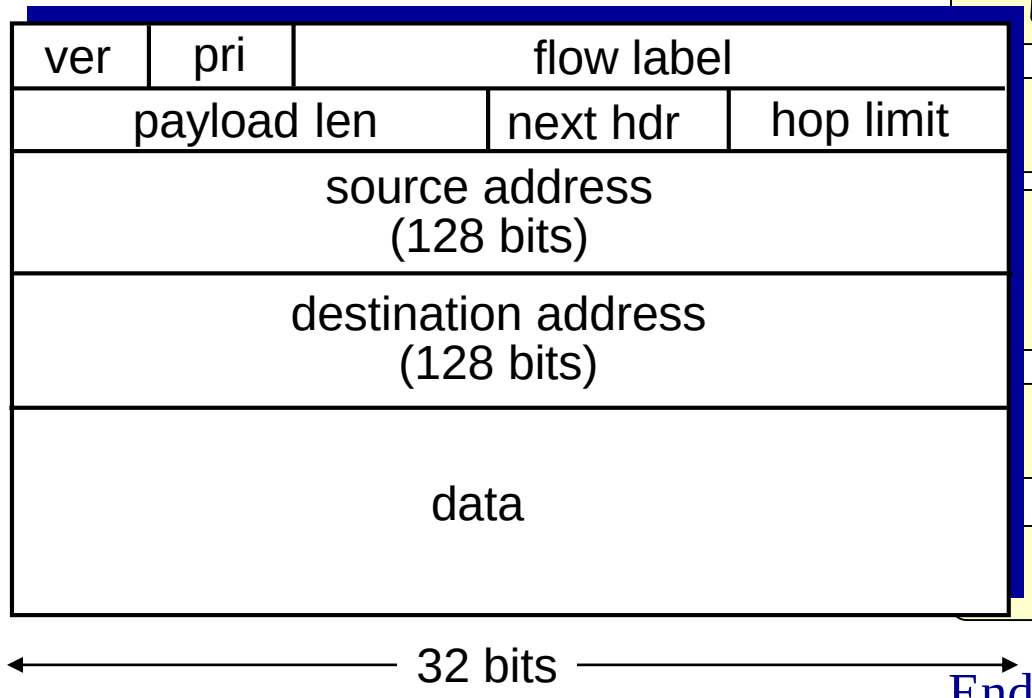
IPv6: Motivation

- initial motivation: 32-bit address space soon to be completely allocated.
- additional motivation:
  - header format helps speed processing/forwarding
  - header changes to facilitate QoS

IPv6 datagram format:

- fixed-length 40 byte header
- no fragmentation allowed --- hosts must perform path MTU discovery to learn about path MTU!

Simplified Design of IPv6



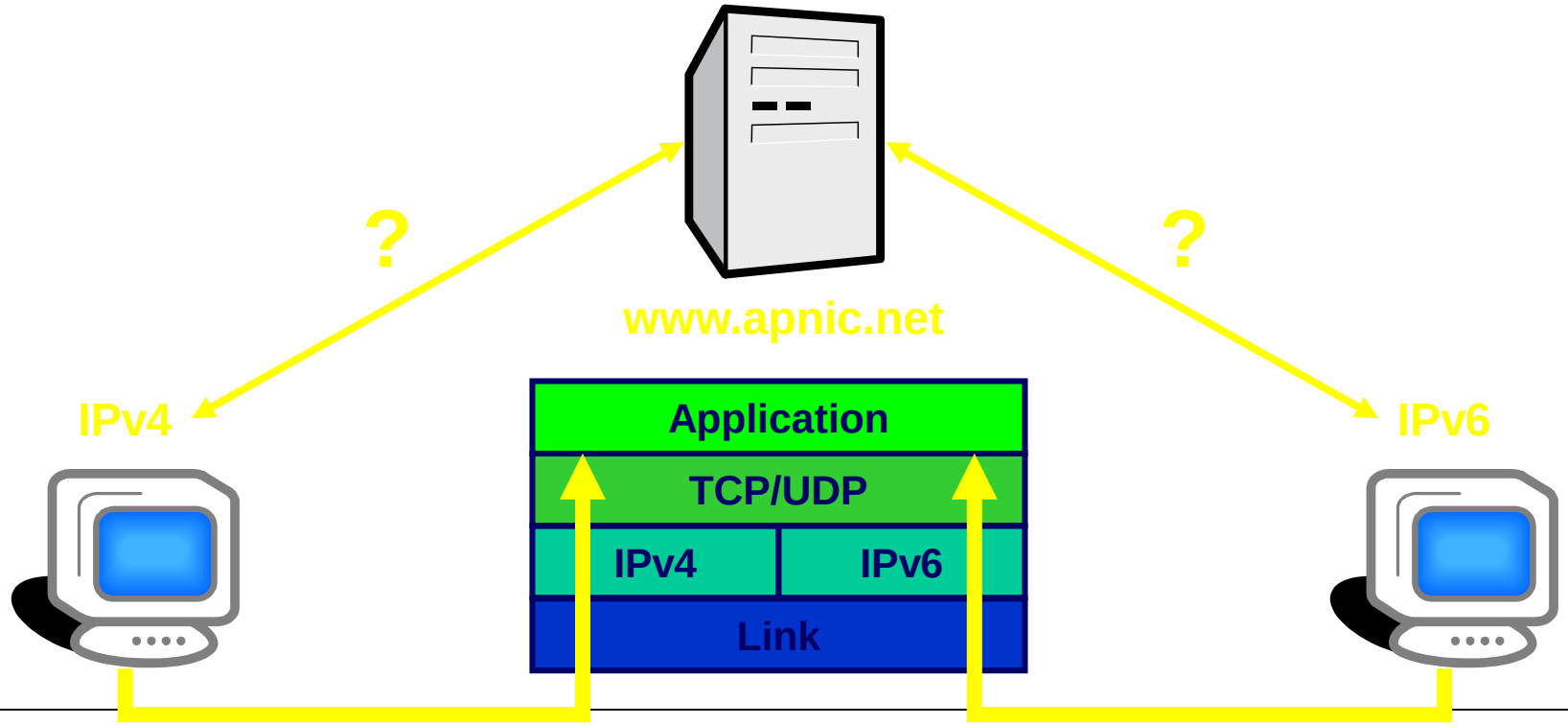
- Longer addressing space
- Fix size IP Header
- Can have one or more extension header fields
- No checksum operation
- No fragmentation

End hosts must perform *path MTU* discovery (using ICMP) per destination before sending any data!

2001:0db8:85a3:0000:0000:8a2e:0370:7334

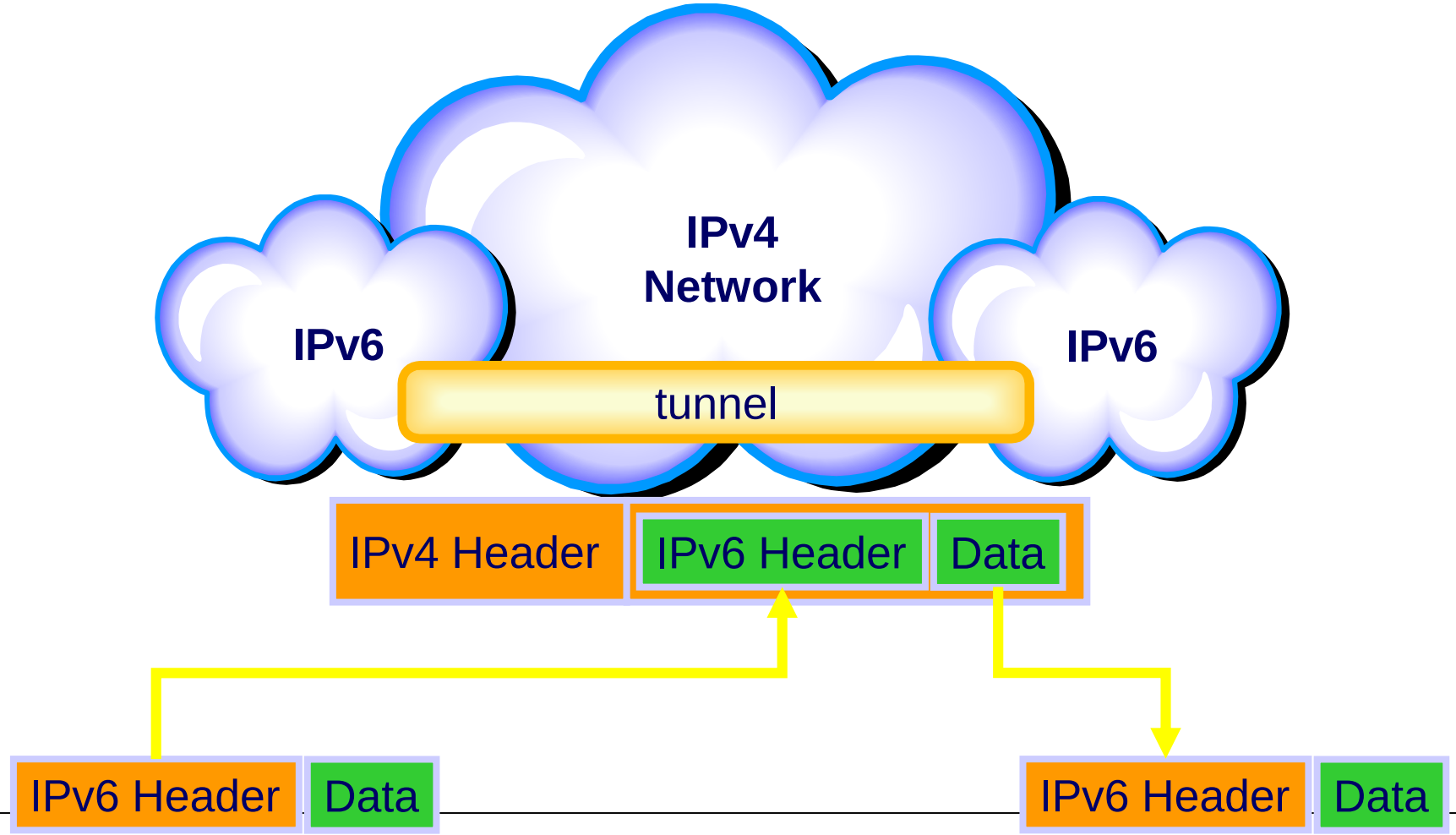
IPv6 Transition

- Dual stack hosts
  - Two TCP/IP stacks co-exists on one host
  - Supporting IPv4 and IPv6
  - Client uses whichever protocol it wishes



IPv6 Transition (cont'd)

- IPv6 tunnel over IPv4



Tunnels and "Network Virtualization" Techniques

- IPv6 tunnels over IPv4 provides an example of the general way that one type of networks can be used to support another type of networks to, e.g., support incremental deployment of a new protocol, accommodate the co-existence of multiple (heterogeneous) networks, or implement "network virtualization" (e.g., a "private network" running on top of a public Internet)
- IP-in-IP tunnels
  - IPv6-in-IPv4 tunnels or IPv4-in-IPv6 tunnels
  - IPv4-in=IPv4 tunnels, e.g., virtual private network (VPN)
- Virtual Circuits as tunnels in IP networks
  - e.g., MPLS (multiple protocol label switching) is often used to form virtual IP "links" (across multiple IP routers)
- VLAN (layer-2 virtual LAN); VxLAN (virtual LANs over UDP/IP)
- GRE, L2TP, and other tunnels; application-layer gateways; ……

Note: impact on MTU !