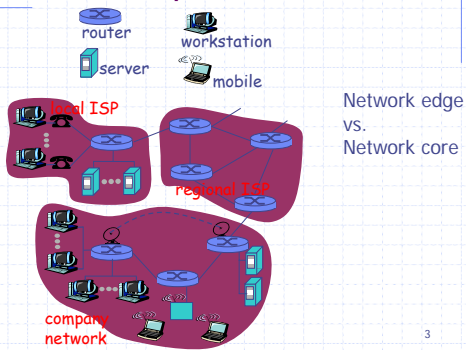# ECE453 - Introduction to Computer Networks

Lecture 1: Introduction

1

Computer Networks - Definition
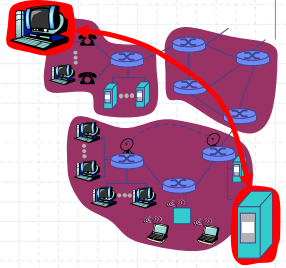
◆A collection of <u>autonomous</u> but <u>interconnected</u> computers

2

Hardware Component

router
workstation
server
mobile

local ISP

regional ISP
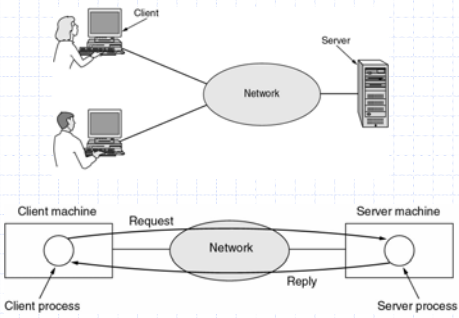
company network

Network edge vs. Network core

3

Network Edge

- end systems (hosts)
  - Client
  - Server
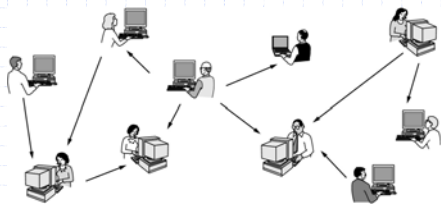- client/server model
- peer-peer model

4

Two Types of Communication Models – Client-Server Model

5

## Two Types of Communication Models – Peer-to-Peer Model

6

Network Core – Information Transmission

- Circuit switching
  - Telephone system
- Message switching
  - Mail delivery
  - The message travels as a complete unit. At any one time, it completely exists in one place.
- Packet switching
  - The Internet

7

Network Core: Circuit Switching

- Reserved bandwidth
- Call setup required
  - Call setup packet
  - Along the path, reserve bandwidth on the router
  - All later traffic will follow the fixed route
- Guaranteed performance
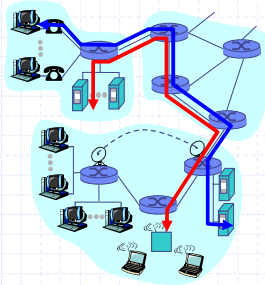
8

Network Core: Packet Switching

- Data stream are divided into *packets*
- Each packets use *whole* bandwidth
- No resource is reserved beforehand
- Each packet is transmitted in *store-and-forward* fashion, one hop at a time

Sending host   Router   Subnet   Receiving host

Sending process   Packet   Router C makes a choice to forward packets to E and not to D   Receiving process
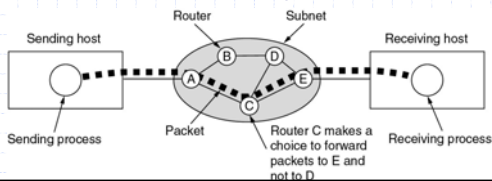
9

How to Classify Networks – 1

- By transmission technology
  - Broadcast links
    - Broadcasting
    - Multicasting
    - LAN
  - Point-to-point links
    - Unicasting
    - WAN

10

How to Classify Networks - 2

- By scale

Interprocessor distance	Processors located in same	Example
1 m	Square meter	Personal area network
10 m	Room	Local area network
100 m	Building	
1 km	Campus	
10 km	City	Metropolitan area network
100 km	Country	Wide area network
1000 km	Continent	
10,000 km	Planet	The Internet

11

How to Classify Networks - 3

- By wireless or wired
  - Wireless vs. mobile

Wireless	Mobile	Applications
No	No	Desktop computers in offices
No	Yes	A notebook computer used in a hotel room
Yes	No	Networks in older, unwired buildings
Yes	Yes	Portable office; PDA for store inventory

12

4

The Layered Design of Computer Network

13

Why Layered? (An Example)

Departing airport

| ticket (purchase) |
| baggage (check) |
| gates (load) |
| runway takeoff |
| airplane routing |

| ticket (complain) |
| baggage (claim) |
| gates (unload) |
| runway landing |
| airplane routing |

arriving airport

intermediate air traffic sites

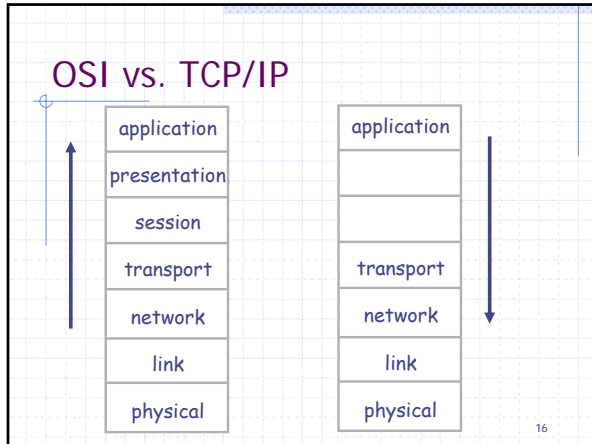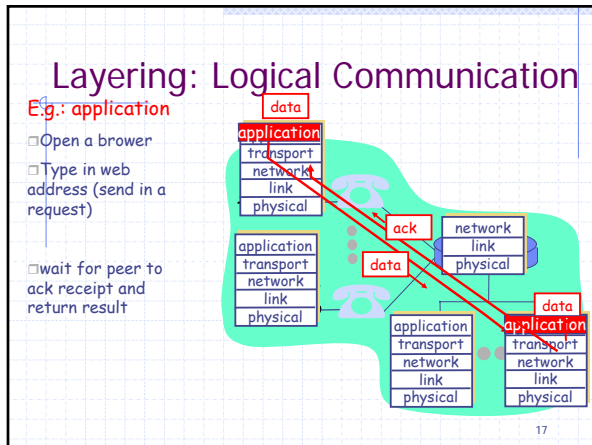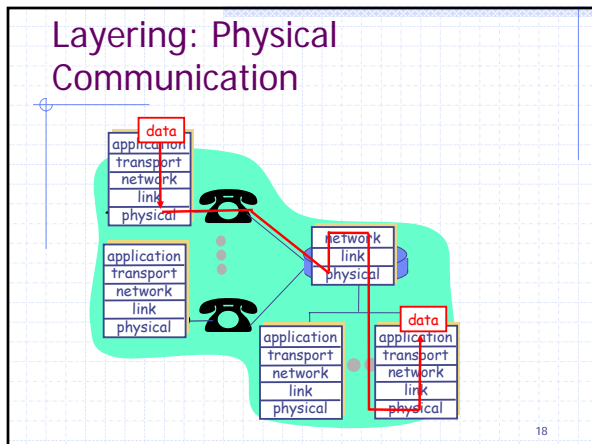| airplane routing | | airplane routing |

| airplane routing |

14

Why Layered Architecture?

To conquer complexity

◆ 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
   ▪ e.g., change in gate procedure doesn't affect rest of system

15

OSI vs. TCP/IP

application		application	
presentation			
session			
transport		transport	
network		network	
link		link	
physical		physical	

16

Layering: Logical Communication

E.g.: application

☐ Open a brower

☐ Type in web address (send in a request)

☐ wait for peer to ack receipt and return result

data

application
transport
network
link
physical

ack

data

network
link
physical

application
transport
network
link
physical

data

application
transport
network
link
physical

application
transport
network
link
physical

17

Layering: Physical Communication

data

application
transport
network
link
physical

network
link
physical

application
transport
network
link
physical

data

application
transport
network
link
physical

application
transport
network
link
physical

18

Three Concepts

- Services
- Interfaces
- Protocols

Host 1 | Host 2

Layer 5 — Layer 5 protocol — Layer 5

Layer 4/5 interface

Layer 4 — Layer 4 protocol — Layer 4

Layer 3/4 interface

Layer 3 — Layer 3 protocol — Layer 3

Layer 2/3 interface

Layer 2 — Layer 2 protocol — Layer 2

Layer 1/2 interface

Layer 1 — Layer 1 protocol — Layer 1

Physical medium
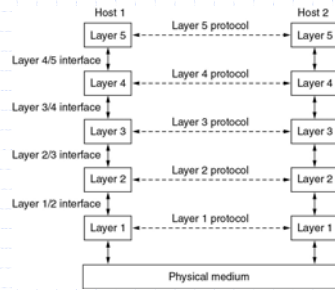
19

Primary Services Provided in Each Layer

- Application (end system)
  - Client/server paradigm
  - Application layer protocol design
- Transport layer (end system)
  - Reliable data transfer service
  - Congestion control
  - Multiplexing/demultiplexing service
- Network layer
  - Routing
  - addressing
- Link layer
  - Error correction
  - addressing
  - Flow control
- Physical layer

20