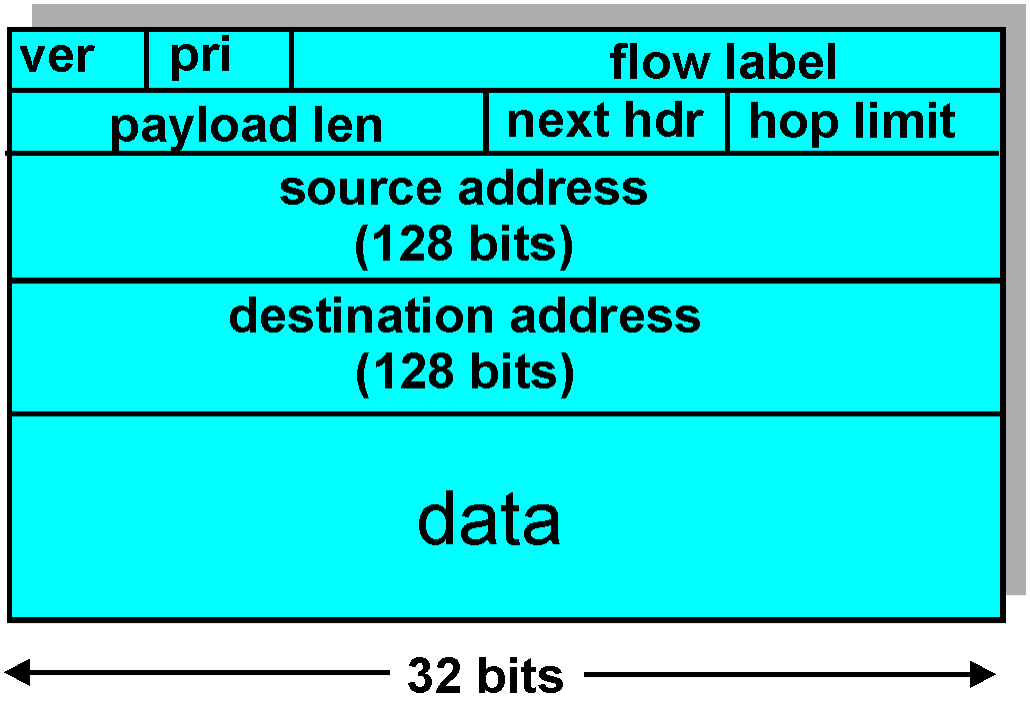
IPv6

- Initial motivation: 32-bit address space completely allocated by 2008.
- Additional motivation:
  - header format helps speed processing/forwarding
  - header changes to facilitate QoS
  - new "anycast" address: route to "best" of several replicated servers
- IPv6 datagram format:
  - fixed-length 40 byte header
  - no fragmentation allowed

IPv6 Header (Cont)

Priority: identify priority among datagrams in flow
Flow Label: identify datagrams in same "flow."
(concept of"flow" not well defined).
Next header: identify upper layer protocol for data



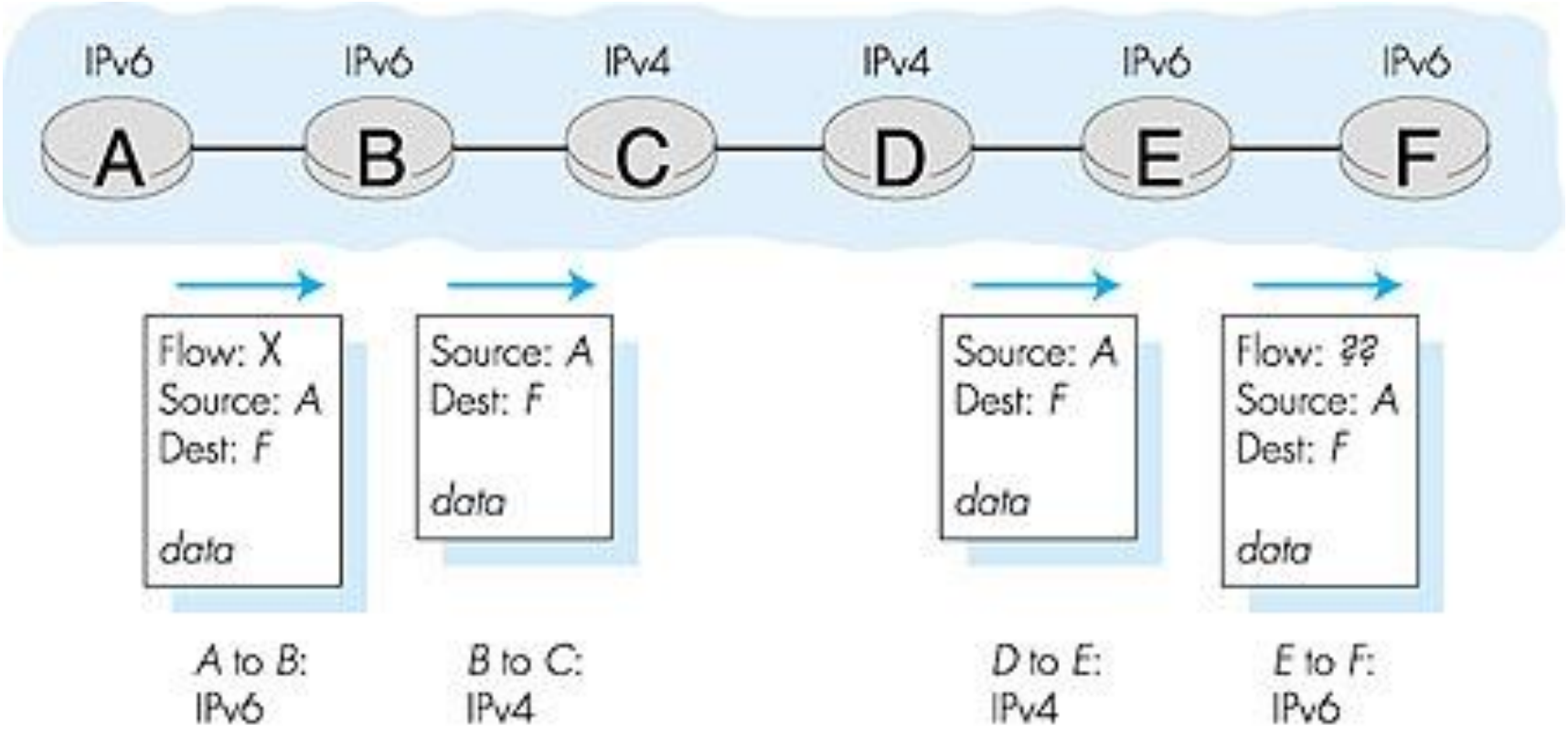
Other Changes from IPv4

- *Checksum:* removed entirely to reduce processing time at each hop
- *Options:* allowed, but outside of header, indicated by "Next Header" field
- *ICMPv6:* new version of ICMP
  - additional message types, e.g. "Packet Too Big"
  - multicast group management functions

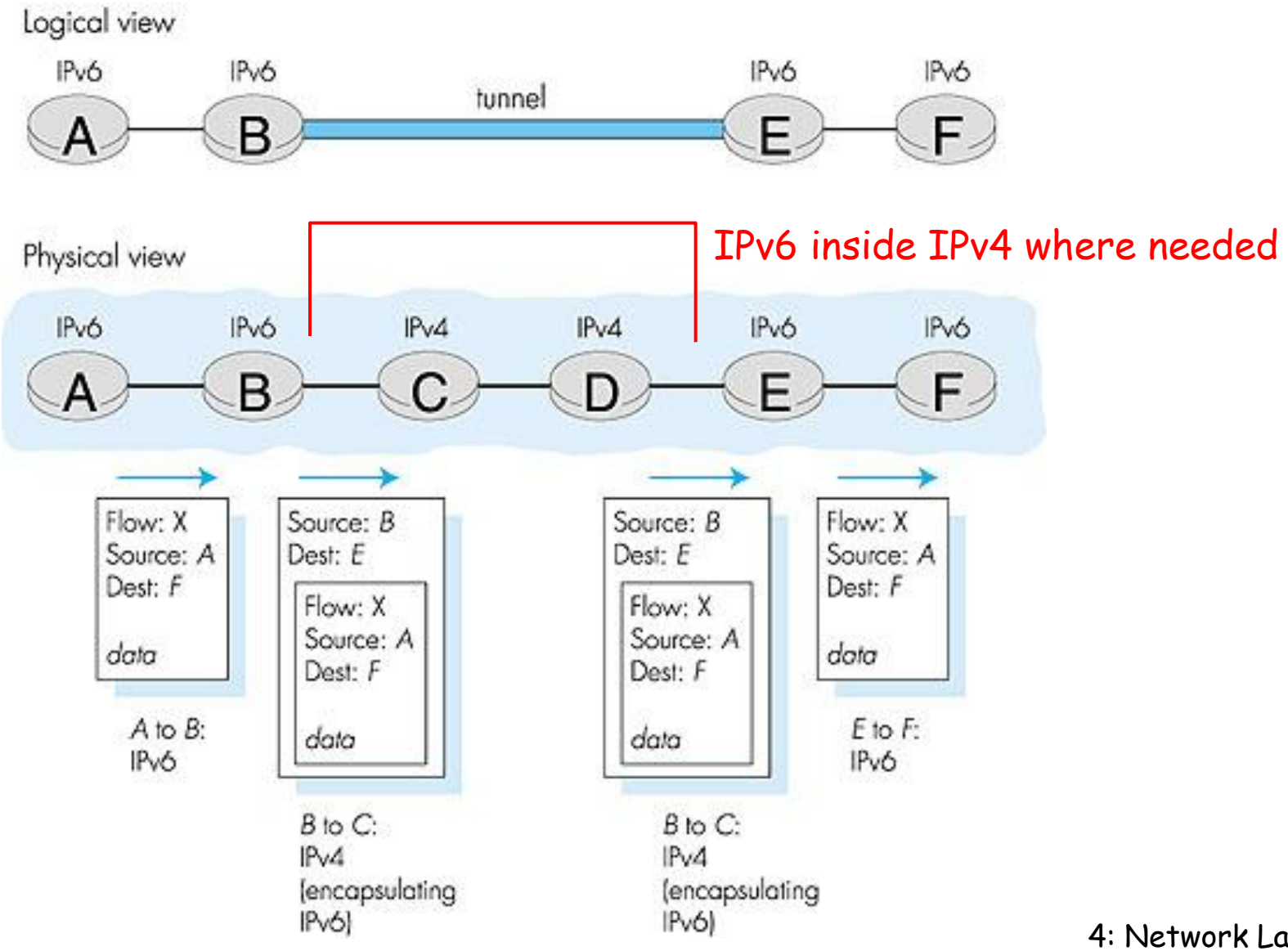
Transition From IPv4 To IPv6

- Not all routers can be upgraded simultaneous
  - no "flag days"
  - How will the network operate with mixed IPv4 and IPv6 routers?
- Two proposed approaches:
  - *Dual Stack*: some routers with dual stack (v6, v4) can "translate" between formats
  - *Tunneling:* IPv6 carried as payload n IPv4 datagram among IPv4 routers

Dual Stack Approach



Tunneling


Logical view
IPv6
IPv6
tunnel
IPv6
IPv6
A
B
E
F
Physical view
IPv6 inside IPv4 where needed
IPv6
IPv6
IPv4
IPv4
IPv6
IPv6
A
B
C
D
E
F
Flow: X
Source: A
Dest: F
data
A to B:
IPv6
Source: B
Dest: E
Flow: X
Source: A
Dest: F
data
B to C:
IPv4
(encapsulating
IPv6)
Source: B
Dest: E
Flow: X
Source: A
Dest: F
data
B to C:
IPv4
(encapsulating
IPv6)
Flow: X
Source: A
Dest: F
data
E to F:
IPv6

Network Layer: summary

What we've covered:

- network layer services
- routing principles: link state and distance vector
- hierarchical routing
- IP
- Internet routing protocols reliable transfer
  - intra-domain: RIP, OSPF
  - inter-domain: BGP
- what's inside a router?
- IPv6

Next stop: the Data link layer!