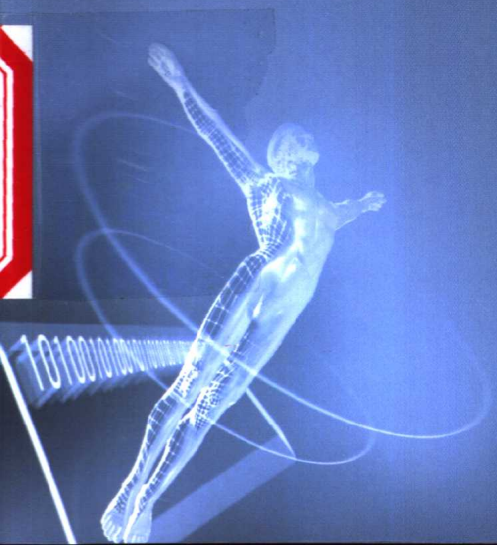
21世纪高新科技专业英语阅读系列

现代通信技术

Communication Technology

魏巍　刘明威　主编



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前　言

世界的发展需要中国，中国的富强也离不开世界。打开国门，与全世界交流，才是中国发展的正确道路。尤其是随着中国成功地加入 WTO，科技英语的地位显得更为重要，国际、国内的许多公司企业急需要掌握这项技能的人才。为了适应社会的发展和需要，同时为了配合目前高等学校纷纷设立的双语课程的教学，我们专门组织各高校工科专业的青年教师骨干和学术学科带头人编写了《21 世纪高新科技专业英语阅读系列》丛书。

本丛书共分 8 册，包括《材料科学与化学工程》、《计算机与信息技术》、《光电世界》、《电子世界》、《现代通信技术》、《航空航天技术》、《生物技术与医学》、《人工智能》等。

每个分册都在精选富有时代感和代表性文章的基础上，精心设计了技术背景、词语注释、句子注释三个方面的内容。技术背景能帮助读者进一步了解到各项科学技术在全世界的发展、现状以及未来；词语注释、句子注释能使读者更好地理解课文内容，并进一步掌握专业词汇和语句。其中：

《材料科学与化学工程》用通俗易懂的语言讲述了材料科学和化学工程的各个研究方向，使读者对这两个学科有了较全面的了解。本书在选材方面注意了材料科学和化学工程领域内的最新科技进展，使读者能够追踪到两个学科的研究前沿发展。

《计算机与信息技术》是一系列当今热点技术的汇总，覆盖了几乎整个计算机与信息技术领域内的相关内容。无论是早期的电

话网、大型电脑和半导体技术，或是新兴的 Internet、局域网、个人电脑及重要软件；无论是最新的理论研究，或是实践中的重大成果，都有相关的英语文章与之相对应。

《光电世界》主要讲述了光电技术的应用，包括电力市场、太阳能发电、电子碰撞电离现象、电荷耦合器件、全光逻辑器件以及光子学的研究等知识。

《电子世界》收集了可编辑逻辑电路、转换脉冲、数字信号处理、动态随机存储器、混合信号设计及有关电子工程技术各个方面的知识。

《现代通信技术》讲述了现代通信技术的各种方式以及各种通信系统，并对下一代通信方式进行了预测：随着社会经济的发展，电话业务的适度发展和数据业务的超常发展将是未来我国电信业务市场的主要特征，电话业务由主变辅，以互联网技术为核心的数据网络将最终成为网络的主体。

《航空航天技术》基于“航天航空技术的发展显示了中国综合国力的增强”这一认识，对航空航天技术中相关领域进行了分别阐述，不仅介绍了太阳系的成员，探索了外层空间，阐述了飞机的制造，更展望了航空航天技术的发展。

《生物工程与医学》涵盖了人类基因工程、人类基因组数据、人工制造血管、超级人造细胞、干细胞、人类寿命、遗传、克隆等生物技术知识，并分析了进餐时间与人体生物钟的关系，人寿保险与社会的关系，癌症药物的新来源以及过敏、精神分析、肥胖症和糖尿病等社会医学问题，全面概述了生物与医学等方面的知识。

《人工智能》讲述了人工智能理论的原理，人类智能与机器之间的关系，人工智能、逻辑推理计算机、模糊计算机和神经网络计算机三者的关系以及人工智能技术开发、人工生命研究、机器人等

知识，能够帮助读者获得有关人工智能各个方面的最新技术发展情况。

通过对丛书的阅读，我们希望不仅能使读者对相关领域内的常用科技英语词汇、术语有一个全面的初步印象，还想借此机会能够让大家进一步了解到科技的发展现状与趋势，从而为大家在具体研究中起到一定的帮助作用。

如果您看完本书后觉得物有所值，能使您的知识有所增长，那就是我们最大的欣慰了。由于时间仓促，限于作者水平，书中难免存在疏漏与不足之处，还望各位专家读者不吝赐教，以便我们修订再版时予以订正。

编者

2003.09

内 容 简 介

为提高通信技术学习和工作人员的科技英语水平，本书收集了通信工程等多个研究领域的文章，知识涉及面较广泛，内容丰富，主要包括无线电通信的基本原理、光学网络、光纤/同轴线混合网电话、同步数字系列、电信管理网络、非对称数字线技术、异步转移模式基本原理、信令系统 7、多协议标记交换、泛欧式数字移动电话系统、通用移动电话系统等技术。

本书面向 21 世纪通信发展的实际，力图多反映一些通信新技术和新发展，系统地介绍通信系统的基本原理、基本概念、基本技术和基本分析设计方法。

本书可作为高等院校电子工程与通信专业师生的科技英语学习指导书，也可作为科研人员和专业人士进行科技英语学习的参考书。

Content

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Chapter 1 Fundamentals of Telecommunications

无线电通信的基本原理

【原文】

Overview

Sometimes, when attending a class, it is okay to miss the first half-hour. After all, we do know something about the subject, and that first half-hour is likely to carry little more than introductory information. The same holds true when picking up a textbook on a particular subject. Maybe the first chapter can be skipped; again, it contains introductory material that we already know.

But often this is not the case. We do not know as much as we thought we knew, and that first half-hour or that first chapter contains material that may well be prerequisite material. The tutorial will cover the fundamentals of telephony, from its inception in Alexander Graham Bell's laboratory to today's emerging technologies.

1. History and Regulation of the Telephone Industry

"Mr. Watson, come here, I want you." With these historic words Alexander Graham Bell called his assistant Thomas Augustus Watson over the so-called"telephone,"and an industry was born.

The place: 5 Exeter Place, Boston, Massachusetts
The time: evening, March 10, 1876

With all inventions, the road had not been smooth. For years, Graham Bell(as he liked to be called)had been experimenting with a harmonic telegraph. It should be possible, he reasoned, to send six tones over the same wire at the same time and cause six reeds attached to the receiving end to be operated. Furthermore, if all worked well, varied combinations of these six pitches could reproduce human speech.

Simultaneously he was working on a scheme that utilized the varying resistance of a wire. A diaphragm, which would be vibrated by the human voice, was attached to a wire that was dipped into a mixture of acid and water. In theory, as the diaphragm moved downward, forcing more wire into the acid, the resistance of the wire would be decreased. As the diaphragm moved upward, the wire would be withdrawn from the conducting liquid, and its resistance would be increased. It was this device that was ultimately successful and that formed the basis for the telephone industry for many years.

A year later, on July 9,1877, the Bell Telephone Company was formed, and Alexander Graham Bell became the company's electrician, at a salary of $3 000, and Watson became superintendent in charge of research and manufacturing. Unfortunately for Bell, the basic patents were due to run out in 1893 and 1894. But by this time, Theodore Newton Vail had been brought in as general manager, and he immediately set about establishing an organization strong enough to survive without a monopoly. "What we wanted to do was

to get possession of the field in such a way that, patent or no patent, we could control it,"Vail said. The first step was to obtain a captive manufacturing facility, and this was accomplished in 1881 with the purchase of Western Electric Company.

Vail also sent his salesmen into the field to set up telephone exchanges in virgin territory. Generally, local promoters were encouraged to organize a local telephone company and sell stock. Thus, by 1885 Vail had established a vertically integrated supply division, a network of companies licensed by the parent, and a strong research and development arm. The expiration of Bell's basic patents in 1893 and 1894 was the starting signal for open competition. Independent telephone operating companies sprang up throughout the country; by the turn of the century there were approximately 6 000 of them, and these 6 000 provided service to some 600 000 subscribers. Through the years, mergers and acquisitions took their toll; at the present time there are approximately 1 300 local exchange carriers.

Not interconnected. Therefore, it was necessary for a subscriber to have two or three instruments to communicate with the total population of the city. However, the great asset of AT&T[1], which became the official name of the company at the end of 1899, was the control of all the long-distance circuits and its steadfast refusal to interconnect any other company to it.

This would never do, and the Justice Department filed suit in 1912. The world was angry with AT&T, and an AT&T vice president—Nathan C. Kingsbury—realized it. He recognized that the best demonstration of AT&T not being in a monopoly position was

to point to thousands of independents apparently operating in harmony. To this end, AT&T agreed to provide interconnection arrangements to all independents. This 1913 agreement was henceforth called the Kingsbury Commitment.

By 1934 telecommunications had become so important to the country that Congress passed a Communications Act and, simultaneously, created the Federal Communications Commission(FCC)【2】. The section of this Act that has turned out to be most important has to do with what we now call universal service. It said:"For the purpose of regulating interstate and foreign commerce in communication by wire and radio so as to make available, so far as possible, to all the people of the United States a rapid, efficient, nationwide, and worldwide wire and radio communication service with adequate facilities at reasonable charges."

As a result of this principle, a support structure has been established whereby certain groups of subscribers(e.g., long-distance users, business subscribers, subscribers in locations where telephone service can be provided with relative ease, etc.)will pay more than true costs, and other groups of subscribers(e.g., subscribers in rural and other high-cost locations)will pay less than true costs.

In 1949 the Justice Department again filed suit against AT&T, claiming that Western Electric charged inordinately high prices from their customers(i.e., the operating telephone companies owned by AT&T), thus making it possible for the operating telephone companies to charge their subscribers inappropriately high rates. The suit dragged on, and a consent decree was reached in 1956. AT&T won; Western Electric need not be divested from AT&T, the Bell

System would engage only in telecommunications business, and nonexclusive licenses would be granted to any applicant on fair terms. This was the final judgment. The eventual breakup of the Bell System in 1984 was accomplished through a modification of this final judgment, hence the modification of final judgment(MFJ).

Although the Bell System appeared to be the winner in this 1956 suit, over the next two decades it would lose battles, one at a time. There was the Hush-A-Phone case in 1955; the Carterfone case in 1968; MCI's above 890 cases in 1959, and the MCI case dealing with a long-distance route from Chicago to St. Louis in 1969. In November 1974, the Justice Department once again filed suit to break up the Bell System. The case trudged on until 1978, when Judge Harold Greene took over. He moved things quickly, and on January 4, 1982, a terse announcement was issued by the Justice Department and AT&T saying that negotiations had been reopened. Then, on January 8,1982, the news broke; AT&T had agreed to break up its $136.8 billion empire. It was agreed that AT&T would divest the local parts of the Bell operating telephone companies. It would keep its manufacturing facilities and its long-distance network. The agreement would take effect on January 1, 1984.

The 22 regional Bell operating companies(RBOCs) agreed to form 7 regional holding companies(Bell Atlantic, NYNEX, Bell-South, Ameritech, US WEST, Pacific Telesis, and Southwestern Bell). The agreement also said that the Bell operating companies would not be allowed to manufacture nor would they be allowed to get in the long-distance business within their territories. AT&T would not be allowed to get in the local-exchange business nor to ac-

quire the stock or assets of any RBOC.

That remained the state of affairs until the passage of the 1996 Telecommunications Act. This Act threw most of the rules established in 1984 out the window and left the implementation of the Act to the FCC. There have been problems ever since. What did the Congress mean by "promote competition"? Should AT&T be allowed to get in the local-exchange business? (Answer: yes.) Should the RBOCs be allowed to get in the long-distance business? (Answer: yes, but only after passing a 14-point checklist.) What did "expanded universal service"mean? Should the RBOCs be allowed to merge? (Answer: yes. Bell Atlantic has merged with NYNEX; Southwestern Bell (SBC) has merged with Pacific Telesis and is planning to merge with Ameritech. Bell Atlantic intends to merge with GTE. If all of these are ultimately approved, there will remain four RBOCs). To date, many questions remain, and there is no assurance that they will be answered in the foreseeable future.

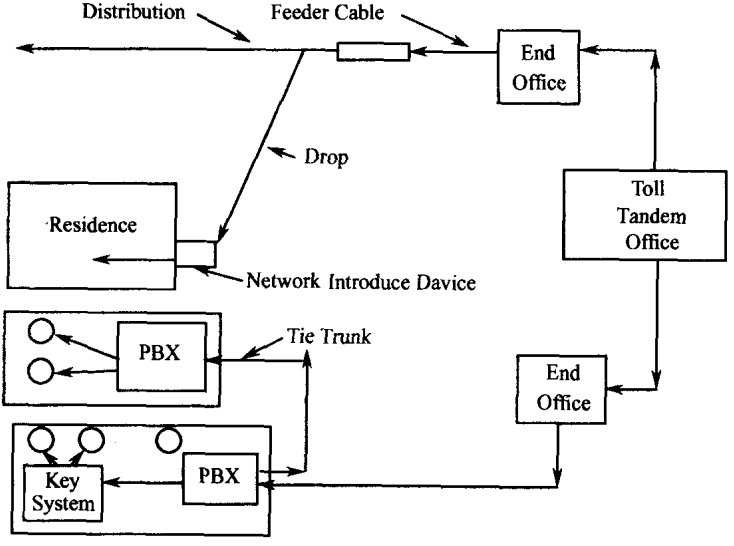
2. Network

If there were only three or four telephones in a locale, it would make sense to connect each phone to all other phones and find a simple method of selecting the desired one. However, if there are three or four thousand phones in a locale, such a method is out of the question. Then it is appropriate to connect each phone to some centrally located office and perform switching there. This switching could be a simple manual operation using plugs and sockets or could be done with electromechanical devices or with electronics. In any case, this central-office(CO)solution is the one that has been chosen by the telecommunications industry.

As we connect each of these thousands of telephones to the central office, we have what is a star configuration; all lines are particular to one and only one station, and all terminate on the nucleus of this star—the CO.

These connections are called the local exchange plant, and the telephone company handling this function is called the local exchange carrier(LEC). The connections themselves are often called the local loop; at other times we refer to them as the last mile. In more technical terms, the section closest to the customer's premises is called the distribution plant and that section closest to the CO, the feeder plant(see Figure 1-1).

Figure 1-1. Particular Names Are Applied to the Various Parts of the PSTN; End Offices Are Class-5 Offices; Toll Tandem Offices Are Generally Class-4 Offices



(Note: This is certainly a generalization, as will be much that follows. Although the feeder plant usually consists of one or more cables leading to some point of demarcation [a terminal box or an enclosure] after which the lines are spread out going in many smaller cables to the customer premises [the distribution plant], there are cases where there is no need for a point of demarcation. Then what do we call the plant? We will not struggle with such semantic difficulties here.)

But what if a particular telephone call is not originated and terminated within the particular CO's geographic coverage? How do we get to another city or another state or even another country?

The answer, of course, is to connect these COs to a higher-echelon CO(see Figure 1-2). We apply numbers to these levels of offices; the local office, also called the end office, is called a Class-5 office. The office to which it connects is called the Class-4 office. The top level, the Class-1 office, appears in only a few places in the country. Please note that the only office that has people as its subscribers is the Class-5 office. The other offices in this hierarchy have lower-level COs as their subscribers. Those lines connecting switching offices to switching offices, rather than to subscribers, are called trunks.

This section of the telephone infrastructure—the section leading upward from the Class-5 offices—is handled not by the LECs but by the interexchange carriers(IXCs), the long-distance carriers. This entire structure has been titled the"hierarchy of switching systems." The total network is called the public switched telephone network (PSTN)[3].