

# Networking Basics

Jin-Soo Kim (jinsookim@skku.edu)  
Computer Systems Laboratory  
Sungkyunkwan University  
<http://csl.skku.edu>



# Computer Networks



## ■ Network

- A **network** is a hierarchical system of boxes and wires organized by geographical proximity
  - LAN (local area network) spans a building or campus.
    - » Ethernet is most prominent example.
  - WAN (wide area network) spans country or world.

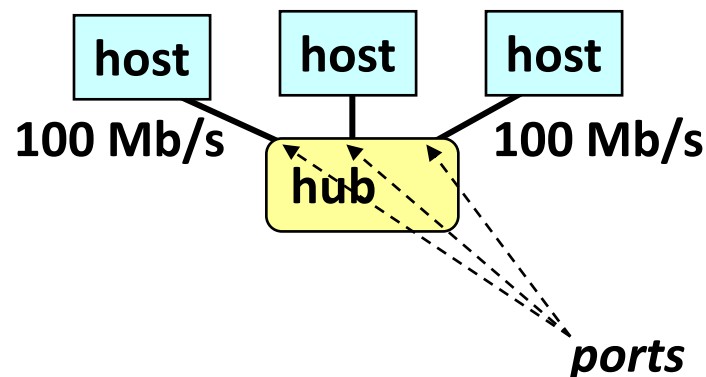
## ■ Internet

- An **internetwork** (internet) is an interconnected set of networks
  - The Global IP **I**nternet is the most famous example of an **i**nternet.

# Ethernet Segment

## ▪ Lowest level network

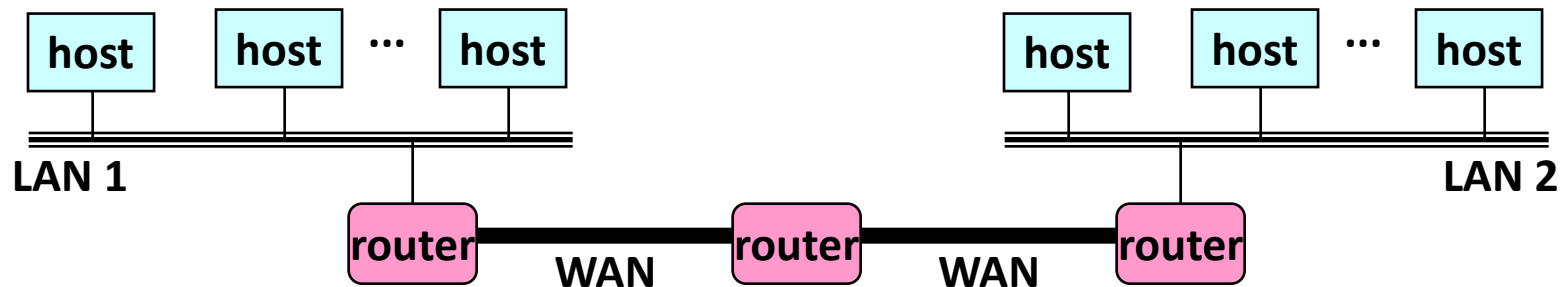
- Ethernet segment consists of a collection of **hosts** connected by wires (twisted pairs) to a **hub**.
  - Each Ethernet adapter has a unique 48-bit address.
  - Hosts send bits to any other host in chunks called **frames**.
  - Hub simply copies each bit from each port to every other port.
  - Spans room or floor in a building.



# Internetwork (internet)

## ▪ Networks of network

- Multiple incompatible LANs can be physically connected by specialized computers called **routers**.
- The connected networks are called an **internet**.



**LAN 1 and LAN 2 might be completely different,  
totally incompatible LANs (e.g., Ethernet and ATM)**

# Network Protocols (1)

## ▪ The notion of an internet protocol

- How is it possible to send bits across **incompatible** LANs and WANs?
- Solution: **protocol software** running on each host and router smoothes out the differences between the different networks.
- Implements an **internet protocol** (i.e. set of rules) that governs how hosts and routers should cooperate when they transfer data from network to network.
  - TCP/IP is the protocol for the global IP Internet.

# Network Protocols (2)

## ■ What does an internet protocol do?

- Provides a naming scheme
  - An internet protocol defines a uniform format for **host addresses**.
  - Each host (and router) is assigned at least one of these internet addresses that uniquely identifies it.
- Provides a delivery mechanism
  - An internet protocol defines a standard transfer unit (**packet**).
  - Packet consists of **header** and **payload**.
    - » Header: contains information such as packet size, source and destination addresses.
    - » Payload: contains data bits sent from source host.

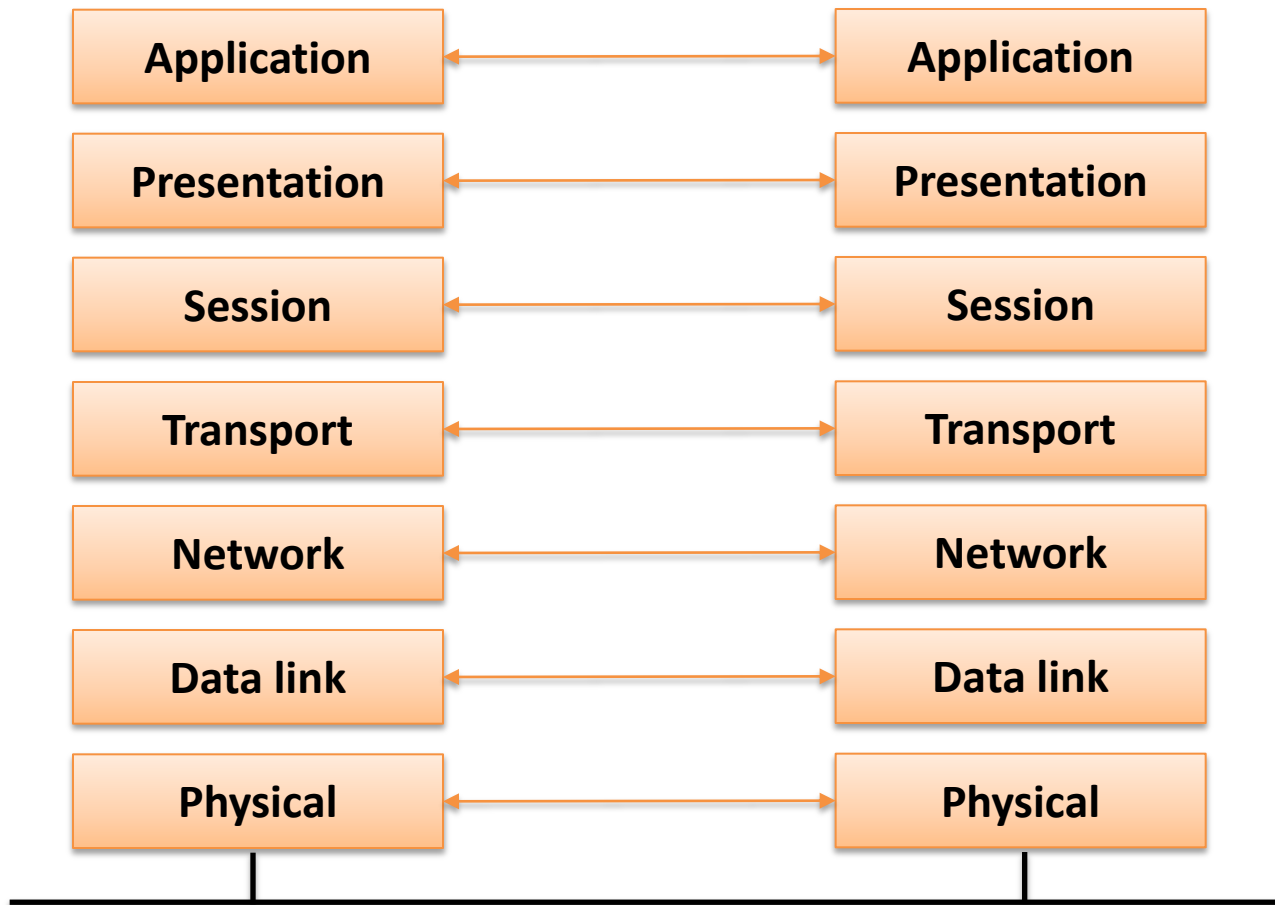
# Network Protocols (3)

## ■ Protocol layers: why layering?

- Explicit structure allows identification, relationship of complex system's pieces.
- Modularization eases maintenance, updating of system.
  - Change of implementation of layer's service transparent to rest of system
- Each layer abstracts the services of various lower layers, providing a uniform interface to higher layers.
  - Each layer needs to know how to interpret a packet's payload and how to use services of a lower layer
- Layering considered harmful?

# Network Protocols (4)

- OSI reference model





# Network Protocols (5)

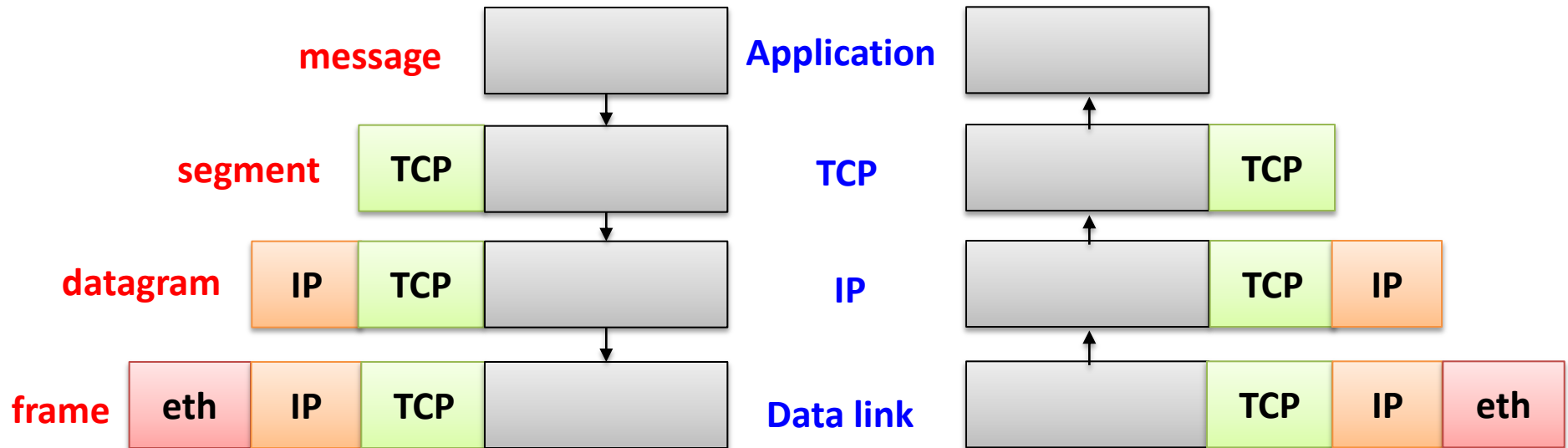


- **Application:**
  - Supporting network applications. (HTTP, SMTP, FTP, etc.)
- **Transport**
  - Process-to-process data transfer.
    - TCP, UDP
- **Network**
  - Routing of datagrams from source to destination.
    - IP, routing protocols
- **Data link**
  - Data transfer between neighboring network elements.
    - PPP, Ethernet
- **Physical**
  - Bits on the wire.

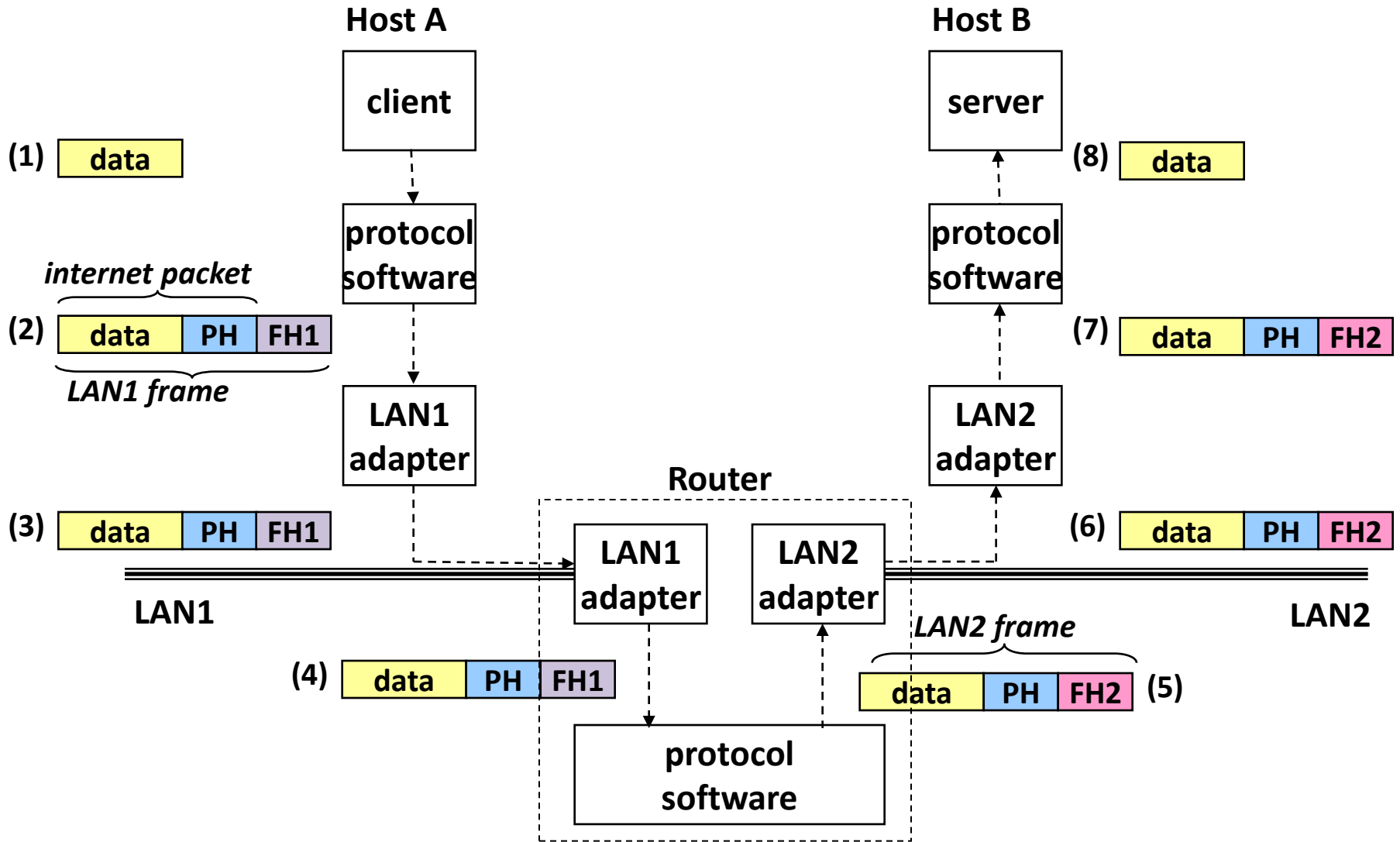
# Network Protocols (6)

## How do layers work?

- Layers do not look inside packet.
- If they need auxiliary information, attach a header to message on way down, strip on way up.



# Network Protocols (7)



# Network Protocols (8)

## ■ Other issues

- What if different networks have different maximum frame sizes?
- How do routers know where to forward frames?
- How are routers informed when the network topology changes?
- What if packets get lost?

- These (and other) questions are addressed by the area of systems known as “**computer networks**”.