Computer Networking

Network Hardware: Broadcast network, Pont to point network, LAN, MAN, WAN, Wireless network, Home network

Network Hardware

- There is no generally accepted taxonomy into which all computer networks fit, but two dimensions stand out as important: **transmission technology** and **scale**.
- Broadly speaking, there are two types of transmission technology that are in widespread use. They are as follows:
  - **Broadcast links.**
  - **Point-to-point links.**

Broadcast links

- Broadcast networks have a single communication channel that is shared by all the machines on the network.

- Short messages, called packets in certain contexts, sent by any machine are received by all the others. An address field within the packet specifies the intended recipient.

- Broadcast systems generally also allow the possibility of addressing a packet to all destinations by using a special code in the address field. When a packet with this code is transmitted, it is received and processed by every machine on the network. This mode of operation is called broadcasting.

- Some broadcast systems also support transmission to a subset of the machines, something known as multicasting. One possible scheme is to reserve one bit to indicate multicasting. The remaining n - 1 address bits can hold a group number.

Point-to-point links

- In contrast, point-to-point networks consist of many connections between individual pairs of machines. To go from the source to the destination, a packet on this type of network may have to first visit one or more intermediate machines.

- Often multiple routes, of different lengths, are possible, so finding good ones is important in point-to-point networks.

- As a general rule (although there are many exceptions), smaller, geographically localized networks tend to use broadcasting, whereas larger networks usually are point-to-point.

Classification by scale

- An alternative criterion for classifying networks is their scale.

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

- Personal Area Network: networks that are meant for one person.
- Beyond the personal area networks come longer-range networks. These can be divided into
  - local
  - metropolitan
  - wide area networks.

Local Area Networks (LANs)

- Local area networks, generally called LANs, are privately-owned networks within a single building or campus of up to a few kilometers in size.

- They are widely used to connect personal computers and workstations in company offices and factories to share resources (e.g., printers) and exchange information.

- LANs are distinguished from other kinds of networks by three characteristics:

(1) their size,

(2) their transmission technology

(3) their topology.

- Ethernet is a way of connecting computers together in a local area network or LAN.

- Various topologies are possible for broadcast LANs.(a) Bus. (b) Ring.

Computer

Cable

(a)

Computer

(b)
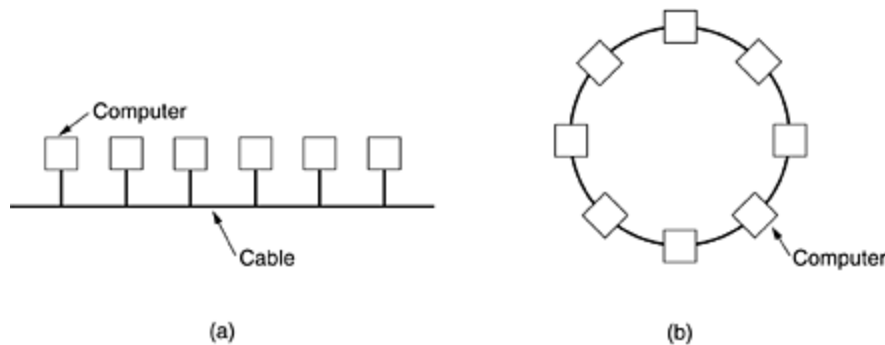
- Broadcast networks can be further divided into **static and dynamic**, depending on how the channel is allocated.

- **A typical static allocation** would be to divide time into discrete intervals and use a round-robin algorithm, allowing each machine to broadcast only when its time slot comes up.

- **Static allocation wastes channel capacity** when a machine has nothing to say during its allocated slot, so most systems attempt to allocate the channel dynamically (i.e., on demand).

Metropolitan Area Networks (MAN)

- A metropolitan area network, or MAN, covers a city. The best-known example of a MAN is the **cable television network** available in many cities.
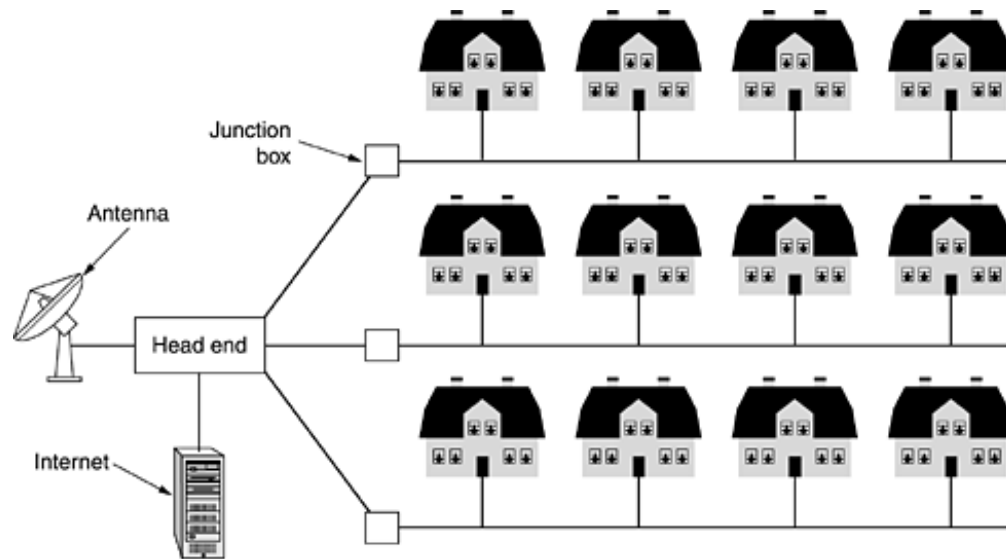
Wide Area Networks (WAN)

- A wide area network, or WAN, spans a large geographical area, a country or continent.

- It contains a collection of machines intended for running user (i.e., application) programs and call these machines hosts.

- The hosts are connected by a communication subnet, or just subnet for short. **The hosts are owned by the customers** (e.g., people's personal computers),

- The communication subnet is typically owned and operated by a telephone company or Internet service provider.

- The job of the subnet is to carry messages from host to host.

- In most wide area networks, the subnet consists of two distinct components: **transmission lines and switching elements.**

Subnet

Router

Host

LAN
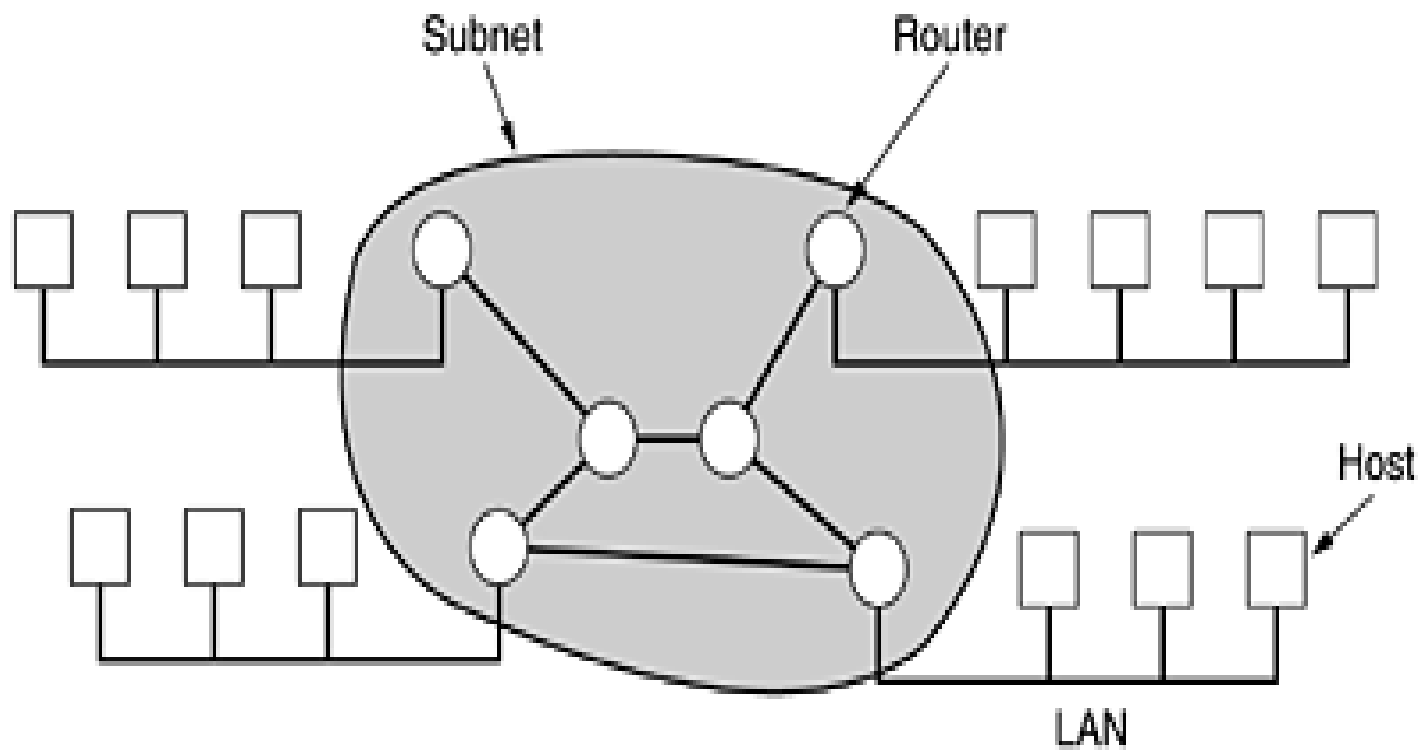
Packet-Switched WAN

- In most WANs, the network contains numerous transmission lines, each one connecting a pair of routers. If two routers that do not share a transmission line wish to communicate, they must do this indirectly, via other routers.

- When a packet is sent from one router to another via one or more intermediate routers, the packet is received at each intermediate router, stored there until the required output line is free, and then forwarded.

- A subnet organized according to this principle is called a store-and-forward or packet-switched subnet.

- Nearly all wide area networks (except those using satellites) have store-and-forward subnets. When the packets are small and all the same size, they are called cells.
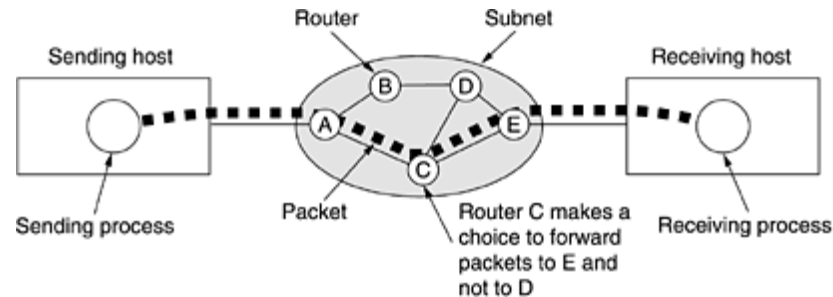
<u>Wireless Networks</u>

- wireless networks can be divided into three main categories:

  –System interconnection.

  –Wireless LANs.

  –Wireless WANs.

- System interconnection is all about interconnecting the components of a computer using short-range radio. Almost every computer has a monitor, keyboard, mouse, and printer connected to the main unit by cables.

- The next step up in wireless networking are the wireless LANs. These are systems in which every computer has a radio modem and antenna with which it can communicate with other systems.

- The third kind of wireless network is used in wide area systems. The radio network used for cellular telephones is an example of a low-bandwidth wireless system.

- This system has already gone through three generations. The first generation was analog and for voice only. The second generation was digital and for voice only. The third generation is digital and is for both voice and data.

(a) (b)
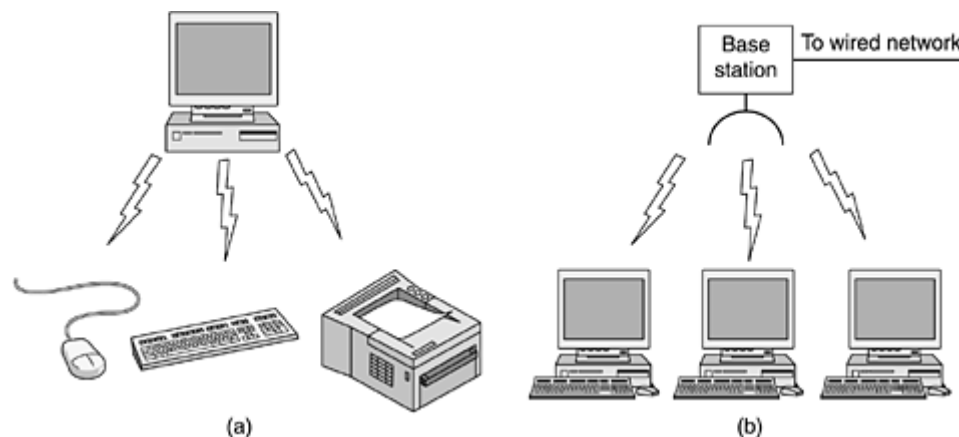
Home Networks

- The fundamental idea is that in the future most homes will be set up for networking. Every device in the home will be capable of communicating with every other device, and all of them will be accessible over the Internet.

- Many devices are capable of being networked.

- Some of the categories (with examples) are as follows:

  - Computers (desktop PC, notebook PC, PDA, shared peripherals).
  - Entertainment (TV, DVD, VCR, camcorder, camera, stereo, MP3).
  - Telecommunications (telephone, mobile telephone, intercom, fax).
  - Appliances (microwave, refrigerator, clock, furnace, airco, lights).
  - Telemetry (utility meter, smoke/burglar alarm, thermostat, babycam).

Internetworks

- A collection of interconnected networks is called an internetwork or internet.

- A common form of internet is a collection of LANs connected by a WAN.

o Subnets, networks, and internetworks are often confused.

o subnet makes the most sense in the context of a wide area network, where it refers to the collection of routers and communication lines owned by the network operator.

o The combination of a subnet and its hosts forms a network.

o An internetwork is formed when distinct networks are interconnected.

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