Computer Networks

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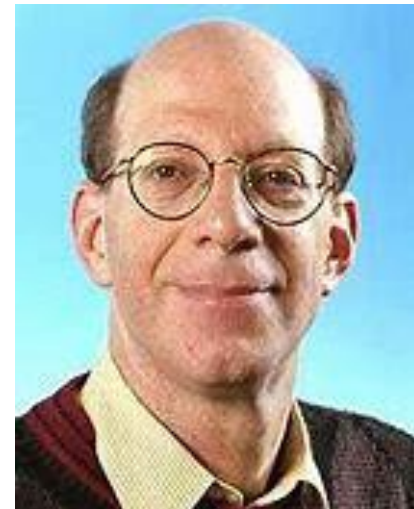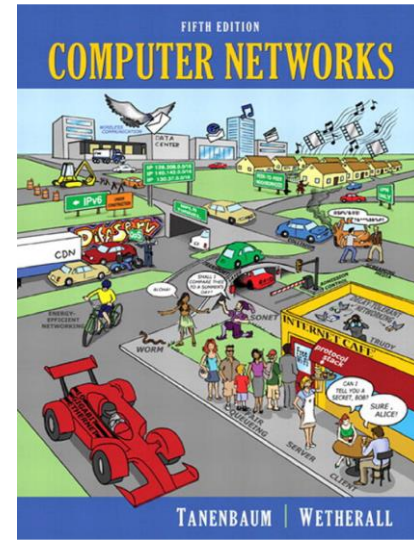
教学安排

■ 教材：Chapter 1-7

◆ Computer Networks, Andrew S.Tanenbaum, 机械工业出版社，2016
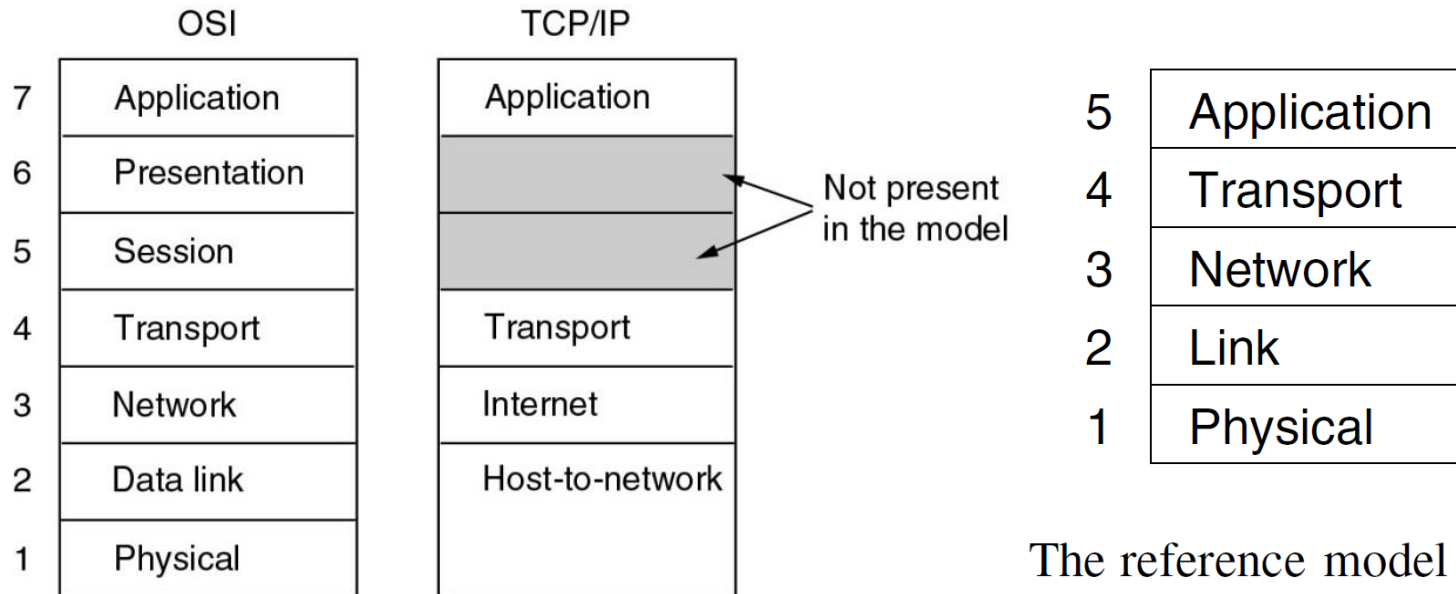
■ 成绩考核

◆ 课后作业(10%)

➢ 雨课堂平台提交（**须截止时间前完成**）

◆ 实验成绩（25%）

➢ 协议分析实验(10%)

➢ 协议设计及实现实验(15%)

◆ 期中考试：5%

◆ 期末考试：60%

教学内容

- **教材：Chapter 1-7**
  - ◆ Computer Networks, Andrew S.Tanenbaum,机械工业出版社，2016

OSI	TCP/IP	
7 Application	Application	5 Application
6 Presentation	(Not present in the model)	4 Transport
5 Session	(Not present in the model)	3 Network
4 Transport	Transport	2 Link
3 Network	Internet	1 Physical
2 Data link	Host-to-network	
1 Physical		

The reference model used in this book.

Chapter 1
Introduction

1. 计算机网络的概念与应用

Outline

- *What is a Computer Network?*
- What can we do with Computer Networks?
- Categories of Computer Networks
- Network architecture and protocols
- Reference Models
- Example Networks
- Network Standardization

What is a Computer Network?

a group of interconnected computers

This involves...

- **What can be connected?**
  - ◆ Computers, PADs, Smart phones, Home appliances, Sensors, *Anything?*

- **How to connect?**
  - ◆ 直接相连 or 需要中转（中转设备：HUB or Router）

- **What kind of links?**
  - ◆ 有线（Wired） or 无线（wireless）
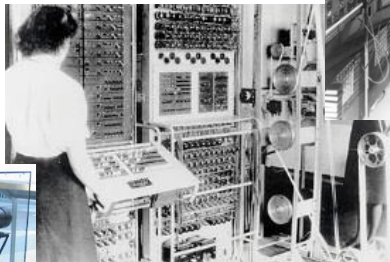
- **How far can be reached?**
  - ◆ 相邻几个房间（LAN），一个省/国家内（WAN）
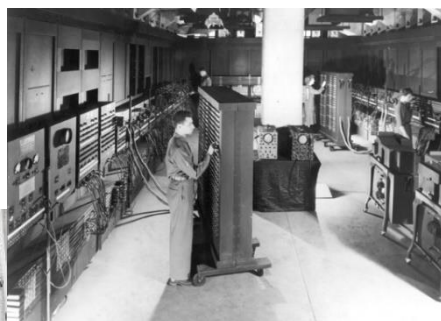
    or 全球（Internet/因特网）

Review of History(1)

1969:
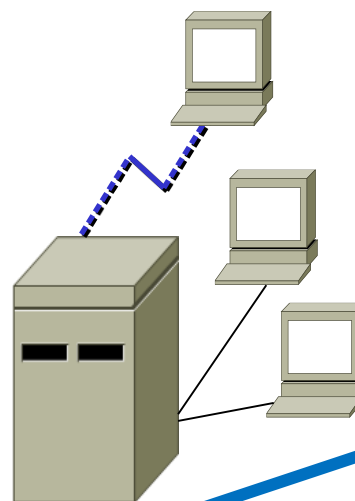**APARNet**
计算机网络

1960s:
联机系统
（主机带终端）

1946: ENIAC
(by Mauchly+
Eckert)

第一台通用
电子计算机

终端：有键盘和显示器，
没有处理能力，不能独立
工作

1943-1945:
Colossus
巨人计算机

不能存储
程序

1942:
ABC

阿塔纳索夫-贝瑞计算机

不可编程

Review of History(2)

	1970s	1980s	1990s	2000s	2010--
网络应用 Applications	E-mail BBS 文件下载 (文本传输)	WWW (1989) (超媒体)	电子商务 即时消息 (ICQ、QQ) BLOG	VoIP IPTV P2P 社交网络(Facebook) 自媒体(Twitter, 微博) 音乐视频分享 (Youtube) 团购网 云计算	移动社交 (微信) 互联网+ 共享经济 (共享单车/ 嘀嘀快车) 移动支付 (线下支付/ 外卖） 大数据 短视频
网络技术 Networks	数百台主机连接到ARPANet; TCP/IP协议开发	NSFNet→Internet, TCP/IP支持异构网, LAN	WiFi	传感网 物联网 (IoT)	
主机硬件 Hardware	大型主机	PC 掌上电脑	智能手机 (IBM,1993) 触屏式平板电脑		
带宽 Bandwidth	100kbps	1~10Mbps	10~100Mbps	1~10Gbps	100Gbps

Concepts may be Confused

■ Communication vs. Computer

◆ Communication: process of transferring information from one entity to another.(*wikipeida*)

◆ Computer: machine helping human beings to process information.

■ Distributed Systems vs. Computer Networks

■ Distributed Systems : A collection of independent computers appears to its users as a single coherent system（单一的系统）

■ Computer networks: A collection of autonomous(自主工作) computers interconnected by a single technology

Distributed System(分布式系统)

- **A single model or paradigm that it presents to the users**
    - Transparency(透明：不可见)
    - "The illusion that you have something as simple as a uniprocessor system."

- **A well-known example：the World Wide Web,**
    - everything looks like a document (Web page)

What is a Computer Network

- **Computer Network**
  - ◆ Users are exposed to the actual machines
  - ◆ If the machines have different hardware and different operating systems, that is fully visible to the users

- **However**
  - ◆ Some networks or parts of them (e.g., name services) are also distributed systems
  - ◆ every distributed system relies on services provided by a computer network

Computer Network is not

- **Internet**（因特网）
  - ◆ A network of networks
  - ◆ The unique global network

- **WWW**（万维网）
  - ◆ A distributed system (or an application) running on top of Internet

Outline

- **What is a Computer Network?**
- *What can we do with Computer Networks?*
  - ◆ *Business applications*
  - ◆ *Home applications*
  - ◆ *Mobile network users*
  - ◆ *Social Issues*
- **Categories of Computer Networks**
- **Network architecture and protocols**
- **Reference Models**
- **Example Networks**
- **Network Standardization**

Business Applications

■ Resource sharing

◆ Printers, scanners, documents，database, …

◆ Goal: make all programs, equipment, and especially data available to anyone on the network without regard to the physical location of the resource or the user

◆ Sharing information(data) is the most important

Client-Server Model

■A network with two clients and one server
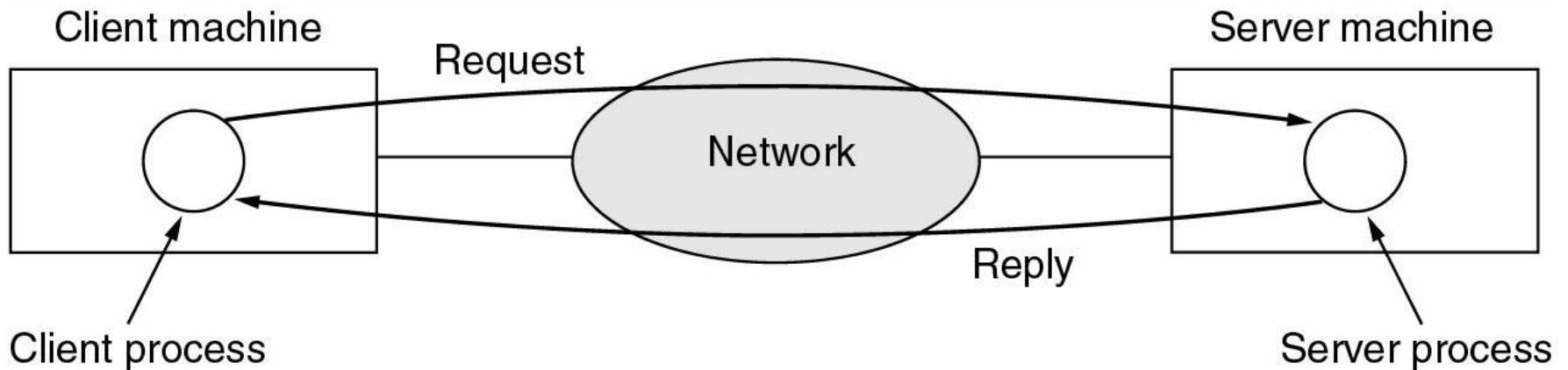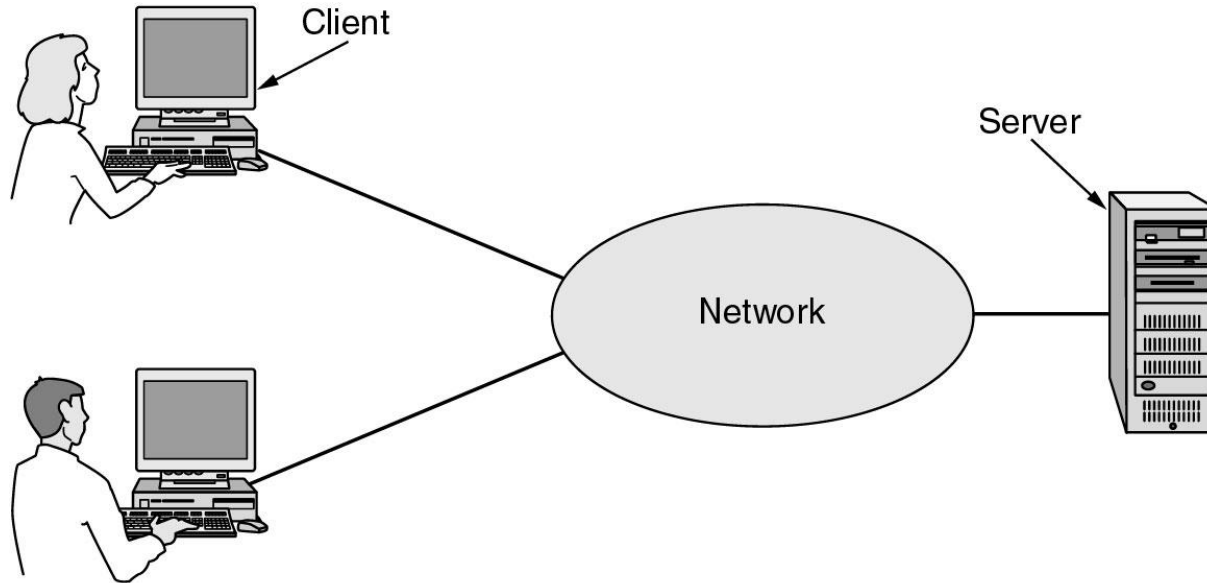
Business Applications

- **Communication** medium among employees
  - ◆ Email, VoIP, videoconferencing…
  - ◆ QoS
    - ◆ latency (or delay), jitter
    - ◆ bandwidth
    - ◆ bit-error-rate
- Electronic commerce
  - ◆ Airlines, bookstores, shopping carts,…
- ……

Home Applications

- **Access to remote information**
  - ◆ Web browsing
- **Person-to-person communication**
  - ◆ Instant messaging (QQ), social networks
- **Interactive entertainment(交互式娱乐)**
  - ◆ Game playing
- **Electronic commerce**
- **Ubiquitous computing(普适计算)**
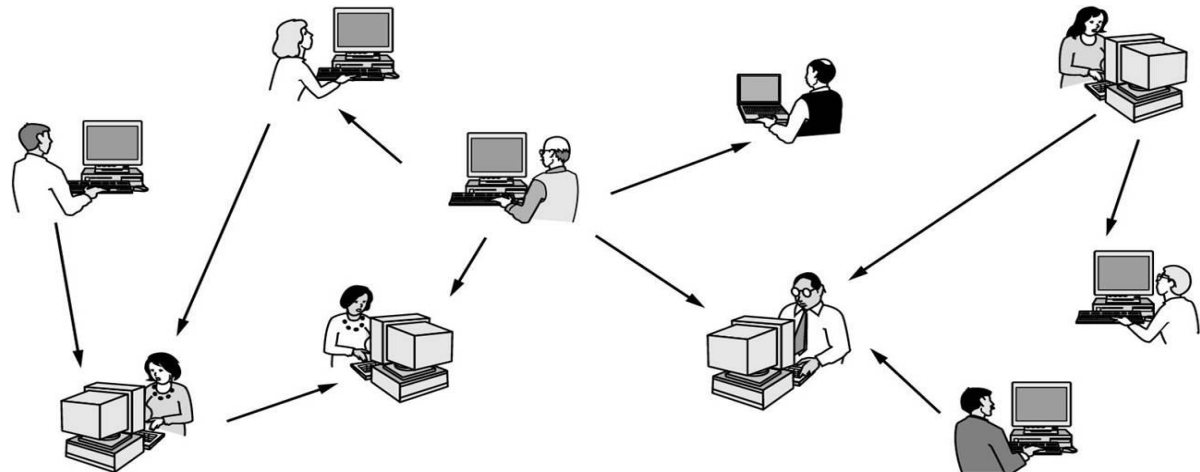
peer-to-peer(P2P) model

Mobile Network Users

- Combinations of wireless networks and mobile computing.

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

m-commerce(移动商务)

Mobile Network Users

- Portable office(移动办公)
- Vehicle communication: trucks, taxis, …, keeping in contact with each other and with home office
- Meter reading (远程抄表)
- RFID
- Sensor networks
- VANET
- …..

Usage of RFID: 智能餐盘

- 在餐盘底部植入**RFID**射频芯片
- 餐盘放到结算台的指定区域，可自动识别出价格
- 读写频率：**HF13.56MHz**
- 餐盘材质： 密胺
- 耐受温度：**260**℃
- 读写次数：**>10**万次

Social Issues

- Politics, religion, sex
- Eavesdropping(窃听)
- Credit card
- Unwanted communication (Spam, ...)
- Privacy