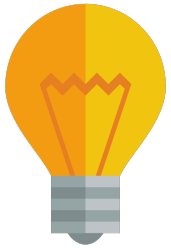
# Lesson 06-04:
# IPv6 and Generalized Forwarding

CS 356 Computer Networks

Mikyung Han

mhan@cs.utexas.edu

Internet Reference Model



| Example Protocols | | Responsible for |
|---|---|---|
| FTP, HTTP, SMTP | Application | application specific needs |
| TCP, UDP | Transport | process to process data transfer |
| IP | Network | host to host data transfer across different network |
| Ethernet, WiFi | Link | data transfer between physically adjacent nodes |
| 802.3 PHY | Physical | bit-by-bit or symbol-by-symbol delivery |



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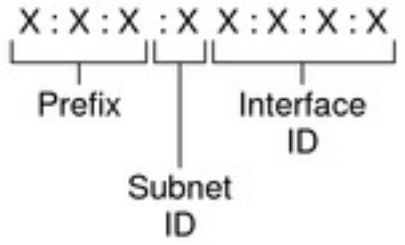
# Outline

1. IPv6

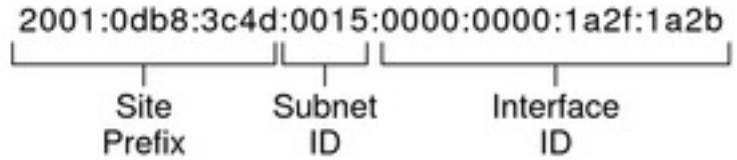
# Motivation: IPv4 addresses are being exhausted!

- Let's try to reuse within local network: NAT
- Let's use longer IP address: IPv6
  - x4 longer: 128 bits
  - And let's do some other improvements such as performance/security

# IPv6 address example




Example:



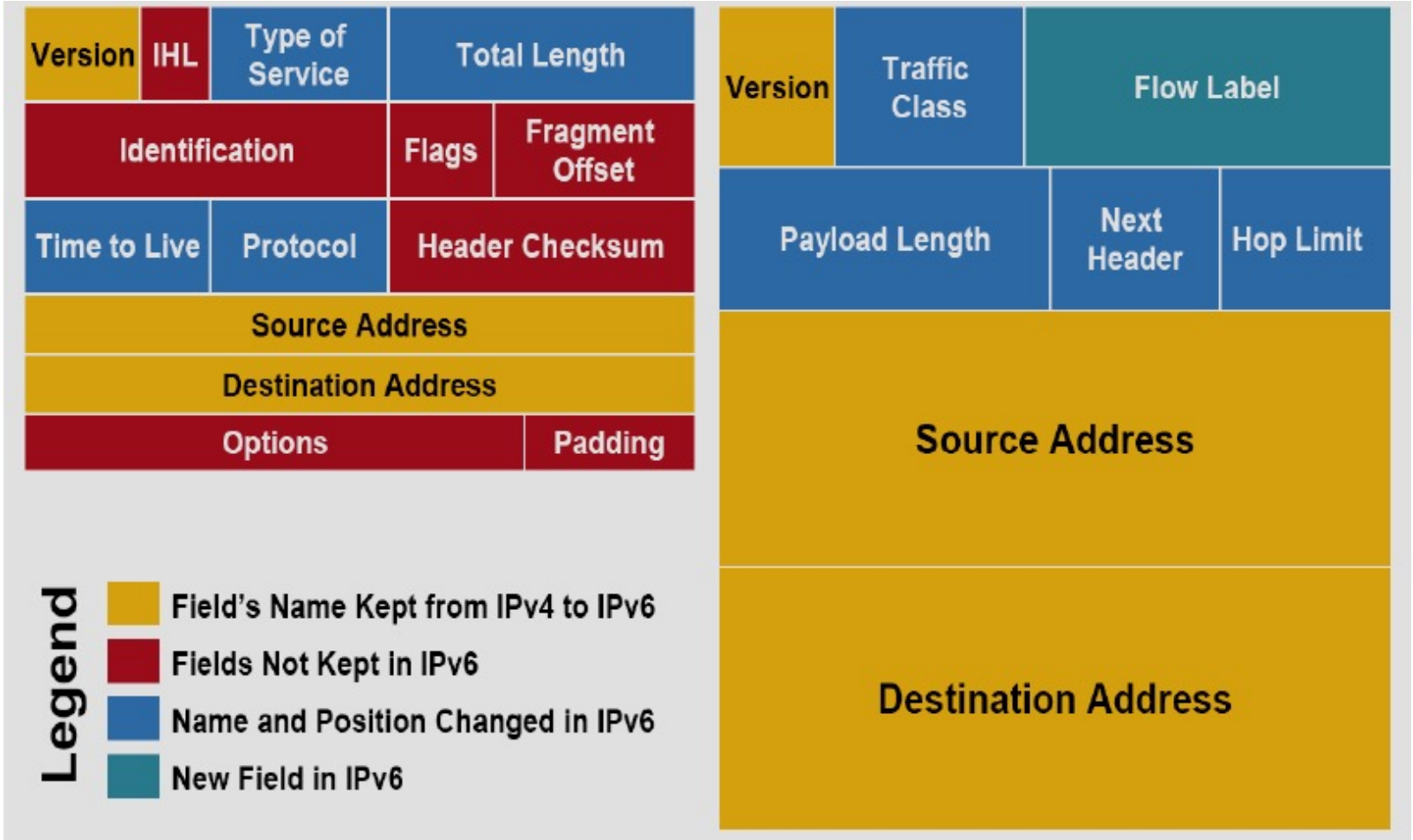

- Each x is a hextet
- Site prefix: public topology (allocated by ISP)
- Subnet ID: private topology (internally set by org)
- Interface ID: automatically self-configured based on MAC address

# IPv4 vs IPv6 comparison

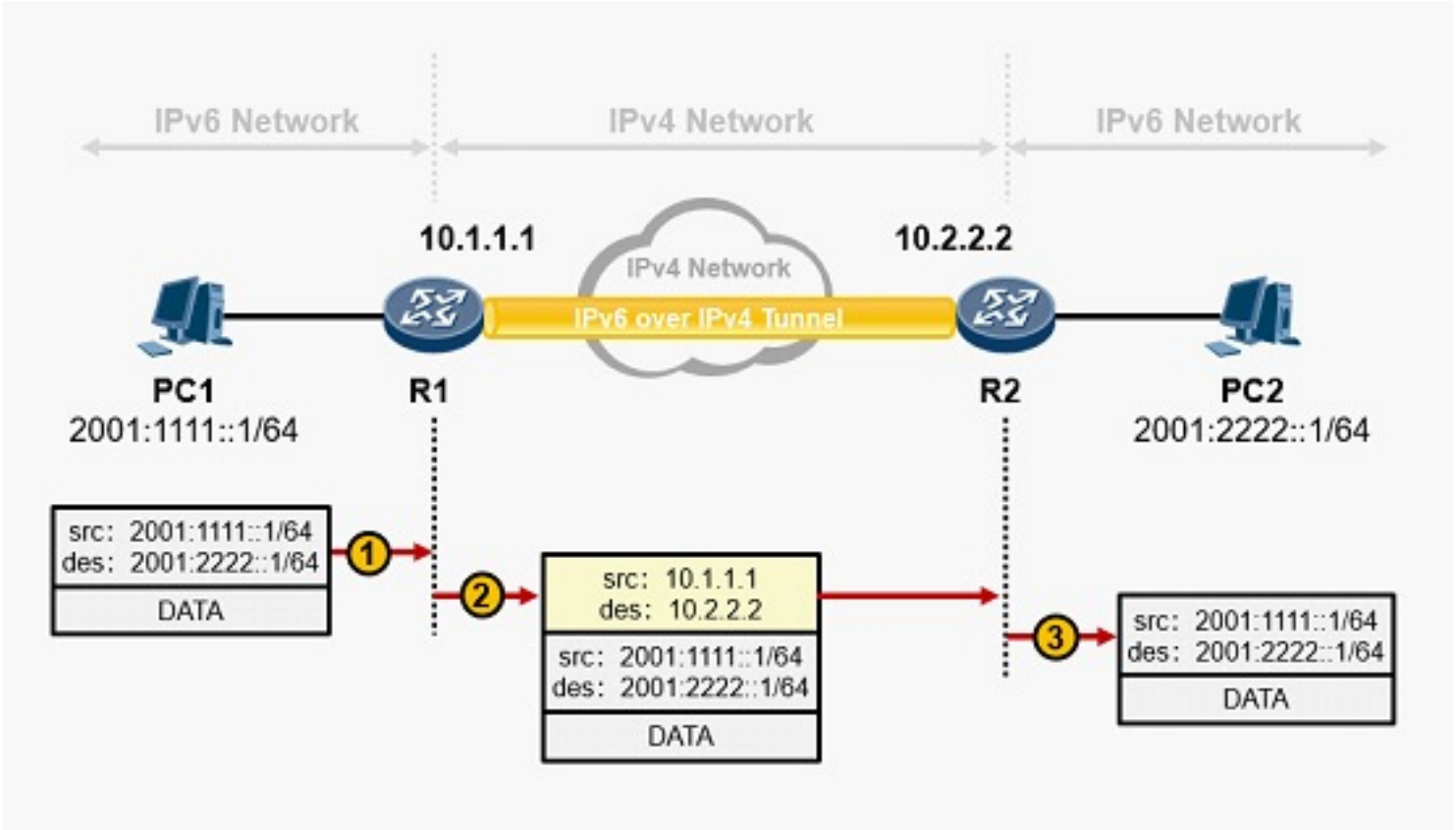
| | IPv4 | IPv6 |
|---|---|---|
| Address | 32 bits | 128 bits |
| Packet Fragmentation | Routers and sending hosts | Sending hosts only |
| Flow Identification | No identification of flow for QoS | Contains Flow Label field for QoS purpose |
| Checksum | Yes | No |
| Broadcast | Yes | No |
| Multicast | Yes, via IGMP | Yes, via MLD |
| IPSec | Optional | Required |
| IP address configuration | Stateful auto-configuration via DHCP server | Stateless self auto-configuration (Self-generates address from the underlying data link layer address) |
| NAT | Yes | No need! |

# Header differences

## IPv4 vs IPv6



# IPv6 over IPv4 tunneling enables co-existence




Tunnel is implemented by encapsulating IPv6 datagram with IPv4

# Outline

1. IPv6
2. Generalized Forwarding

# Motivation: Why just destination? Why just forwarding?

- Let's generalize!
- Not destination based, but flow-based!
  - Look at headers from all layers (not just network layer)
  - Look at other parts in the headers
- Not just forwarding, but more actions!
  - Forward
  - Drop (firewall)
  - Modify (NAT)
  - Send to controller

# T/F GF can handle destination-based forwarding

- True and much more!

# Acknowledgements

Slides are adopted from Kurose' Computer Networking Slides