

# ECEN1012

# Computer Programming and Network Fundamentals

**Introduction**

**Instructor: HOU, Fen**

**2025**

# General Information

- Course ECEN1012
  - Venue and Time: Every Tuesday, Wednesday, and Friday
    - Tuesday 14:00 – 15:45 @ E4-G078
    - Wednesday 10:00 – 11:45 @ E12-G005
    - Friday 13:30 – 15:15 @ E12-G005
- Instructor: HOU, Fen (侯芬)
  - Email: [fenhou@um.edu.mo](mailto:fenhou@um.edu.mo)
  - Office: E11-3051
  - Office Hours:
    - Tuesday: 16:00-17:00
    - Wednesday: 15:00-16:00
- Assessment
  - Assignment, lab, quiz, and attendance: 40%
  - Mid-term: 30%
  - Final exam: 30%

# General Information (Cont'd)

- Textbook and References
  - J. F. Kurose and K. W. Ross, Computer Networking-A Top-Down Approach (5th edition). Addison Wesley Higher Education.
  - William Stalling, Data and Computer Communications (9<sup>th</sup> edition), Person Education Ltd.
  - AI Kelley and Ira Pohl, C By Dissection, (4th edition), Addison-Wesley Publishing Co. Inc.
  - Paul Editel and Harvey Deitel, C How to Program (8th edition), Pearson Education.

# Famous Figures in Computer Science

**Alan Turing** 艾伦·图灵 (1912 – 1954): Father of computer science and artificial intelligence.

Alan Turing



- A famous British mathematician and computer scientist.
- He did his undergraduate study major in Mathematics at the University of Cambridge, Cambridge, England, and Ph.D. at the Institute for Advanced Study in Princeton, New Jersey, USA.
- Award named after Alan Turing: since 1966, the ACM (Association of Computer Machinery) set up an annual prize- **Turing Award**, which is given for technical or theoretical contributions to the computer community. It is widely considered to be the computer world's Nobel Prize.

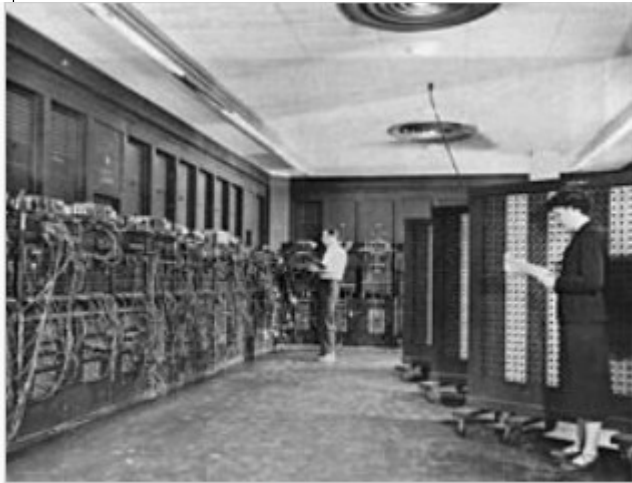
# John Von Neumann 约翰·冯·诺依曼 (1903 – 1957): a founding figure in Computer Science.



John von Neumann in the 1940s

- A greatest Hungarian-American scientist who made major contributions to a vast number of fields: **mathematics, computer science, economics, game theory**, etc.
- He wrote the report for the project EDVAC, which described a computer architecture in which the data and the program are both stored in the computer's memory (i.e., use the stored program). This architecture is the basis of modern computer design. He also designed the instruction set for the computer.
- John Von Neumann & Morgenstern, "**Theory of Games and Economic Behavior**" published in 1944 is the milestone in the history of game theory.

# History in the Development of Computer



ENIAC

- **ENIAC** (Electronic Numerical Integrator and Computer): **the first electronic general-purpose computer.**
- This project was led by two professors in the University of Pennsylvania, and the computer was announced in 1946 at a “Giant Brain” with 17468 vacuum tubes (电子管), 7200 crystal diodes (二极管), 1500 relays (继电器), 70000 resistors (电阻), 10000 capacitors (电容) and around 5 million hand-soldered joints (电路焊点). It weighted about **17 tons** and took up **167 square meter.**

# 1951, the EDVAC was built



EDVAC

- EDVAC (Electronic Discrete Variable Automatic Computer): One of the earliest electronic computers. Unlike its predecessor the ENIAC, it was binary rather than decimal, and was stored program computer.
- EDVAC was installed and began operation in 1951. **John Von Neumann** made a great contribution in the developments of EDVAC. For example, the part of logical design in the first draft of a report on the EDVAC was written by Neumann.
- It weighted about **7.8 tons** and took up **45.5 square meter**.

# 1981, IBM PC



IBM 5150 PC

- Philip Don Estridge (唐·埃斯特利奇): is known as the father of IBM PC due to his contribution in the development of original IBM personal computer.
- At August, 1981, the research group leaded by Estridge developed the first IBM PC model 5150 with CPU 8088 and floppy disk system, which is one of the most important event in the history of PC.
- Two years later they introduced the first IBM PC with an internal hard drive as a standard device.



# The Development of Computer

- 1G: Vacuum tube 电子管
- 2G: Transistor 晶体管
- 3G: SSI/ MSI (Small/Middle Scale Integration) 中小规模集成电路
- 4G: LSI/ VLSI (Large/Very Large-scale Integration) 大规模/超大规模集成电路
- 5G: ULSI (Ultra-large-scale Integration) 甚大规模集成电路

# Computer Network

- What is Network?
- What is Computer Network?
- Classification of Networks
- Layered Architecture

# Network

- Network: a network is a collection of entities that exchange information or goods.
  - The nervous system of a human being is a network that facilitates the movement of information to and from the brain to other parts of the body.
  - A railway system, transportation system, phone lines...

# Computer Network

- Computer Network: a collection of **autonomous** computers **interconnected** by a single technology.
- **Autonomous**: it means that no computer can start, stop or control another computer connected to the network.
- **Interconnected**: two computers are said to be interconnected if they are able to exchange information. Their connection can be via different ways such as a copper wire, Fiber optics, microwaves, infrared, and communication satellites, radio, etc.

# Computer Network

- A computer network exchanges information between computers.
- Computer networks come in different **sizes**, **topologies**, etc.
- The Internet is a network of computer networks.

# Network Classification by Size

- PAN (Personal Area Network)
- LAN (Local Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)

1 m	Square meter	PAN
10 m	Room	LAN
100 m	Building	
1 km	Campus	
10 km	City	MAN
100 km	Country	WAN
1000 km or more	Continent, planet	

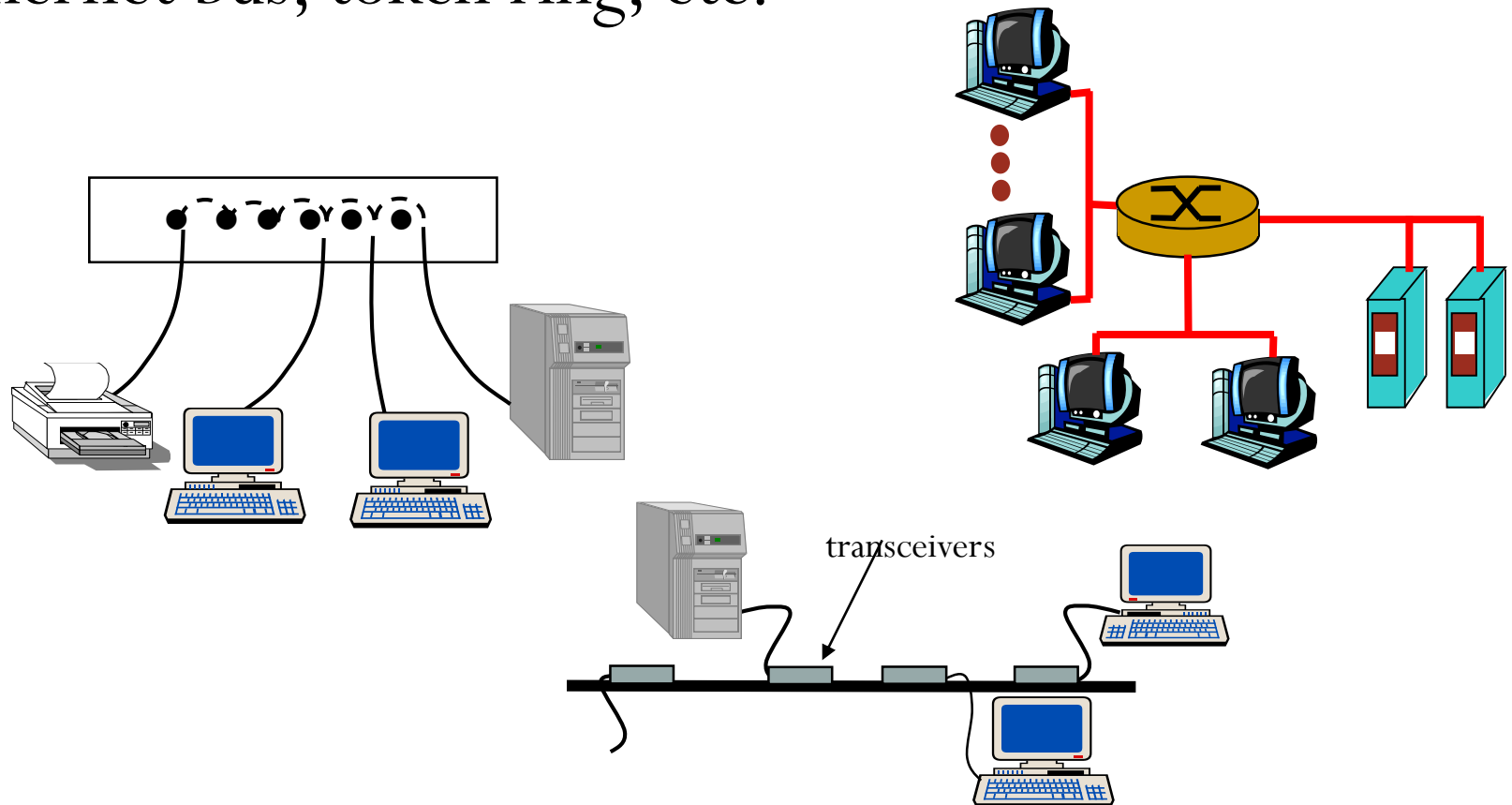
# Personal Area Network (PAN)

- **PAN** is a computer network organized around an individual person. It typically involves a mobile computer, a cell phone, a handheld computing device such as a PDA, Tablet, etc.
- We can use these networks to transfer files including email, digital photos, music, etc.



# Local Area Network (LAN)

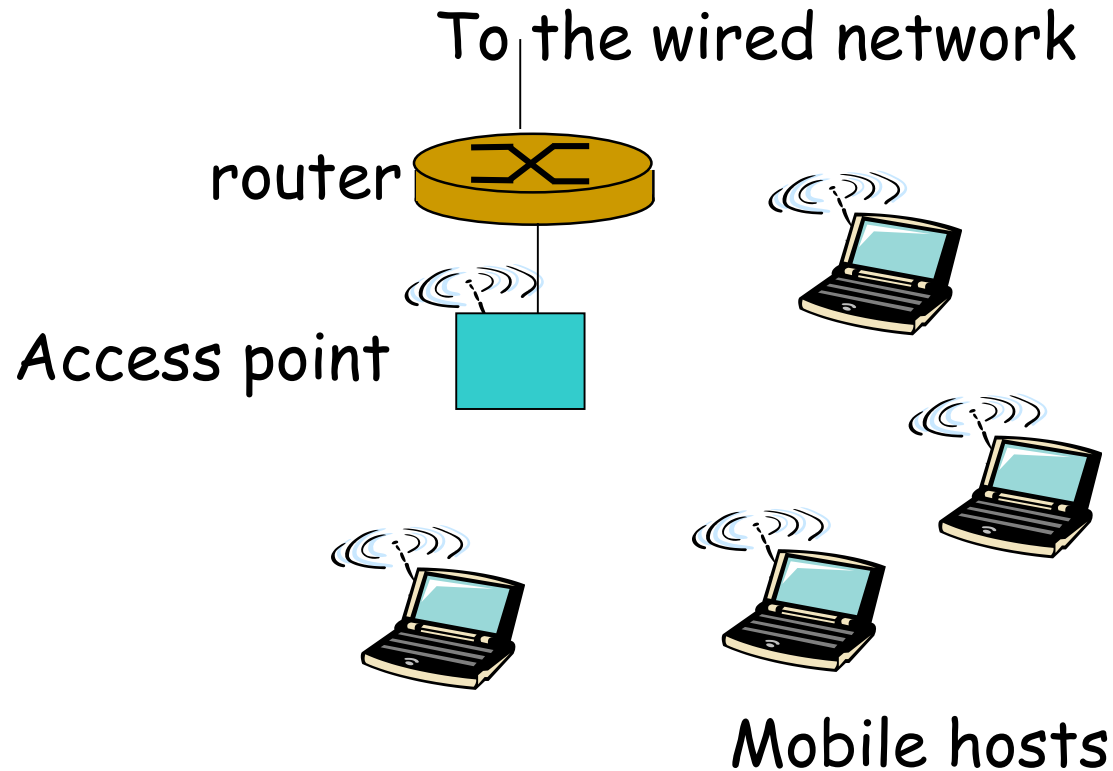
- Wired LAN: It connects end systems and routers through shared or dedicated wired links such as Ethernet bus, token ring, etc.





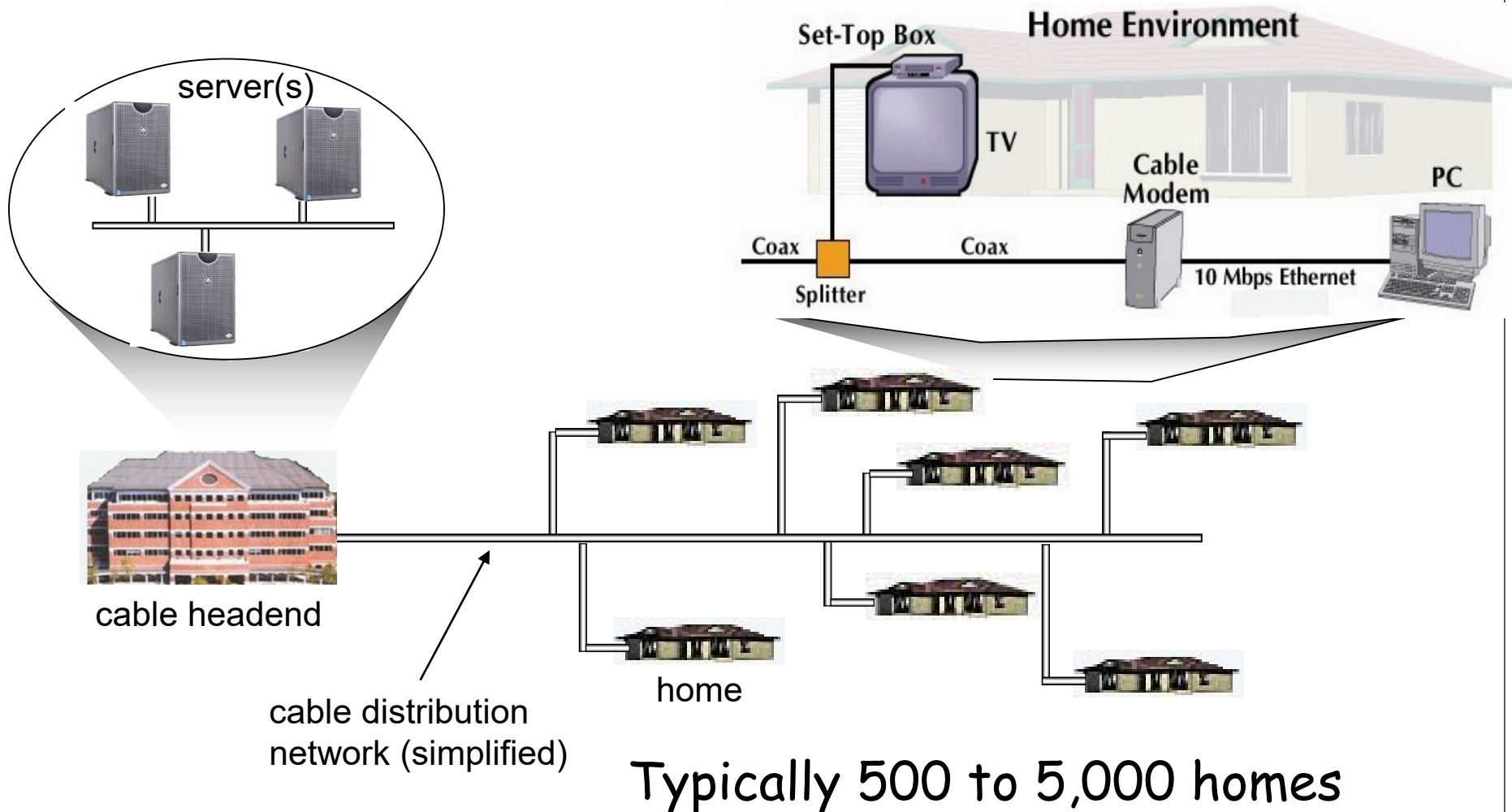
# Local Area Network (LAN)

- Wireless LAN



# Metropolitan Area Network (MAN)

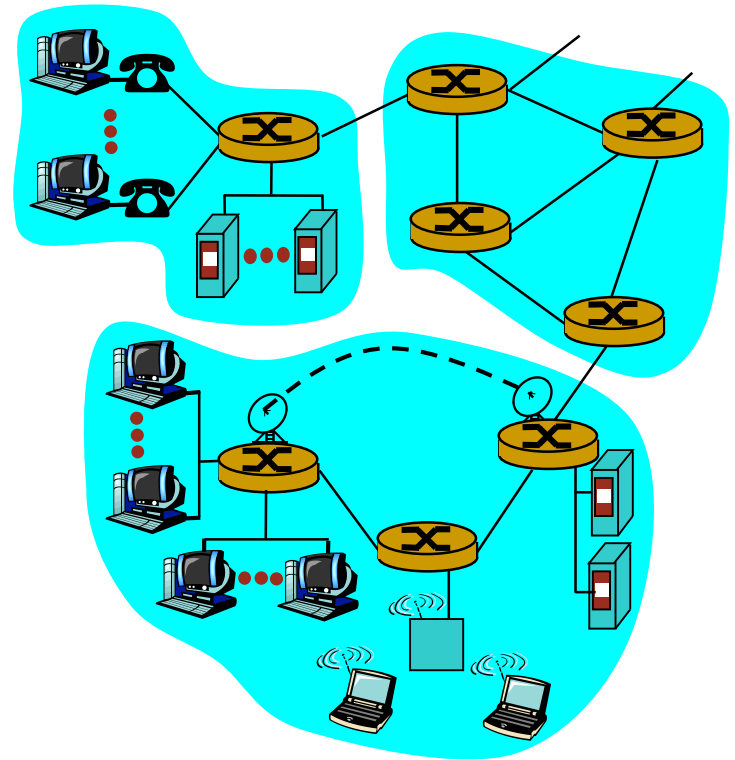
- A MAN based on cable TV



Typically 500 to 5,000 homes

# Wide Area Network (WAN)

- Spans a large geographic area, e.g., a country, a continent, or planet.
- A WAN consists of several transmission lines and routers.
- **Internet** is an example of a WAN

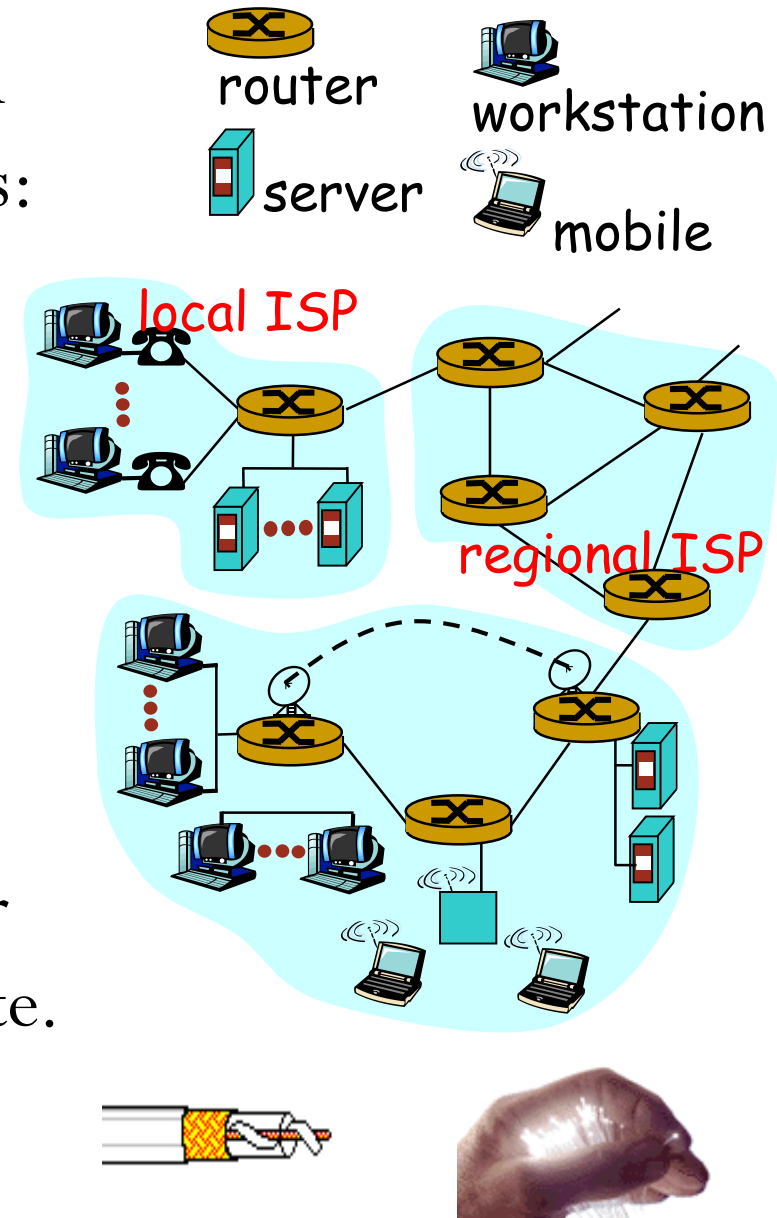


# Internet

- What is **the Internet**?
  - **An internet**: a collection of interconnected networks is called **an internetwork** or **an internet**.
  - **The Internet** is one specific internet. It is an example of internet.
  - **The Internet** is the network of networks where different networks such as enterprise networks, home networks, mobile networks are interconnected through Internet Service providers (ISPs).
  - **The applications** running on the top of Internet includes Email, Web surfing, media streaming, etc.

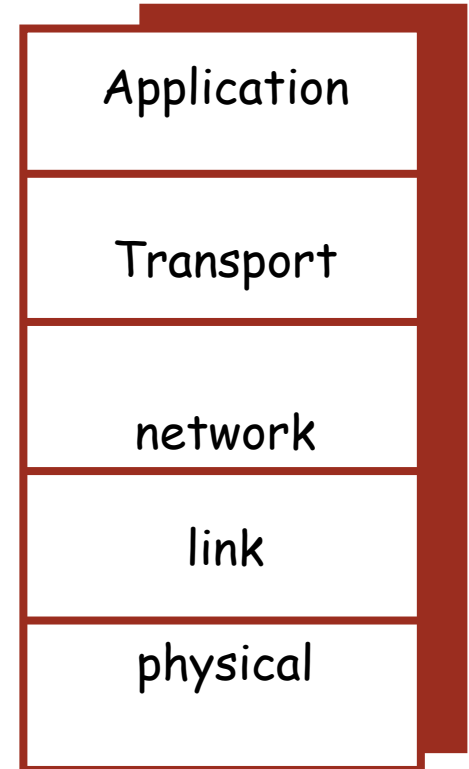
# Internet

- It includes millions of connected computing devices and networks:
  - Routers, Hosts, mobile phones, servers, workstations, home networks, company networks, university networks, etc.
- Communication links/ physical media include
  - Fiber optics, twisted-pair copper wire, coaxial cable, radio, satellite.
  - Links have different bandwidth



# Five Layer Internet Protocol Stack

- **Application(应用)**: supporting network applications
- **Transport(传输)**: process connection admission control, congestion control
- **Network(网络)**: provide efficient routing
- **Link(链路)**: deal with media access control, resource allocation and scheduling problems.
- **Physical(物理)**: provide efficient data transmission over different physical media such as copper wire, fiber.



# Layered Structure

- Advantages of layered structure
  - Make the maintenance and updating of system easier
    - Change of implementation of layer's service transparent to rest of system.
  - A layered architecture allows us to discuss a well-defined, specific part of a large and complex system.

# Summary

- Famous figures in Computer Science
- History of computer
- Computer network
  - Classification: PAN, LAN, MAN, WAN
- The Internet
  - Layered architecture