Unit Five   Networking
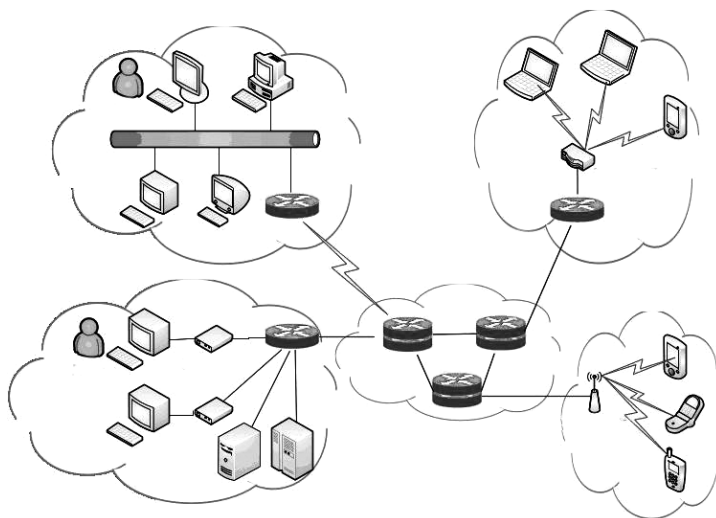
Section A   Networking

The need to share information and resources among different computers has led to linked computer systems，called **networks**，in which computers are connected so that data can be transferred from machine to machine.

network

/ˈnetwɜːk/

n. 网络

Ⅰ. Network Classifications

A computer network is often classified as being either a local area network(**LAN**)，a **metropolitan** area network(**MAN**)，or a wide area network(**WAN**). In recent years，with the development of wireless communication technology，a new concept，personal area network(**PAN**) is put forward. A LAN normally consists of a collection of computers in a single building or building complex. For example，the computers on a university campus or those in a manufacturing plant might be connected by a LAN. A MAN is a network of intermediate size，such as one spanning a local community. A WAN links machines over a greater distance— perhaps in neighboring cities or on opposite sides of the world. A

LAN
局域网
metropolitan
/ˌmetrəˈpɒlɪtən/
n. 大都市的
MAN
城域网
WAN
广域网
PAN
个域网

PAN is a personal information network，as **cable radio** or **infrared** instead of the traditional cable，to realize the intelligent internet of personal information terminal.

Another means of classifying networks is based on whether the network's internal operation is based on designs that are in the public domain or on innovations owned and controlled by a particular entity such as an individual or a corporation. A network of the former type is called an **open network**；a network of the latter type is called a closed，or sometimes a **proprietary** network. The Internet is an open system. In particular，communication throughout the Internet is governed by an open collection of standards known as the TCP/IP protocol suite.

Still another way of classifying networks is based on the **topology** of the network（Figure 5A-1），which refers to the pattern in which the machines are connected. Two of the more popular topologies are the bus，in which the machines are all connected to a common communication line called a **bus**，and the star，in which one machine serves as a central focal point to which all the others are connected. The bus topology was popularized in the 1990s when it was implemented under a set of standards known as **Ethernet**，and Ethernet networks remain one of the most popular networking systems in use today. The star topology has roots as far back as the 1970s. It evolved from the paradigm of a large central computer serving many users. Another topologies are the ring topology，tree topology，**mesh** topology and **hybrid** topology.

cable radio
无线电
infrared
n.红外线

open network
开放网络
proprietary
adj.专有的

topology
n.拓扑学

bus
n.总线

Ethernet
n.以太网
mesh
n.网状；网格
hybrid
adj.混合的

(a) bus   (b) star   (c) tree
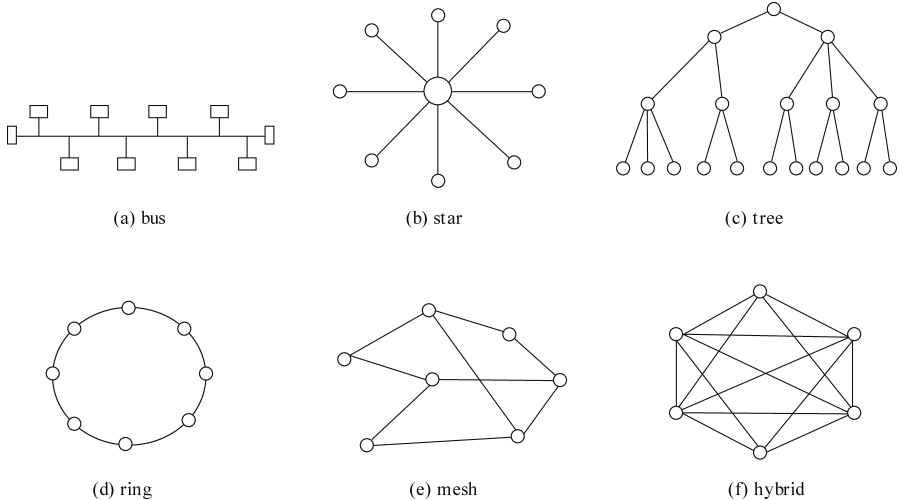
(d) ring   (e) mesh   (f) hybrid

Figure 5A-1   The Topology of the Network

Ⅱ. Combining Networks

Sometimes it is necessary to connect existing networks to form an extended communication system. This can be done by connecting the networks to form a larger version of the same type of network. In the case of bus networks based on the Ethernet protocols，it is often possible to connect the buses to form a single long bus. This is done by means of different devices known as **repeaters**，**bridges**，and **switches**，the distinctions of which are **subtle** yet **informative**. The simplest of these is the repeater，which is little more than a device that simply passes signals back and forth between the two original buses（usually with some form of **amplification**）without considering the meaning of the signals.

A bridge is similar to，but more complex than，a repeater. Like a repeater，it connects two buses，but it does not necessarily pass all messages across the connection. Instead，it looks at the destination address that accompanies each **message** and **forwards** a message across the connection only when that message is destined for a computer on the other side. Thus，two machines residing on the same side of a bridge can exchange messages without interfering with communication taking place on the other side. A bridge produces a more efficient system than that produced by a repeater.

A switch is essentially a bridge with multiple connections，allowing it to connect several buses rather than just two. Thus，a switch produces a network consisting of several buses extending from the switch as spokes on a wheel. As in the case of a bridge，a switch considers the destination addresses of all messages and forwards only those messages destined for other spokes. Moreover，each message that is forwarded is relayed only into the appropriate spoke，thus minimizing the traffic in each spoke.

Sometimes，however，the networks to be connected have incompatible characteristics. For instance，the characteristics of a **WiFi**[①] network are not readily compatible with an Ethernet network. In these cases the networks must be connected in a manner that builds a network of networks，known as an internet，

repeater

n. 中继器

bridge

n. 网桥

switch

n. 交换机

subtle

adj. 微妙的

informative

adj. 信息量大的

amplification

n. 放大

message

n. 报文

forward

vt. 转发

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① WiFi：基于 IEEE 802.11b 标准的无线局域网。

in which the original networks maintain their individuality and continue to function as **autonomous** networks. The connection between networks to form an internet is handled by devices known as **routers**，which are special purpose computers used for forwarding messages.

    As an example，Figure 5A-2 depicts two WiFi star networks and an Ethernet bus network connected by routers. When a machine in one of the WiFi networks wants to send a message to a machine in the Ethernet network，it first sends the message to the **AP**[①] in its network. From there，the AP sends the message to its associated router，and this router forwards the message to the router at the Ethernet. There the message is given to a machine on the bus，and that machine then forwards the message to its final destination in the Ethernet.
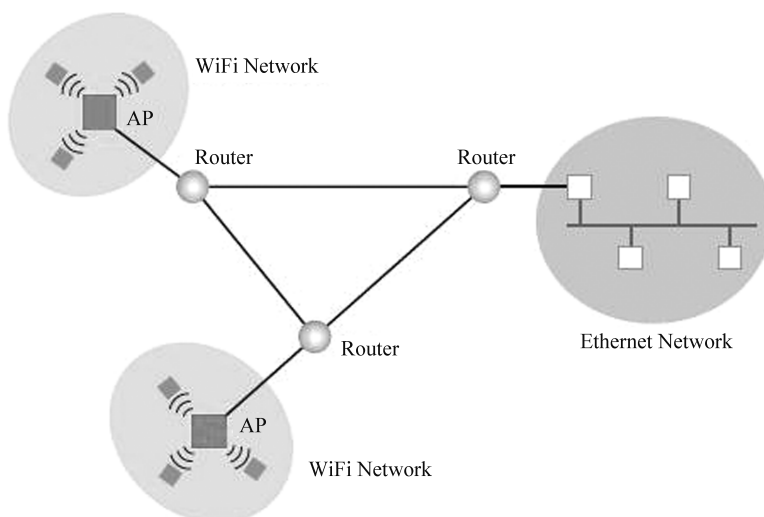
autonomous

adj. 自主的

router

n. 路由器

Figure 5A-2   Routers Connecting Two WiFi and an Ethernet Bus Network

    The point at which one network is linked to an internet is often called a **gateway** because it serves as a passageway between the network and the outside world. Gateways can be found in a variety of forms，and thus the term is used rather loosely. In many cases a network's gateway is merely the router through which it communicates with the rest of the internet. In other cases the term gateway may be used to refer to more than just a router. For

gateway

n. 网关

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① AP：Access Point，即（无线）访问接入点，是组建小型无线局域网最常用的设备。

example，in most residential WiFi networks that are connected to the Internet，the term gateway refers collectively to both the network's AP and the router connected to the AP because these two devices are normally packaged in a single unit.

Ⅲ. Methods of Process Communication

The various activities(or processes) executing on the different computers within a network(or even executing on the same machine via time-sharing/multitasking) must often communicate with each other to coordinate their actions and to perform their designated tasks. Such communication between processes is called **interprocess** communication.

A popular convention used for interprocess communication is the client/server model. This model defines the basic roles played by the processes as either a client，which makes requests of other processes，or a server，which satisfies the requests made by clients. Today the client/server model is used extensively in network applications.

However，the **client/server**(**C/S**) model is not the only means of interprocess communication. Another model is the **peer-to-peer** (**P2P**) model. Whereas the client/server model involves one process (the server) providing a service to numerous others(clients)，the peer-to-peer model involves processes that provide service to and receive service from each other(Figure 5A-3). Moreover，whereas a server must execute continuously so that it is prepared to serve its clients at any time，the peer-to-peer model usually involves processes that execute on a temporary basis. For example，applications of the peer-to-peer model include instant messaging in which people carry on a written conversation over the Internet as well as situations in which people play competitive interactive games.

The peer-to-peer model is also a popular means of distributing files such as music recordings and motion pictures via the Internet. In this case，one peer may receive a file from another and then provide that file to other peers. The collection of peers participating in such a distribution is sometimes called a **swarm**. The swarm approach to file distribution is in contrast to earlier approaches that

interprocess

| |

n. 进程间

client/server

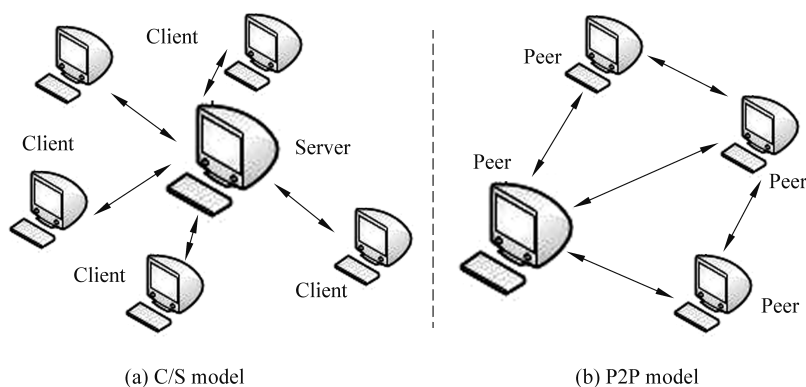客户/服务器

peer-to-peer

对等网；点对点

swarm

n. 聚合；群

Figure 5A-3　Two Popular Models of Interprocess Communication

applied the client/server model by establishing a central distribution center(the server) from which clients downloaded files.

Exercises

Ⅰ. Fill in the blanks with the information given in the text.

1. The need to share information and _____ among different computers has led to linked computer systems，called _____，in which computers are connected so that data can be transferred from machine to machine.

2. A computer network is often classified as being either a _____，a MAN，a WAN，or a _____.

3. The Internet is an _____ system，which is governed by an open collection of standards known as the _____ protocol suite.

4. Based on the topology of the network，two of the more popular topologies are _____，and _____.

5. A _____ is essentially a bridge with multiple connections，allowing it to connect several buses rather than just two.

6. The connection between networks to form an internet is handled by devices known as _____.

7. The point at which one network is linked to an internet is often called a _____ because it serves as a passageway between the network and the outside world.

8. In most residential WiFi networks that are connected to the Internet，the term gateway refers collectively to both the network's _____ and the _____ connected to the AP because these two devices are normally packaged in a single unit.

9. The popular convention used for interprocess communication is the _____ model and _____ model.

Ⅱ. **Translate the following terms or phrases from English into Chinese.**

LAN	MAN
WAN	PAN
cable radio	open network
proprietary network	bus topology
Ethernet network	ring topology
tree topology	mesh topology
hybrid topology	repeater
bridge	switch
router	WiFi
AP	gateway
client/server(C/S)	peer-to-peer(P2P)

Ⅲ. **Translate the following passage from English into Chinese.**

The Generations of Wireless Telephones

In the past decade mobile phone technology has advanced from simple，single purpose，portable devices to complex，multifunction hand-held computers. The first generation wireless telephone network transmitted analog voice signals through the air，much like traditional telephones but without the copper wire running through the wall. In retrospect，we call these early phone systems "1G"，which using FDMA. The second generation mainly using TDMA，can provide voice and low-speed digital services such as text messaging. Third generation(3G) phone network which using CDMA technology is characterized by user peak rate of 2Mb/s to reach tens of Mb/s，allowing for mobile video calls and other multimedia data services. 4G OFDMA technology as the core，the user peak rate of up to 100Mb/s～1Gb/s，can support a variety of mobile broadband data services. 5G key competencies richer than previous generations of mobile communications，user experience，speed，density of connections，end to end delay，the peak rate and mobility and so will be the 5G key performance indicators.

Section B　Distributed System

Ⅰ. Introduction

With the success of networking technology，interaction between computers via networks has become common and **multifaceted**. Many modern software systems，such as global information retrieval systems，company-wide accounting and inventory systems，computer games，and even the software that controls a network's infrastructure itself are designed as **distributed** systems，meaning that they consist of software units that execute as processes on different computers.

A distributed system（see Figure 5B-1）consists of a collection of autonomous computers，connected through a network and distribution **middleware**，which enables computers to coordinate their activities and to share the resources of the system，so that users perceive the system as a single，integrated computing facility.

The certain common characteristics can be used to assess distributed systems：

- Resource Sharing
- Openness
- **Concurrency**
- Scalability
- Fault **Tolerance**
- **Transparency**

Middleware is a class of software technologies designed to help

multifaceted
adj.多方面的

distributed
adj.分布式的

middleware
n.中间件
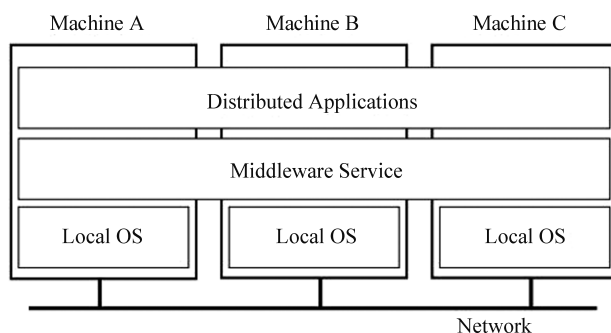
concurrency
n.并发性

tolerance
n.容忍

transparency
n.透明性

Figure 5B-1   General Structure of a Distributed System

manage the complexity and **heterogeneity inherent** in distributed systems. It is defined as a layer of software above the operating system but below the application program that provides a common programming abstraction across a distributed system.

heterogeneity

ˌ   ˌ   ˌ

n. 异构性

inherent

ˌ

adj. 固有的；内在的

Ⅱ. Application of Distributed System

Several types of distributed computing systems are now common.

• Cluster Computing

Cluster computing(Figure 5B-2) is a type of parallel or distributed processing system，which consists of a collection of interconnected stand-alone computers cooperatively working together as a single，integrated computing resource. The cost of these individual machines，plus the high-speed network to connect them，can be less than a higher-priced supercomputer，but with higher reliability and lower maintenance costs. Such distributed systems has the key operational benefits of high performance，expandability and scalability，high **throughput** and high availability.

cluster

ˌ

n. 集群

throughput

ˌ   ʊ

n. 吞吐量

Figure 5B-2   Cluster Computing

Cluster computing is mainly used in grand challenging applications such as weather forecasting，quantum chemistry，molecular biology modeling，data-mining web servers，etc.

• Grid Computing

Grid computing is a form of distributed computing in which an organization uses its existing computers(desktop and/or cluster nodes) to handle its own long-running computational tasks(see Figure 5B-3). Grid computing aims to "enable resource sharing and coordinated problem solving in dynamic，multi-institutional virtual organizations". Examples include University of Wisconsin's Condor system[①]，or Berkeley's Open Infrastructure for Network Computing(BOINC)[②]. Both of these systems are often installed on computers that are used for other purposes，such as PCs at work or at home，that can then **volunteer** computing power to the grid. Enabled by the growing connectivity of the Internet，this type of **voluntary**，distributed grid computing has enabled millions of home PCs to work on enormously complex mathematical and scientific problems.

grid

n. 网格

volunteer

v. 自愿去做/
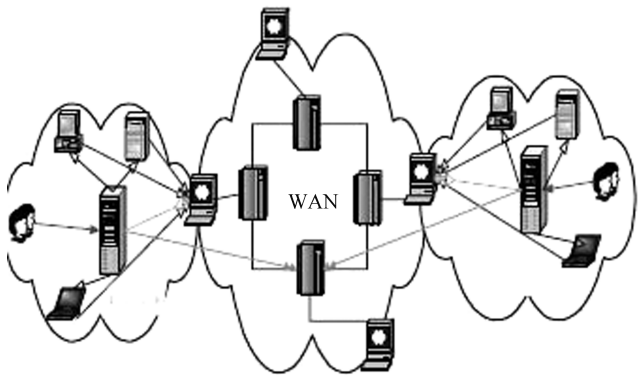*n.* 自(志)愿者

voluntary

n. 自愿；
adj. 自愿的

Figure 5B-3　A Distributed Grid Task Scheduling System

• Cloud Computing

Cloud computing(Figure 5B-4) is a large-scale distributed

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① Wisconsin's Condor system：威斯康星大学研发的 Condor 系统，是一个开源的高吞吐量计算软件框架，用于计算密集型任务的粗粒度分布式并行计算。
② BOINC：伯克利开放式网络计算，由美国加利福尼亚大学伯克利分校空间科学实验室研发的用于志愿者和网格计算的一个开源的中间件系统。