Unit 1 Brief Introduction of Modern Communication

1.1 Text

1.1.1 Communication

Modern communication means a technology using light wave and electromagnetic wave to transmit or exchange information from one place to another rapidly and accurately, so it's also called ***telecommunication*** technique.

Along with the unceasing development and fusion of communication technique, computer technique and control technology, performance of communication systems have enormously expanded, such as visible text, electronic mail-box, video telephone and conference, etc., accompanied with the communicating content extension from simplex voice and text signals to multimedia information including sound, text, data, picture and so on. Not only efficient information transmission, but also information collecting, processing, storage and displaying are carried out by modern communication network.

Classification of modern communication systems is different along with the different classifying manners.

1. Simplex & Half-duplex & Full-duplex Communication

According to the information direction transmitted in channel, modern communication systems can be divided into the ***simplex communication*** systems, ***half-duplex communication*** systems, and ***full-duplex communication*** systems.

In simplex communication systems such as radio and television broadcasting, signals can only flow in one direction. In half-duplex communication systems, signals can flow in both directions, but only one direction at a time (not simultaneously). Typically, once a party begins to receive a signal, it must wait for the transmitter to stop transmitting, before replying. Full-duplex systems are employed in many communication networks, in which signals can flow in both directions.

2. Serial & Parallel Communication

According to the number of information communicating approaches, modern communication systems can be divided into the ***serial communication*** systems and the ***parallel communication*** systems.

Serial transmission is the process of sending data one bit at one time, sequentially, over a communication channel, as shown in Fig 1-1(a). Parallel transmission is mainly employed in real-time communication and data communication between computer and its peripherals, in which several data bits are packed together and transmitted simultaneously as shown in Figure.1-1(b).

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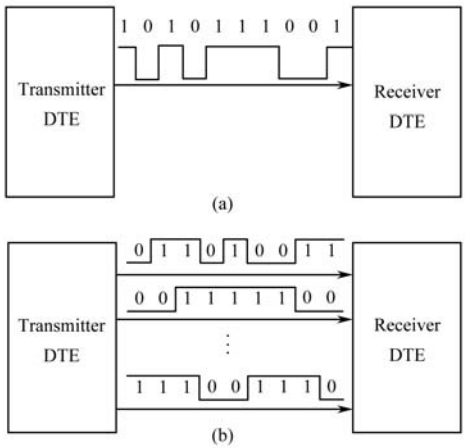

Figure 1-1 Serial communication and Parallel communication

3. Synchronous & Asynchronous Communication

According to the control methods of information transmitted in channels, modern communication systems can be divided into the ***synchronous communication*** systems and the ***asynchronous communication*** systems.

In asynchronous communication system, every symbol is transmitted independently at variable data rate, only one symbol at one time. A start bit (e.g. logic level 1) serves to represent the start of a new symbol, and a stop bit (e.g. logic level 0) serves to the represent the end of a symbol. Usually, the start bit length takes one bit while the stop bit length required by the system can be 1, 1.5 or 2 bits as shown in Figure1-2. Since the transmission of every symbol usually requires 2~3additional bits, asynchronous transmission usually lacks efficiency.

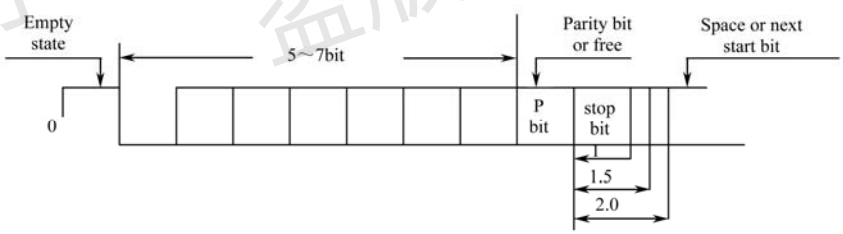

Figure 1-2 Asynchronous communication

In synchronous communication system, information is transmitted in forms of data block. Each block has a preamble bit and postamble bit respectively for symbolizing the start and end of block. Apparently, synchronous communication system is more efficient than asynchronous communication system, and is more adaptive for high speed data transferring .

4. Point-to-point & one-to-multi-points & multi-to-multi-points Communication

According to the line connecting modes and signal interacting ways between signal source and destination, modern communication systems can be divided into ***point-to-point communication***

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systems, ***one-to-multi-points communication systems*** and ***multi-to-multi-points communication*** systems.

In point-to-point communication system shown in Figure1-3(a), the connection between the terminals, such as terminal A and B, was generally implemented through a dedicated line. In point-to-multipoint communication system shown in Figure1-3(b), connection between every terminals (such as terminal A, B,…, et al.) is accomplished via a transferring equipment. In multipoint-to-multipoint communication system, data is transmitted flexibly between several terminals through a switching device, with the direct or stored-and-transferred method.

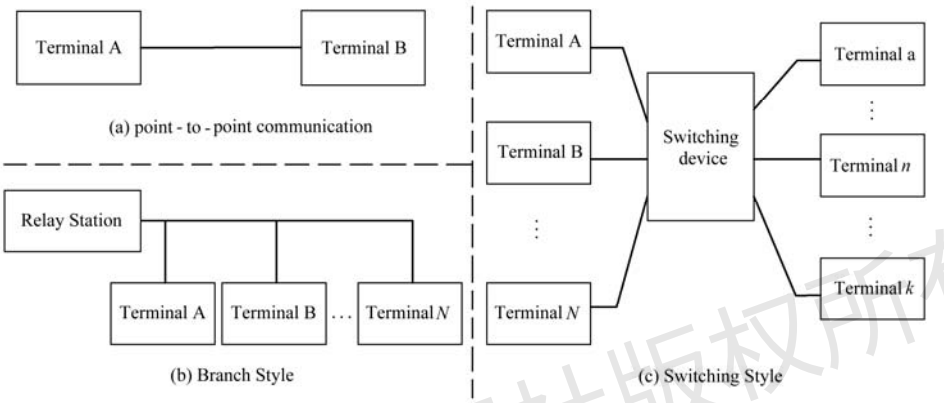

Figure 1-3 point & one-to-multi & multi-to-multi points communication

1.1.2 History of Modern Communication

Communication comes up along with the history of humanity since people have to transmit information and exchange their views each other. Since the invention of electric battery by Alessandro Volta in 1799, people had begun to try to communicate making use of electricity. The development of modern communication can be illustrated by those milestone events listed in the following Table 1-1.

Table 1-1 Memorabilia of modern communication

Age	Event	Significance
1837	Samuel Morse invented the electric telegraph	Beginning of a new era that electricity being used by people for long-distance information transmission
1876	A.G.Bell invented telephone	Transmitting voice signals by using current intensity directly
1864，1887	Maxwell predicted the existence of electromagnetic radiation in 1864, and was verified experimentally by Hertz it in 1887	Providing modern wireless communication with theory basis
Early 20th century	Amplitude modulation (AM) appeared	Changing communication signal from simplex audio signal to hybrid signal of voice, music, picture signals
1933	Frequency modulation (FM) appeared	Improved communicating quality by overcoming the bug that AM signal is prone to interference, and impelled the development of mobile communication

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（续）

Age	Event	Significance
1928 1937	***Nyquist's Theorem*** was proposed; A.H.Reeves invented pulse code modulation (PCM) communication technique	Development of communication from analog to digital transmission; Analog signal being digitally transmitted via PCM technique, and improving the ability of communication system to anti-jamming
1940s-1950s	Shannon Formula, ***Non-distortion Coding Principle***, ***Error-correction Coding Principle***, Signal and Noise Theory, Modulation Principle, Signal Detection Theory appeared	Providing communication validity and reliability with theory basis, promoting communication technology to be mature and progressive
l960	The first satellite for communication launched successfully	Breaking the new path for international communication, bringing on the rapid development of space communication
1960s	***Cable television***, ***laser communication***, radar, computer network and digital communication technology appeared	***Photoelectricity processing technology*** and ***radio astronomy*** getting great development
1970s	***large-scale-integrated circuit*** **(*LSI*)**, Private (Automatic) Branch exchange, microprocessor developed rapidly	Commercial ***satellite communication***, optical fiber communication getting rapid development
1980s	***Very-large-scale-integrated circuit*** **(*VLSI*)**, Integrated Services Digital Network (ISDN) appeared	Mobile communication and optical fiber communications coming into application

Technical words and phrases

communication [kəmju:ni'keiʃən] *n.* 通信；联络
electromagnetic [i'lektrəumæg'netik] *adj.* 电磁的；电磁学的
telecommunication ['teli-kəmju(:)ni'keiʃən] *n.* 电信，无线电通信；电信学
unceasing [ʌn'si:siŋ] *adj.* 不停的，持续的
visible ['vizəbl] *adj.* 看得见的；明显的, 显而易见的
video [vidiəu] *adj.* 视频的；录像的
telephone ['telifəun] *n.* 电话；电话机
channel ['tʃænl] *n.* 信道，频道
simplex ['simpleks] *adj.* 单纯的，单一的
simplex communication 单工通信
half-duplex *n.* [计]半双工
half-duplex communication 半双工通信
duplex ['dju:pleks] *adj.* 双倍的，复式的，[电信、计]双工的，双向的
full-duplex communication 全双工通信
serial ['siəriəl] *adj.* 连续的；系列的；按顺序的
serial-communication 串行通信
parallel [pærəlel] *adj.* 平行的，相同的，类似的，并联的
parallel-communication 并行通信
synchronous ['siŋkrənəs] *adj.* 同时发生的；同步的
asynchronous [ei'siŋkrənəs] *adj.* 不同时的；[电]异步的
signal ['signəl] *n.* 信号
source [sɔ:s] *n.* 来源，水源；消息来源

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point-to-point communication　点到点通信
one-to-multi-points communication　点到多点通信
multi-to-multi-points communication　多点到多点通信
Amplitude modulation (AM)　幅度调制，调幅（常规双边带调幅）
Frequency modulation (FM)　频率调制，调频
Nyquist's Theorem　奈奎斯特定理
pulse code modulation (PCM)　脉冲编码调制
Shannon Formula　香农公式
Non-distortion Coding Principle　不失真编码原理
Error-correction Coding Principle　纠错编码原理
Signal and Noise Theory　信号和噪声理论
Modulation Principle　调制原理
Signal Detection Theory 信号检测理论
Very-large-scale-integrated circuit (VLSI)　超大规模集成电路
large-scale-integrated circuit (LSI) 大规模集成电路
Integrated Services Digital Network (ISDN)　综合业务数字网
optical fiber communications　光（纤）通信
photoelectricity　[fəutəuilek'trisiti]　[物]光电(学)；光电现象
PBX (Private Branch Exchange)　专用分局交换机
PABX (Private Automatic Branch eXchange)　自动用户小交换机
microprocessor　微处理器
principle　['prinsəpl]　*n.*　法则，规则，原则；原理，定理
satellite communication　卫星通信
space communication　宇宙通信，空间通信

1.2　Reading Materials

1．Google Wins Internet Advertising Contract with China Telecom

Search giant, Google Inc., is poised to increase its share of the Chinese internet advertising market, due to a new agreement with China Telecom.

Google has won the right to place ads of 400 of the telecom giant's websites, giving it valuable leverage against Microsoft, and leading local rival, Baiducom.

"This is a big win for Google because Microsoft and Baidu both wanted this agreement with China Telecom", said Analysis International internet analyst, Foo Xinghua, in a telephone interview. "China Telecom likely picked Google because they have better technology for Web ads."

China's internet advertising market will surge to US$3.1 billion in 2011, from $420 million in 2005, according to estimates.

（Source: teleclick）

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2．Google, China Telecom Form Online Ad Alliance

Google has inked an agreement with China Telecom to sell online advertising on 400 of its web sites. This venture will allow Google into a new market space, as it will provide Google with entry into China Telecom's network of web sites that reached out to a domestic audience.

China Telecom has revealed that its subscriber base touches 30.5 million broadband users. Under the terms of the agreement the companies will share the revenue generated, though the specific financial details of the deal were not divulged.

This is the third time both the companies are coming together to do business. Google wants to tap the burgeoning Chinese market.

（Source: sda-india）

3．China to Launch Mobile Phone TV Satellites in 2008

China is going to launch two satellites for mobile multimedia broadcasting in May 2008, revealed an expert involved in the formulation of China Mobile Multimedia Broadcasting (CMMB) system, the recommended industrial standard announced by the country's broadcasting regulator in late October.

The commissioning of the satellite system is considered to be a significant step for the operation of China's independently-developed mobile multimedia broadcasting system, as the country plans to build a CMMB network with large-scale satellite signal as a major mode of signal coverage and the transmission on the ground as a complement, in view of the country's vast extension of territories with different development stages.

Remarkably, the nation's broadcasting administration will adopt the experience of the telecom department in building the network for the next-generation telecommunications in the CMMB network project.

It will start to build a ground test network by the end of this year, and complete the test network in the middle of next year and by then start system testing; to complete the building of the ground network for commercial use and start commercial operation test by the end of next year; and will form a nationwide CMMB network with the commissioning of the satellite system in the first half of 2008 and by then officially start providing mobile multimedia broadcasting services, before the opening of Beijing Olympics.

(Source: stocknews.com.cn)

4．Asia Pacific region plans for next-generation networks (NGN)

Geneva, 12 April 2007—ITU and the Asia Pacific Telecommunity (APT) jointly organized a workshop in Bangkok, Thailand to plan for the implementation and development of Next-Generation Networks (NGN) in the region. Over 180 experts from 24 countries representing APT and ITU Members, international organizations and the private sector joined the forum, which was inaugurated by Mr Kraisorn Pornsutee, Permanent Secretary, Ministry of Information and Communication Technology, Royal Government of Thailand.

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NGN is a catch phrase for the network infrastructure that will enable advanced new services offered by mobile and fixed network operators in the future, while continuing to support all existing services. This next-generation architecture will help leverage new technologies to dramatically reduce the cost of market entry, increase flexibility and accommodate seamlessly in a single multiservice network both voice and data.

Mr Malcolm Johnson, Director of the ITU Telecommunication Standardization Bureau, said, "NGN has the potential to accelerate the deployment of telecommunication networks and services in developing countries."As cost and revenue are the drivers of this development, the capital cost of deploying NGN technology, both in the core of the network, and the operating costs are significantly lower than circuit switched technologies. "This will enable rapid expansion of network capabilities," Mr Johnson added. "NGN will also enable a range of multimedia services to be provided more easily and with less cost, and so increase potential revenues. It offers the opportunity for developing countries to leapfrog several generations of technology." He also stressed the importance of "bridging the standardization gap" by planning for NGN at regional levels.

5．International steps taken to build global Information Society

Geneva, 20 July 2006—Implementation of the outcomes of the recently concluded World Summit on the Information Society (WSIS) gathered momentum with the launch of the United Nations Group on the Information Society (UNGIS). High level representatives of twenty-two UN agencies met on Friday, 14 July 2006 at ITU Headquarters in Geneva under the chairmanship of ITU Secretary-General Yoshio Utsumi to facilitate the process.

UNGIS will serve as an interagency coordinating mechanism within the UN system to implement the outcomes of WSIS. The Group will enable synergies aimed at resolving substantive and policy issues, avoiding redundancies and enhancing effectiveness of the system while raising public awareness about the goals and objectives of the global Information Society. UNGIS will also work to highlight the importance of ICTs in meeting the Millennium Development Goals.

To maximize its efficiency, the Group agreed on a work plan in which it would concentrate its collective efforts each year on one or two cross-cutting themes and on a few selected countries.

1.3 Exercises

1. Please translate the following Chinese words into English, and write out the corresponding English abbreviation if existing.

（1）单工通信系统
（2）全双工通信
（3）同步通信
（4）异步通信
（5）点到点通信
（6）串行通信
（7）并行通信

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（8）电信
（9）有线电视
（10）光电处理技术
（11）射电天文学
（12）卫星通信
（13）大规模集成电路
（14）超大规模集成电路
（15）奈奎斯特定理
（16）无失真编码理论
（17）纠错编码

2. Read the following sentences carefully, and fill the brackets with correct words, phrases, abbreviations and numbers according to the text.

（1）Modern communication means a technology using light wave and（　　）wave to（　　）or exchange information from one place to another rapidly and accurately, so it's also called（　　）technique.

（2）According to the information direction transmitted in channel, modern communication systems can be divided into the（　　）communication systems, half-duplex communication systems, and（　　）communication systems.

（3）According to the number of information communicating approaches, modern communication systems can be divided into the（　　）communication systems and（　　）communication systems.

（4）According to the control methods of information transmitted in channels, modern communication systems can be divided into the（　　）communication systems and（　　）communication systems.

（5）Modern communication can be divided into analog communication and（　　）communication according to the transmitted signal type. If signals transmitted are（　　）signals, then the communication system is an analog communication system.

3．Judge each the following description correct or not, and write your answer in the bracket behind the sequence number respectively.

（1）（　　）Because of using electromagnetic wave to transmit or exchange information from one place to another rapidly and accurately, modern communication is also called telecommunication technique.

（2）（　　）Classification of modern communication systems is different along with the different classifying manners.

（3）（　　）According to the information transmitting direction, modern communication systems can be divided into point-to-point communication systems, one-to-multi-points communication systems and multi-to-multi-points communication systems.

（4）（　　）Morse's invention of line telegraphy began a new era of light-wave communication.

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（5）（　　）Hertz’s prediction and Maxwell’s demonstration about the existence of electromagnetic radiation provided modern wireless communication with theory basis.

（6）（　　）Frequency modulation improved communicating quality and impelled the development of mobile communication.

（7）（　　）The successful launch of first communication satellite broke the new path of space communication.

（8）（　　）SLSI and ISDN technologies promoted mobile communication and optical fiber communications into application.

1.4　课文参考译文　现代通信简介

1.4.1　通信

现代通信（communication）指利用光、电技术手段，借助光波或电磁波，实现从一地向另一地迅速而准确地信息传递和交换的技术，也称之为电信（telecommunication）技术。

通信技术、计算机技术和控制技术不断发展与融合极大地扩展了通信的功能，通信传递的内容也已从单一的语音或文字转换为集声音、文字、数据、图像等的多媒体信息，通信网不仅能有效地传递信息，还可以存储、处理、采集及显示信息，实现了可视图文、电子信箱、可视电话、会议电视等多种信息业务功能。

按照不同的划分依据，通信系统有多种不同的分类。

1. 单工、半双工、双工通信

按信息在信道中的传输方向，通信方式可分为单工通信、半双工通信和全双工通信。单工通信系统的信号只能单方向传送，如广播、电视系统传输系统。半双工通信系统的信号可以在两个方向上传输，但时间上不能重叠，即通信双方不能同时既发送信号又接收信号而只能交替进行。全双工通信方式是目前使用最多的通信方式，其信道可以随时双向传输信息。

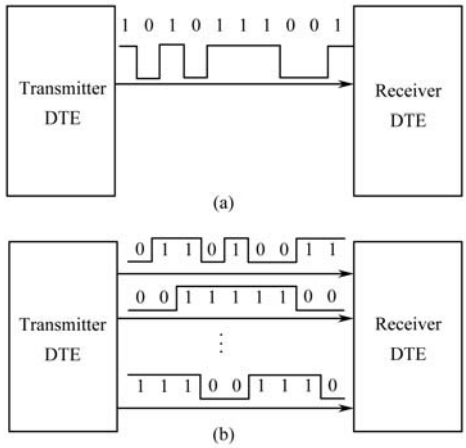
2. 串行、并行通信

按照通信双方传输信息的路数，通信方式又可分为串行通信和并行通信。串行传输的数据码元是一位接一位地在同一条信道上传输的，如图 1-1（a）所示。并行传输常用于现场通信或计算机与外设之间的数据传输，一次将构成一个字符的多个码元同时传送，如图 1-1（b）所示。

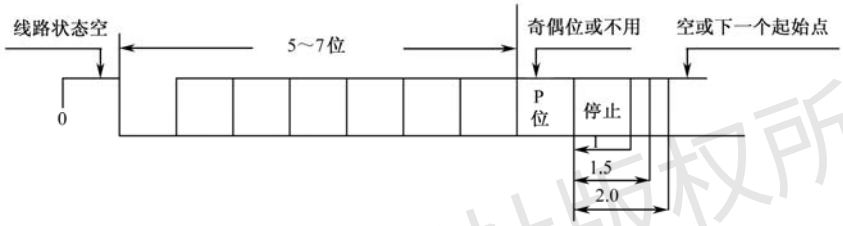
3. 同步、异步通信

按照信息在信道中传输的控制方式，通行的方式可分为同步传输和异步传输。

异步通信系统的每个字符都以不均匀速率独立发送，每次只传送一个字符，分别由起始位（如逻辑电平 1）、停止位（如逻辑电平 0）表示一个新字符的开始和结束。起始位一般占一位码元时间，停止位可根据需要取 1、1.5 或 2 位码元宽度，如图 1-2 所示。由于每个码元的传输都需要增加 2～3 比特的附加信息，异步通信传输效率较低。



译图 1-1　串行通信和并行通信



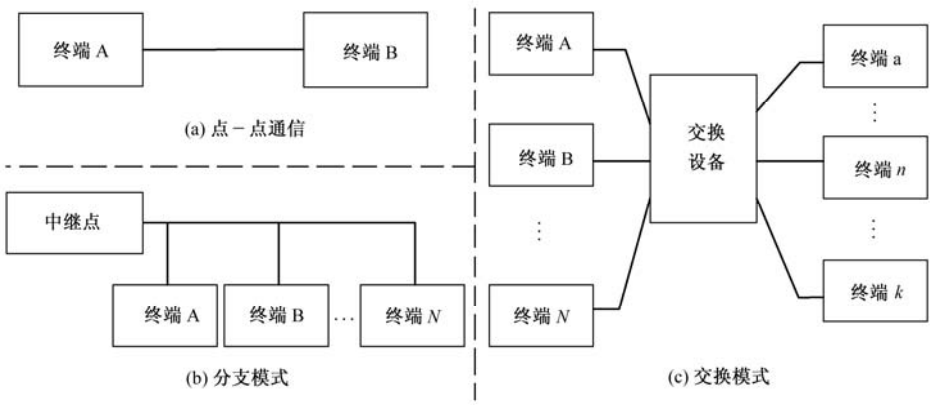
译图 1-2　异步通信

同步通信以数据块为单位传输信息，并在每个数据块的前、后端分别加上前文（preamble）、后文（postamble），以表示数据块的开始、结束。显然，同步通信的效率要比异步通信的效率高，更适用于高速数据传输的场合。

4. 点—点、点—多点、多点—多点通信

根据信源、信宿之间不同的线路连接与信号交互方式，通行又可以分为点到点的通信、点到多点通信以及多点到多点的通信等。

点到点的通信方式如图 1-3（a）所示，进行通信的两个终端 A 与 B 之间通过专用线路直接进行信息交流。点到多点的通信方式中，每个终端（如终端 A，终端 B，…，终端 *N*



译图 1-3　点–点、点–多点、多点–多点通信

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等）都经过同一个信道与转接站连接，其相互之间的通信必须经过转接站转接才能实现。多点到多点通信方式中，借助交换设备，各个终端之间可以灵活地采用直接连通线路的方式，或存储、转发的形式进行通信。

1.4.2 现代通信简史

人类必须要进行思想交流和信息传递，所以有人类就有通信。从 1799 年伏特发明电池以来，人们就开始努力试图利用电来进行通信了。其发展过程可以从表 1-1 所列事件代表的阶段得以描述。

译表 1-1 现代通信大事记

年代	事件	意义
1837	莫尔斯（Morse）发明了电报	人类开始利用电进行远距离消息传递
1876	贝尔（A.G.Bell）发明了电话机	直接利用电流强弱传送语音信号
1864，1887	麦克斯韦（Maxwell）预言电磁辐射，赫兹（Hertz）实验证实	为现代的无线电通信提供了理论根据
20 世纪初	出现了幅度调制 AM	将通信内容由单一的语音传送变为语音、音乐、图像等多种信号传送
1933	调频 FM 技术出现	FM 技术克服了 AM 技术容易受到干扰的缺点，改善了通信质量，推动了移动通信技术发展
1928 1937	奈奎斯特（Nyquist）定理被提出； 瑞维斯（A.H.Reeves）发明 PCM（脉冲编码调制）通信	通信技术由频分复用发展到时分复用，开始由模拟通信转向数字通信； 通过 PCM 技术，模拟信号被数字化传送，进一步提高了抗干扰能力
20 世纪 40～50 年代	香农公式和不失真编码原理、纠错编码原理、信号和噪声理论、调制原理以及信号检测理论出现	对通信的有效性和可靠性提供了理论依据，促进了通信技术的成熟与进步
l960	第一颗通信卫星发射成功	开辟国际通信通道，促进空间通信发展
20 世纪 60 年代	电缆电视、激光通信、雷达、计算机网络和数字技术出现	光电处理技术和射电天文学飞速发展
20 世纪 70 年代	大规模集成电路、程控数字交换机、微处理机迅猛发展	商用卫星通信、光纤通信迅猛发展
20 世纪 80 年代	超大规模集成电路，综合业务数字网出现	移动通信、光纤通信得到应用

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