Overview of Computers

Module-IV

Computer Networks

Contents

- Introduction to Computer Networks
- Networks and Types of Networks
- Protocol Layers
- Ethernet

Physical (Transmission) Media

- Physical media fall into two categories: **guided media** and **unguided media**.
- With guided media, the waves are guided along a solid medium, such as a fiber-optic cable, a twisted-pair copper wire, or a coaxial cable.

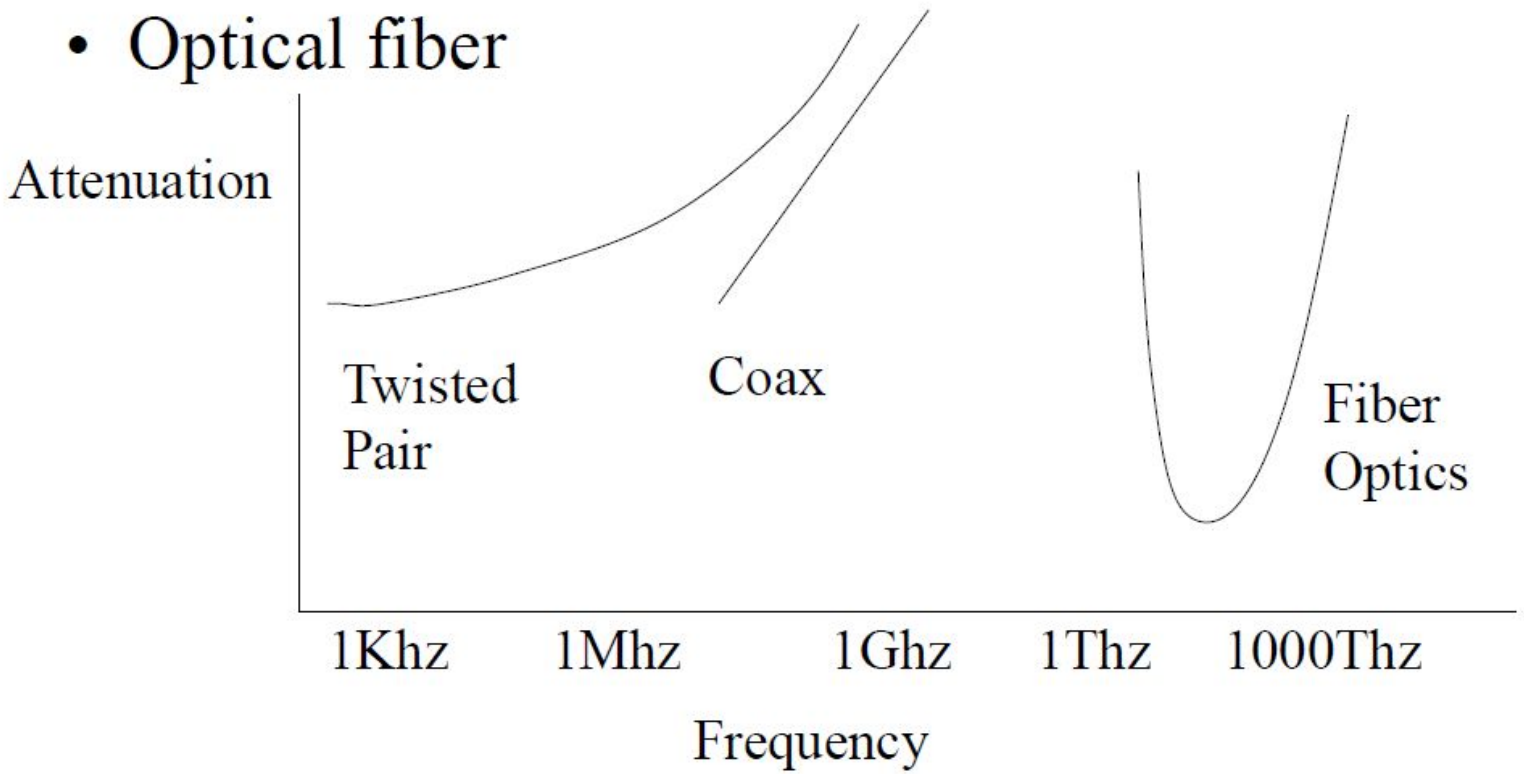
- With unguided media, the waves propagate in the atmosphere and in outer space, such as in a wireless LAN or a digital satellite channel.

Examples:

- HFC uses combination of fibre cable and coaxial cable.
- DSL and Ethernet use copper wires.
- Mobile access network uses radio spectrum
- Cost involved?

Guided Transmission Media

- Twisted Pair
- Coaxial cable
- Optical fiber



Twisted Copper Wire

Least expensive and most commonly used in home and work environments.

Unshielded Twisted pairs (UTP): used for computer networks within a building (LANs), ranges form 10 MBPS to 10GBPS. Suffers from external EM interference.

Shielded Twisted Pairs (STP): More expensive and harder to handle

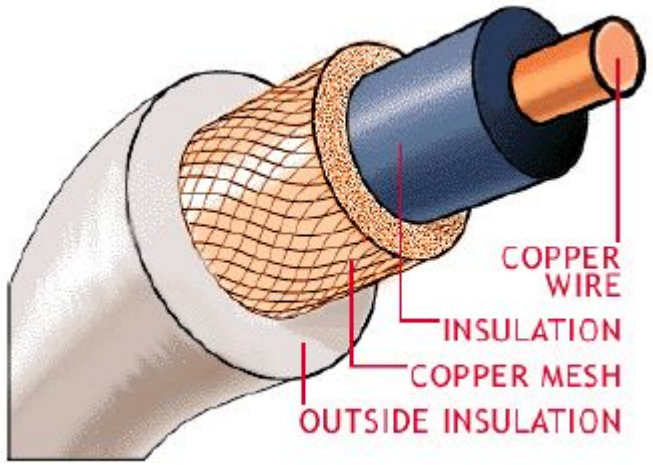
Coaxial Cable

Shielded and less susceptible to noise and attention than the twisted pair.

Applications:

Television distribution

Long distance telephone transmission



Fiber Optics

Have greater capacity

Smaller size and weight

Lower attenuation, not vulnerable to interference

Guided Media

Media	Network Type	Cost	Transmission Distance	Security	Error Rates	Speed
Twisted Pair	LAN	Low	Short	Good	Low	Low-high
Coaxial Cable	LAN	Mod.	Short-Mod	Good	Low	Low-high
Fiber Optics	any	High	Mod.-long	V. Good	V.Low	High-V.High

Unguided Media: Wireless transmission

- Transmission and reception via antenna!
- The characteristics of a radio channel depend significantly on the propagation environment and the distance over which a signal is to be carried Environmental considerations determine path loss and shadow fading.
- broadly classified into :
- Very short distance: spanning from ten to a few hundred meters
- Operate in the wide area, spanning tens of kilometers, cellular access technologies use wide-area radio channels
- wireless LAN technologies use local-area radio channels.

Network Software

- Protocol
  - Is an agreement between the communicating parties on how communication is to proceed.
  - Violation of protocol will make communication more difficult, if not completely impossible.

What's a protocol?

human protocols:

- "what's the time?"
- "I have a question"
- introductions

… specific msgs sent

… specific actions taken when msgs received, or other events

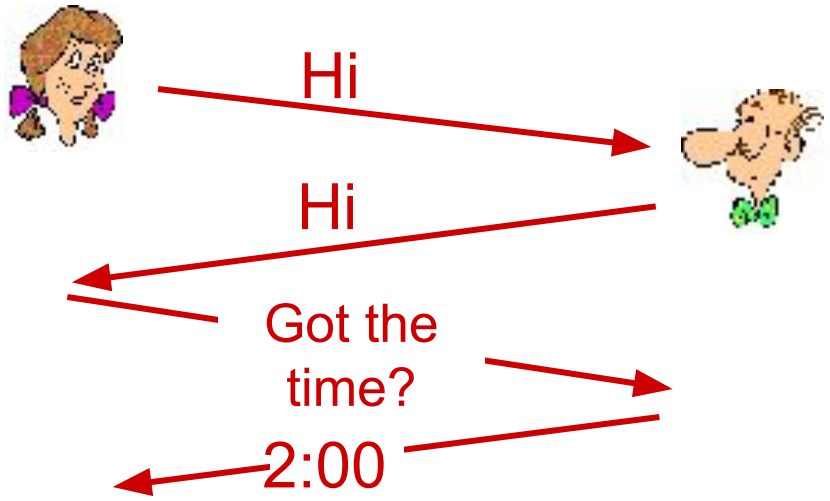
network protocols:

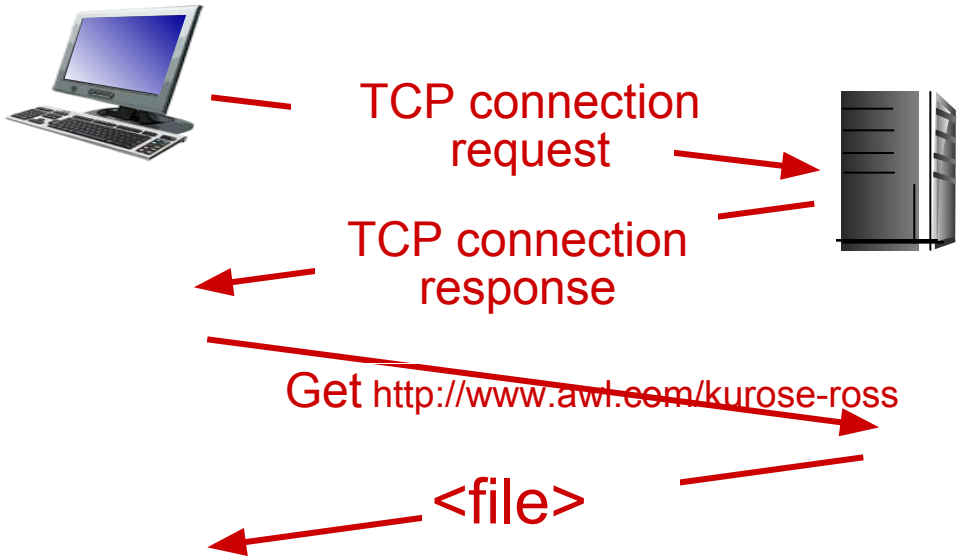
- machines rather than humans
- all communication activity in Internet governed by protocols

protocols define format, order of msgs sent and received among network entities, and actions taken on msg transmission, receipt

What's a protocol?

a human protocol and a computer network protocol:





tim
e

Q: other human protocols?

Protocol "layers"

Networks are complex, with many "pieces":

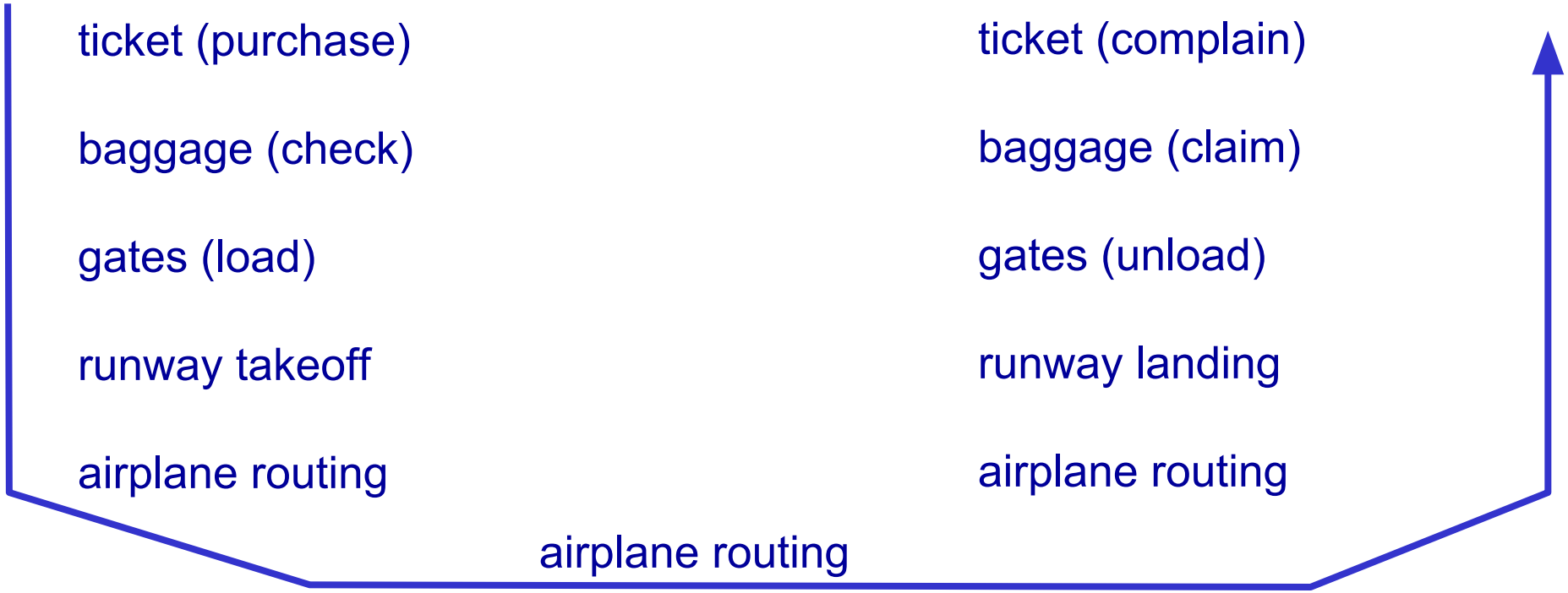
- hosts
- routers
- links of various media
- applications
- protocols
- hardware, software

Question:

is there any hope of *organizing* structure of network?

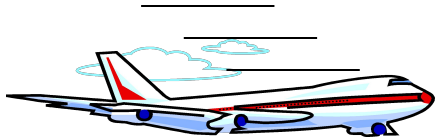
…. or at least our discussion of networks?

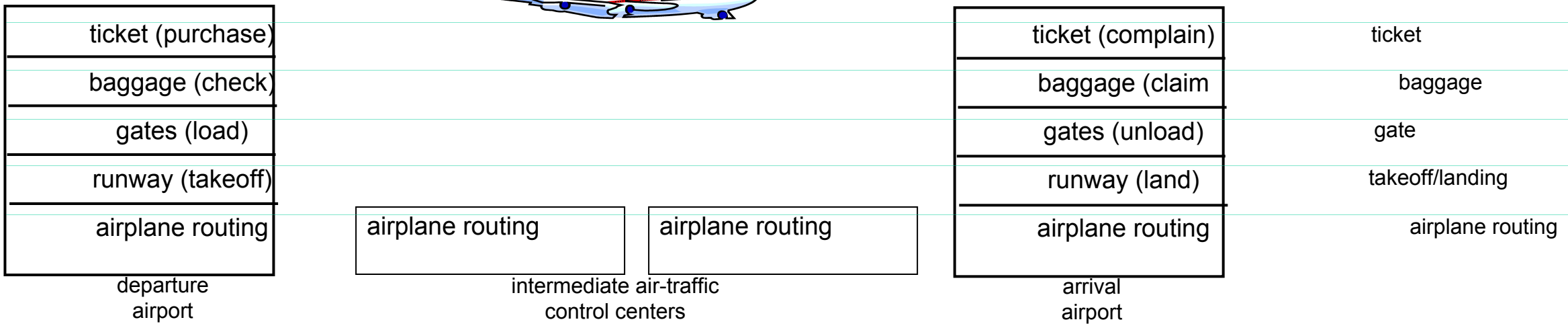
Organization of air travel



- a series of steps

Layering of airline functionality

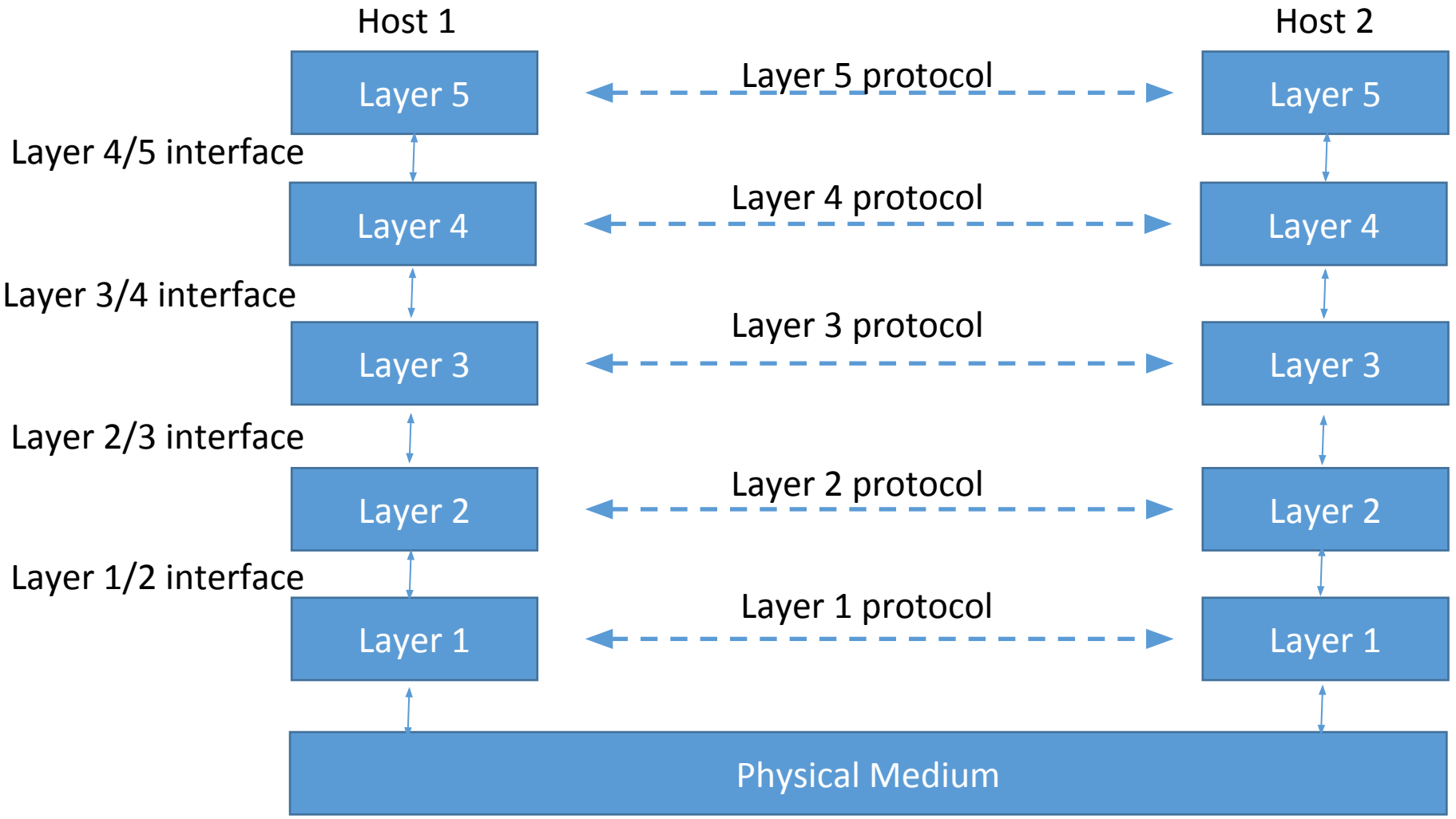




layers: each layer implements a service

- via its own internal-layer actions
- relying on services provided by layer below

Layers, protocols, and interfaces



Layered Network Architecture

Why Layered Architecture?

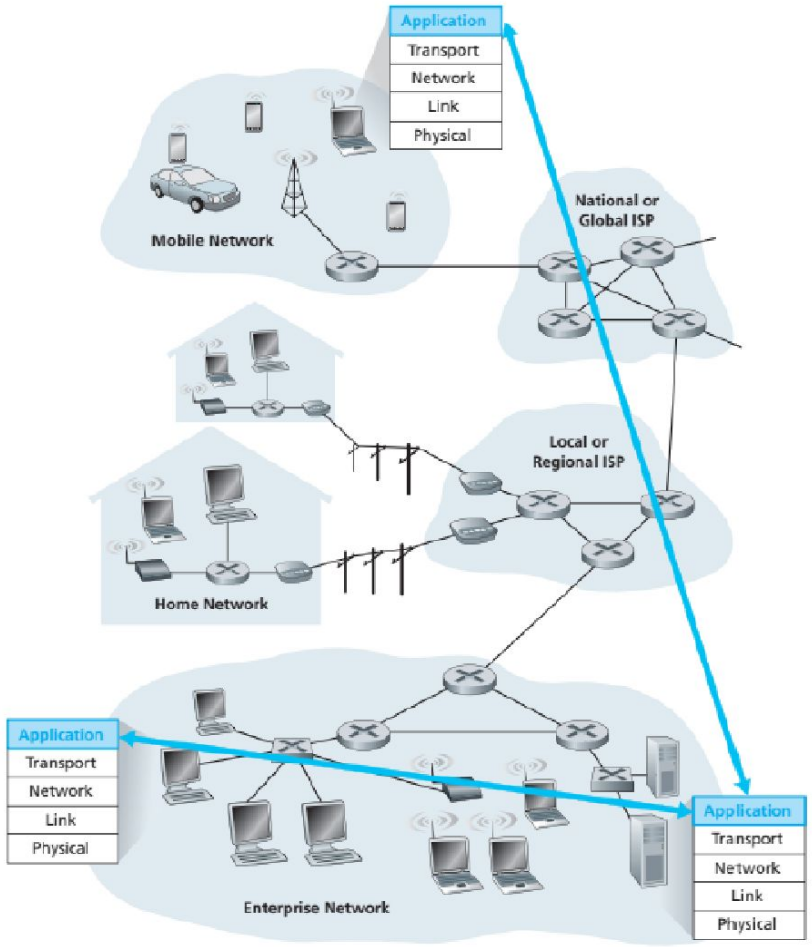
- Organizing a network is a big and complicated task.
- Divide and conquer
- Example: Organization of an institute
  - academic section
  - finance section
  - administration section
  - procurement section

Advantages of Layered Architecture

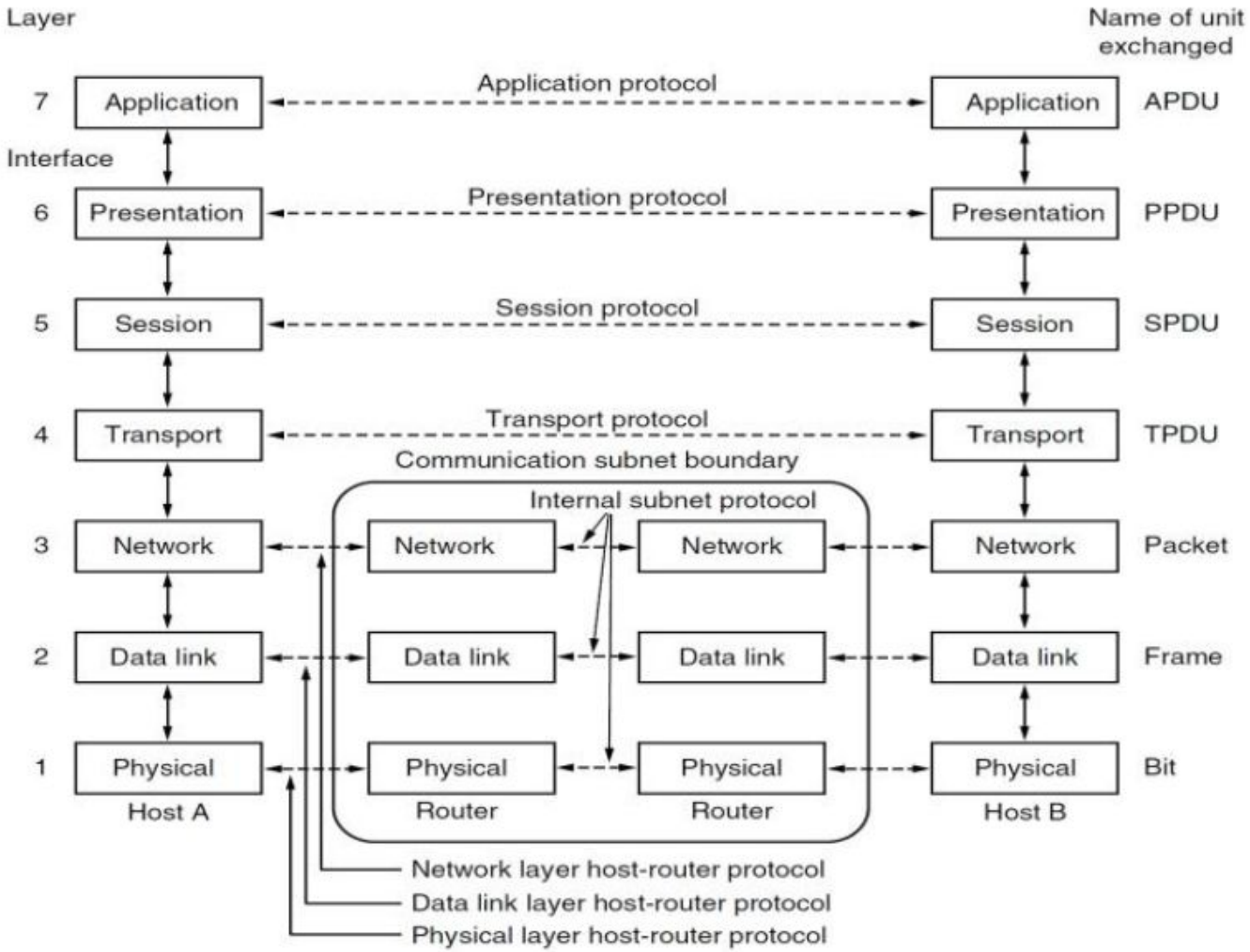
- Divide the design issues into small pieces.
- A layer provides a service (set of actions) to the immediate higher layer.
- New technologies can be adopted in a layer without affecting other layers.
- Each layer can be analysed and tested independently.

Open System Interconnection (OSI) Reference Model

- Developed by International Organization for Standardization (ISO)
- 7-layer model:
  - Application layer
  - Presentation layer
  - Session layer
  - Transport layer
  - Network layer
  - Data-link layer
  - Physical layer



Layers


Layer
Name of unit exchanged
7
Application
Application protocol
Application
APDU
Interface
6
Presentation
Presentation protocol
Presentation
PPDU
5
Session
Session protocol
Session
SPDU
4
Transport
Transport protocol
Transport
TPDU
Communication subnet boundary
Internal subnet protocol
3
Network
Network
Network
Network
Packet
2
Data link
Data link
Data link
Data link
Frame
1
Physical
Physical
Physical
Physical
Bit
Host A
Router
Router
Host B
Network layer host-router protocol
Data link layer host-router protocol
Physical layer host-router protocol

Application Layer

- Consists of user programs, network applications that does work at hand
- Examples:
  - File transfer, Remote login, Mail, Web access
- Protocols: FTP, Telnet, Simple Mail Transfer Protocol(SMTP), HTTP.

Presentation Layer

- Concerned with syntax and semantics of information transmitted
- Translation
- Encoding data: Data compression/conversion, encryption and decryption

Session Layer

- Allows to establish a session between peers
- Dialogue control: Session can allow bidirectional traffic or only unidirectional traffic.
- Token management: In some protocols, it is required that both sides do not attempt same operation at same time. Session layer provides tokens to perform such actions
- Synchronization: Pausing and resuming a download.

Transport Layer

- Connection-oriented services to applications
  - flow control
  - guaranteed delivery of messages to destination
- Ensures data delivery is
  - error-free
  - in sequence
  - no loss, duplication and corruption of packets

Network Layer

- Interface between host and network
- Routing
- Congestion and deadlock
- Internetworking

Data-Link Layer and Physical Layer

- Data-link layer
  - Takes packet from network layer and moves it to the next router
  - error-free delivery: computes error detection information
- Physical layer
  - Controls transmission into the network cable.
  - Defines electrical signals.

Internet Protocol Stack

- Application layer
- Transport layer
- Network layer
- Data-link layer
- Physical layer

Encapsulation

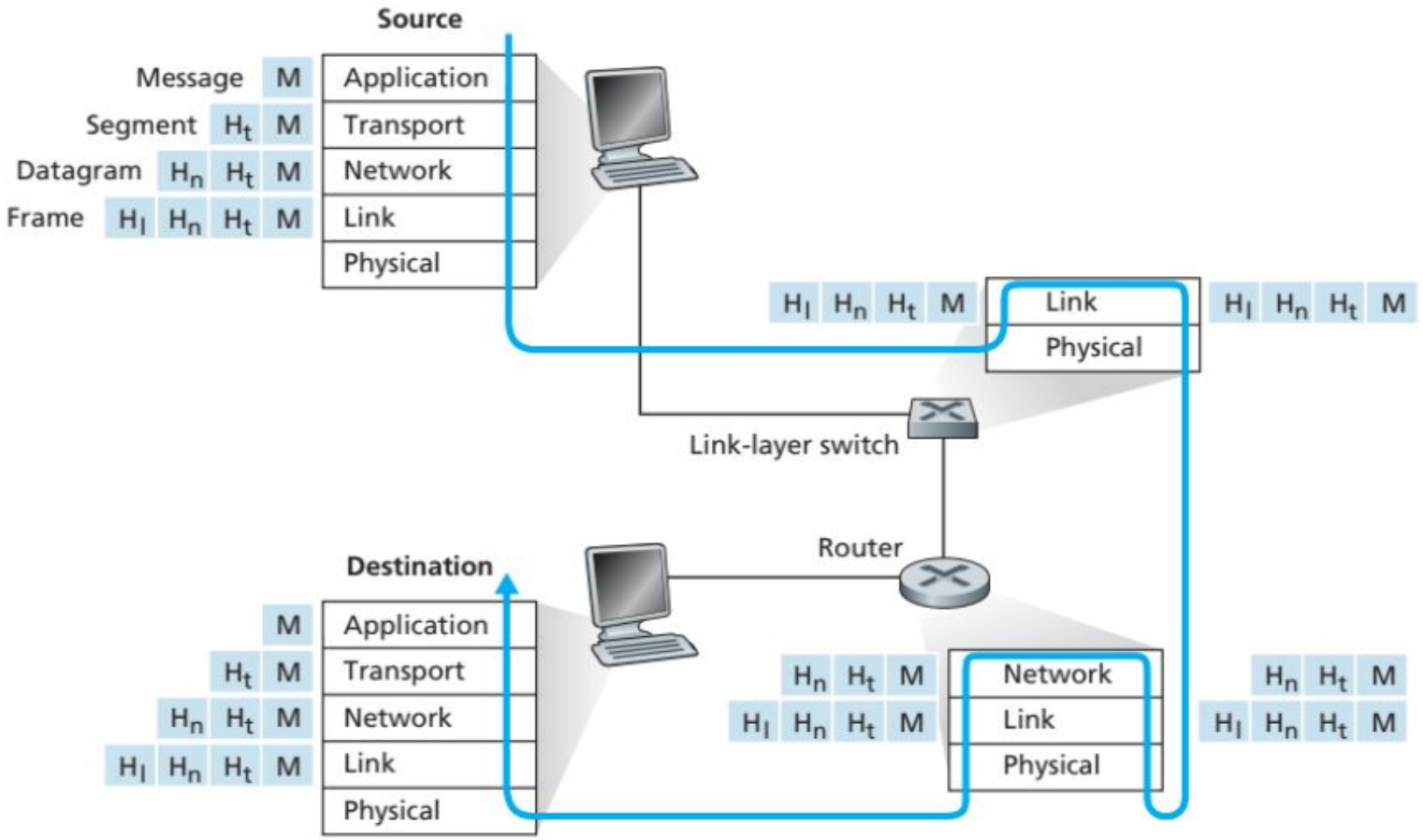


Figure 1.24 ♦ Hosts, routers, and link-layer switches; each contains a different set of layers, reflecting their differences in