6

Technical E-Commerce Strategy

E-commerce, as one kind of new business model, is commercial trade over a wide range of activities with information technology, such as online shopping, online transactions and online payment businesses. Although the business model is the most important for the development of e-commerce, the development of information technology is also very important. E-commerce can not develop well without the development of information technology. Information technology is the foundation of e-commerce. At first, the emergence of e-commerce came from the application of EDI. Then, with the development of information technology, people gradually adopted more and more new information technology in e-commerce to promote its development, which led to high efficiency and low cost for business operations. Many popular technologies such as RFID, mobile computing and cloud computing are adopted by e-commerce.

From the perspective of the development of e-commerce technologies, e-commerce solutions can be divided into three kinds [1]. They are solutions for small and medium size companies, solutions for medium size to large businesses and solutions for large businesses. Small and medium size companies usually use a basic Commerce Service Provider (CSP) to provide e-commerce services because of weak capital resources. CSP can provide a wide range of standard e-commerce services including catalog and transaction processing. Taobao is a typical CSP. For midsize enterprises and some large enterprises, they can choose to purchase the equipment and establish their own e-commerce system so that they can have more control over the site. In general, e-commerce systems for medium size enterprises can interact with database software. Due to high transaction rates and partnerships, large enterprises usually need customizable systems according to their own characteristics. Solutions for large businesses include ERP, CRM, SCM, knowledge management and so on. Now e-commerce provides people with a brand-new communication path in different fields including taxation, banking, transportation, commodity inspection, customs, foreign exchange, insurance, telecommunications and authentication, as well as units such as shopping malls, merchants, enterprises and clients. In addition, with the development of information technology, e-commerce is developing from wired to mobile, from non-embedded to embedded, and from fixed to feasibly customized.

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It can be seen that grasping the trends of information technology is very important for developing e-commerce. Only when adopting proper information technology, can e-commerce solutions be accepted by customers and developed fast. Although there are various kinds of information technologies relative to e-commerce, they still have something in common. Any e-commerce site needs fundamental technologies to support it. In addition, advanced technologies can make e-commerce sites more convenient and colorful. We will present e-commerce fundamental technologies, mobile communication technology and advanced technologies in the following.

6.1 E-Commerce Fundamental Technology

E-commerce fundamental technology refers to those technologies any e-commerce solution will need. As we know, e-commerce is based on the Internet. All the information is transferred and displayed on the Internet. So Web technology is needed. In addition, EDI is used to exchange electronic data. E-commerce develops on the basis of EDI technology. Meanwhile, e-commerce needs information processing technologies such as GPS, GIS and RFID. Moreover, there is no doubt that e-commerce is related to electronic payment and customer information protection. So how to protect online transactions and information safety is very important. If the e-commerce system is unsafe, customer information can be easily stolen and hackers can easily pretend to be real customers to purchase commodities. Therefore, security technology is also one of the fundamental e-commerce technologies. Next we will briefly introduce the four kinds of e-commerce fundamental technologies.

6.1.1 Web Technology

Web technology mainly consists of the Web technical structure, markup languages and computer networks. As we know, most e-commerce systems are based on Client-Server architecture, and the Web technical structure is used to standardize the process of information transfer. The markup languages are used to present the information on the WebPages. Meanwhile, computers are distributed in different places so that how to build a computer network is very important.

6.1.1.1 The Web

The structure of Web technology is shown in Fig. 6.1. The Web client acts as the terminal with a browser while the Web server is the mainframe which stores multimedia data resources and provides www services. The middleware invokes

the database and other applications in the Web server. CGI, JDBC and Web API are common middleware. The mechanism of the Web technical structure is that the browser sends an http request to the www server, then the www server processes the request, and returns the processing result to the browser in the form of an html file after receiving the request, and the browser interprets and displays the information finally to the user.

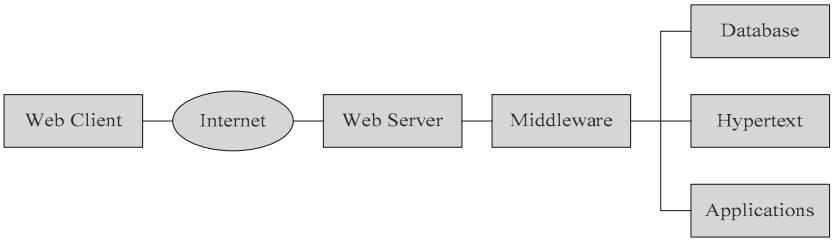


Fig. 6.1 Web technical structure

In addition, the concept of the Web has also developed further, from Web 1.0 to Web 2.0 and to Web 3.0 now. Web 1.0 refers to the first stage of the World Wide Web linking webpages with hyperlinks. Web 1.0 is mainly dial-up with 50 K average bandwidth [2]. Its main function is to read contents on the Internet. At the time, most websites were all about read-only content and static HTML websites. Web 2.0 has developed the Web 1.0 further. It is relative to many kinds of Web applications such as social networking sites, blogs, wikis, video sharing and hosted services to promote users to interact and collaborate with each other in a virtual community. People can share, operate and design with each other on the World Wide Web[3]. Web 3.0 was first launched by Jeffrey Zeldman in 2006. Now there is no official definition of Web 3.0. In general, Web 3.0 emphasizes intelligence and personality. TV-quality open video, 3D simulations, augmented reality, human-constructed semantic standards, and pervasive broadband, wireless and sensors can all be presented in Web 3.0. Instead of searching by keywords, the searching engineer may automatically suggest relative information according to different people. Differences between Web 1.0, 2.0 and 3.0 are shown in Fig. 6.2[4].

6.1.1.2 Markup Language

Markup languages mainly consist of HTML (HyperText Markup Language) and Extensive Makeup Language (XML).

HTML (HyperText Markup Language) is a simple markup language that is used to make hypertext documents. HTML documents are independent of operating system platforms. Any operating system such as UNIX and Windows can use HTML to form web pages. HTML is composed of HTML elements enclosed in angle brackets. Elements have three components: a pair of element tags,

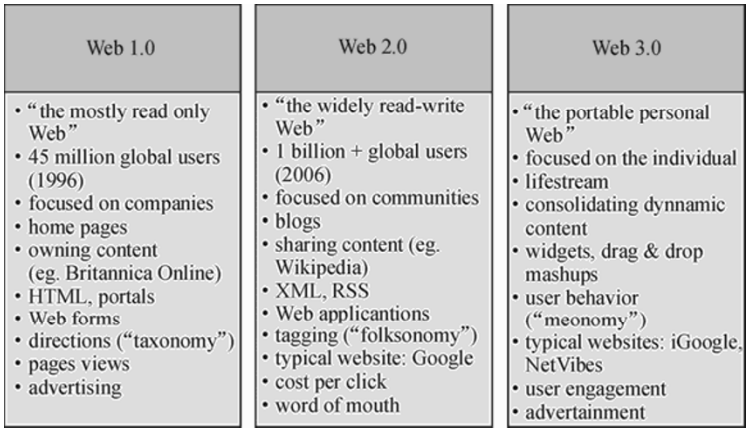


Fig. 6.2 Differences between Web 1.0, Web 2.0 and Web 3.0

a "start tag" and "end tag". Some elements are attributed within the start tag and finally, any textual and graphical content between the start and end tag [5]. Though it describes the structure of the document, it cannot define but suggests the way in which the document displays and arranges the information. The final result displayed in front of the user is determined by the display style and the ability to explain tags of the web browser. That is why the same document will be displayed differently in different browsers. Now the version of html is 2.0, which evolved from a subset of the Standard Generalized Markup Language (SGML).

XML can be seen as the simple extension of HTML. XML combines advantages of SGML and HTML while eliminating their disadvantages. XML is a meta-markup language. "Meta-markup" means that developers can define their own tags according to their own needs. For example, one can define tags such as <book> or <name>. Any names that conform to the naming rule of XML can be used as tags, which provide an access to different applications. For large and complex documents, XML is an ideal language. It allows us to designate the vocabulary in documents and the relationship between elements. For instance, it can be prescribed that an author element must have a name sub-element, or the business should include a sub-business[6].

6.1.1.3 Computer Network

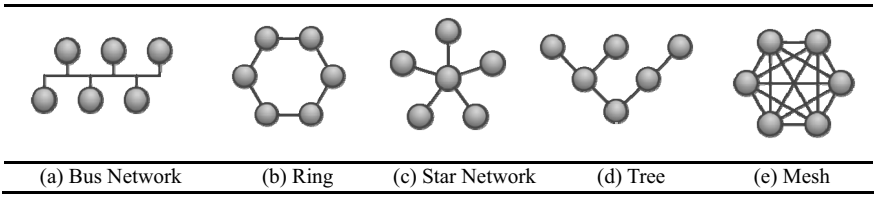
The computer network refers to a system that physically links computers with independent functions which are distributed in different geographic locations via a variety of communication apparatus and circuits (like telephone, cable, microwave, fiber-optical and satellite, etc.) and realizes mutual communication according to network protocol so as to share the software, hardware and data resources.

According to the communication distance or regional coverage range, a computer network may be classified into a Local Area Network, Metropolitan Area Network or Wide Area Network (Table 6.1).

Table 6.1 Computer network classification

Network types	Abbreviation	Approximate distribution	Host computers location
Local area network	LAN	10 m	Room
		100 m	Building
		1 km	Campus
Metropolitan area network	MAN	10 km	City
Wide area network	WAN	100 km	Country

According to network topology structure, a network can be classified into 5-types, such as bus-type, star-type, ring-type, tree-type and net-type, as shown in Fig. 6.3.



(a) Bus Network (b) Ring (c) Star Network (d) Tree (e) Mesh

Fig. 6.3 Categories of network topology

6.1.1.4 IPv4 & IPv6

IPv4 (Internet Protocol version 4) is the fourth version of the Internet Protocol (IP) and also the first version that is widely deployed. By far, IPv4 is the most widely used Internet protocol. IPv4 is defined in IETF publication RFC 791 published in 1981 by Jon Postel. As a connectionless protocol for use in packet-switched link layer networks, the IPv4 can be operated in all kinds of bottom networks such as Point-to-Point (PPP) protocol and Serial Line Interface Protocol (SLIP)[7]. IPv4 uses 32-bit addresses, which limits the address space to 2^{32} possible unique addresses. Because some addresses are reserved for special purposes such as private networks, the number of addresses that can really be used is reduced. With a rapidly growing number of Internet users, the IPv4 address pool became exhausted. IPv6 was created to cope with this.

IPv6 has increased the address size from 32 bits in IPv4 to 128 bits, providing vastly more addresses. It is described in the Internet standard document RFC 2460, published in 1998. Like IPv4, IPv6 is also a connectionless protocol for use in packet-switched link layer networks and provides end-to-end datagram transmission across multiple IP networks. Also, IPv6 has many additional features IPv4 does not have. Compared with IPv4, IPv6 has larger address space than in IPv4 because of the longer length of an IPv6 address. Meanwhile, the allocation of IPv6 is much more efficient. The standard size of a subnet in IPv6 is 264 addresses, which is as much as the square of the size of the entire IPv4 address

space. Because of large subnet space and hierarchical route aggregation, Ipv6 can take an entry in the routing table to represent a subnet, which can greatly reduce the length of the routing table and improve the network management and routing efficiency. In addition, Ipv6 increases the support for the multicast and flow control, providing a long-term development opportunity for multimedia on the Internet and a great platform for the control of the Quality of Service (QoS). Moreover, IPv6 hosts can configure themselves automatically when connected to a routed IPv6, which is an improvement of the Dynamic Host Configuration Protocol (DHCP) and makes the network management very convenient. And IPv6 is safer than IPv4. Users in the IPv6 network can encrypt the data in the network layer and decrypt IP packets in Internet Protocol Security (IPsec), which greatly enhances the network security. Lastly, IPv6 also supports network mobility. With IPv6, entire subnets do not need to move to a new router connection point without renumbering[8].

Although IPv6 is superior to IPv4, it is difficult to convert from IPv4 to IPv6. IPv6 deployment is still in its infancy. There is still a long way to go before IPv6 is widely used.

6.1.2 Electronic Data Interchange

According to the description by the United Nations Standards Organization, Electronic Data Interchange (EDI) is a means of computer-to-computer transmission that puts the business or administration into a structured data format with an authorized standard. That is to say, EDI is a computer-to-computer transmission of business information between enterprises that uses a standardized format of some kind. The two enterprises that engage in exchanging information are trading partners. Enterprises that exchange data in certain standard formats are regarded as compatible EDI. The business information exchanged is transaction data; it also includes other information related to transactions, such as price quotes and order status. Transaction data between enterprises includes invoices, purchase orders, requests for quotations, bills of lading, and received reports. The data on these five types of forms account for over 75% of all information exchanged by trading partners in the United States.

EDI emerged in the middle of the 20th century. The trade transaction became increasingly active at that time and the trade volume grew very fast. Meanwhile, with fast development of electronic technology and widespread communication networks, the communication between people became increasingly closer. In order to improve business operations, EDI gradually came into being. In the 1980s, EDI was used only in big companies with complicated management as a way to improve the management, promote efficiency and reduce the cost. Since the 1990s, EDI has not been confined within the enterprise or business any longer. It can be said EDI was the earliest adopted form of e-commerce used by enterprises. EDI is even regarded as the origin of e-commerce[9,10].

EDI has five features as follows (Fig. 6.4): i) EDI is electronic information transmission between computer systems; ii) EDI is data exchange from standard format to structured electronic data; iii) EDI is electronic data exchange according to the standard and structure agreed by the sender and the receiver; iv) EDI is electronic data exchange read automatically by computer without human intervention; v) EDI is electronic data exchange for business purposes.

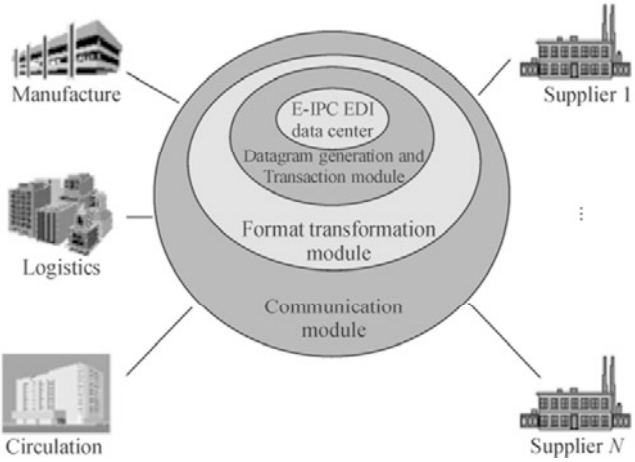


Fig. 6.4 EDI framework

6.1.3 RFID, GPS, and GIS Technologies

6.1.3.1 RFID Technologies

Radio Frequency Identification (RFID) is one of the top ten technologies of the 20th century. In addition, RFID is the core technology of the Internet which will be described in detail below. RFID chips store a lot of information and transmit data information by identifying objects automatically via frequency signals and by acquiring relevant data frequency transmission technology. When an RFID electronic tag (e-tag) is in the valid area of an RFID reader, the information stored in the RFID electronic tag will be automatically emitted to the reader.

The RFID logistics system is operated as follows. When the goods are leaving the distribution center, the RFID reader reads the information on the tags and then transmits it to the processing system for generating the delivery list. When trucks arrive at stores, the RFID reader at the receiving channel scans the goods in the trucks directly, and then accomplishes the receiving and checking processes. After being moved into stores, goods can be put onto the shelves. Real-time information of goods is transmitted to the processing system via the readers on the shelves, to update and monitor inventory data on the shelves.

RF technologies based on RFID can identify and track all physical objects, provide accurate and real-time data, gather, exchange and process real-time information of goods in movement. Thus, different enterprises are integrated into an efficient unified network, which can keep track of the status of vehicles and products efficiently, improve the efficiency of transporting, warehousing, logistics and distribution, and help enterprises realize the automation of business, transaction and work flow in commerce, logistics and manufacturing so that a more intelligent and rapid business chain can be built. Therefore, an efficient logistics tracking system with RFID technology will provide enterprises with a critical platform to collect, release and manage data in the business chain.

6.1.3.2 GPS Technologies

The Global Positioning System (GPS) is a new generation satellite navigation and positioning system which has real-time three-dimensional navigation and positioning capabilities on land, sea and in the air. GPS is composed of 24 satellites evenly distributed in six orbit planes. The ground supervision center including a principal controlling station, 3 upload stations and 5 monitoring stations is in charge of supervising satellites and calculating satellite calendars. The client device of GPS is primarily composed of hardware and processing software. The user receives a GPS satellite signal via a client device, and obtains the information about his location and speed to finally implement GPS piloting and positioning[11].

In recent 10 years, the GPS experience in China's cartography departments has shown that GPS has gained the trust of the majority of cartographers for its notable features such as high precision, automation and efficiency. Now GPS is successfully applied in geodesy, engineering measurement, aerial photographic surveying, guiding and control of transportation, crust movement monitoring, construction project monitoring, resources surveying, and geodynamics. GPS has revolutionized technologies in the field of cartography. In logistics, GPS can be applied to cars' self-positioning, tracking, dispatching, railway transportation management and military logistics.

6.1.3.3 GIS Technologies

Based on geographic space data, a Geographical Information System (GIS) is a computer technology system which adopts geographic model analysis to provide various spaces and dynamic geographical information for geographic research and decisions. Its basic function is to convert chart data (no matter from the database, electronic forms or by being directly inputted in the programs) into a geographic graphic display. Then displayed results can be browsed, operated and analyzed. The range of display can be from intercontinental to detailed neighborhood maps including population, sales conditions, transportation routes and other contents.

Applied in logistics analysis, GIS is mainly used to improve logistics analysis technologies using the powerful geographic data function of GIS. Companies abroad have developed software that provides specialized analysis for logistics analysis with GIS. GIS logistics analysis software has an integrated vehicle driving route model, shortest route model, network logistics model, distribution and integration model, positioning facilities model and tracking goods model, etc.

6.1.3.4 Case Study: Spatial Logistics Information System Based on 3S Integrated Technology

Due to intense competition, the transportation of raw materials has been a source of profits on account of rising labor productivity and an efficient logistics system. This has attracted attention.

A spatial information system is comprehensive geo-spatial information processing and multi-source information related to information processing technology. A GIS, GPS, RS are included in the scope of spatial information systems. With 3S technology (GPS, GIS, and RS) as the representative of modern mapping technology, information visualization techniques, dynamic real-time updates, rapid information acquisition and information analysis are advocated to provide users with a visual map of application solutions. Thus, spatial information technology in the logistics process can play an important role.

3S technology in the logistics system can effectively achieve the integration of logistics information in fast, real-time, with vast amounts of spatial data acquisition and management. In addition, a graphics display can be more convenient in the cargo logistics system to visualize all aspects of the management, in particular choosing transport routes, delivery vehicles, warehouses, scheduling and distribution centers; and setting the capacity of the warehouse, warehouse layout and a reasonable strategy for handling issues such as effective management and decision analysis. In fact, with the development of the logistics and 3S, 3S technology will become an integral part of the whole logistics management process.

As the supporting technology of Digital Earth, 3S and its integration technology is constantly developing applications. Meanwhile, these applications are increasingly being used. There has been much research of the 3S logistics system in recent years, but mainly its applications in GPS and GIS. 3S integration is the trend. The development trend of logistics, integrated logistics and other technologies should be based on 3S study as a whole in an integrated logistics system.

A logistics information system is very similar to other information systems and contains several major elements: a theoretical basis, technical composition, system structure, relations between elements, and system functions. The spatial logistics information system is formed by effectively integrating information technology such as GIS and GPS with logistics management technology, which greatly changes the database, functional framework, analytical model, application model

and so on. The spatial logistics information system includes logistics management technology. It connects with ERP in the process of information flow. Distributed GIS and GPS technology introduce the concept of geographical space in logistics management, emphasizing wide-area geographical analysis, spatial analysis and visualization management. Fig. 6.5 shows spatial logistics information system architecture.

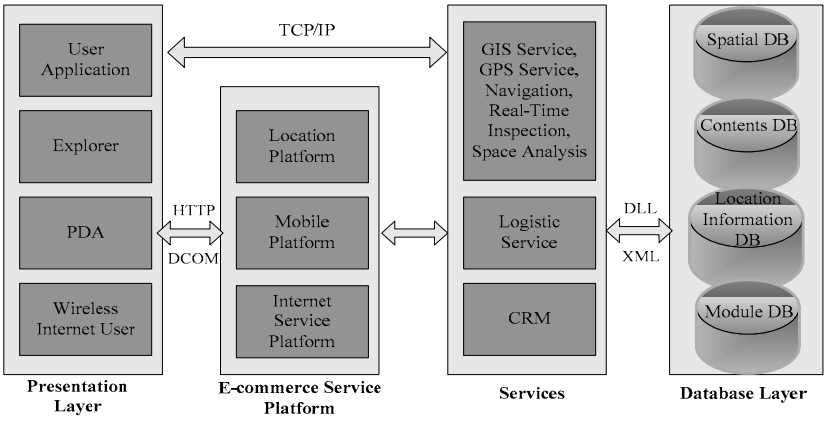


Fig. 6.5 The architecture of a spatial logistics information system

6.1.4 Security and Other Implementation Issues

6.1.4.1 Security Issues

E-commerce is vulnerable to a wide range of security threats. Because e-commerce has a high degree of openness to the Internet through commercial activities, attacks against e-commerce systems can disclose or manipulate proprietary information. In addition, due to its lack of necessary regulatory control and a complete network security system, e-commerce still faces a lot of security threats. Therefore, security technologies should not be ignored. Security has become a core issue of e-commerce. And network security is the core of information security.

The complete security architecture of a computer network includes the network's physical security, access control security, system security, user security, information encryption, secure transmission and security management[11]. In general, information security risks exist in the information sharing and transmission process. In order to make sure the e-commerce system is free of malicious attacks, a lot of security technologies have been developed.

6.1.4.2 Data Encryption Technology

Data encryption technology is used to ensure that the secrecy of information can be traced back. Using data encryption technology can make the information in transit and storage unreadable to anyone except those with special keys. There are two critical keys which are named as the encryption key and decryption key in the encryption/decryption system. Of the two, the encryption key is public while the decryption key is private. The mechanism of the encryption/ decryption system is shown in Fig. 6.6. In order to securely send the message to the receiver, the sender needs to transform the original message (called plain text) to the cipher-text which the attacker can not understand even if he gets the transformed message through the encryption algorithm. When the receiver receives the cipher-text, he decrypts the cipher-text through the decryption algorithm [12]. In the process of encryption and decryption, the encryption key and the decryption key are the core. One of them or two of them are the key parameters of the algorithm. The Data Encryption Standard (DES) is a milestone in data encryption which divides keys into a public key for encryption and private key for decryption. It is based on a symmetric-key algorithm that uses a 56-bit key. But DES has some theoretical weaknesses in the cipher and distributed net and the Electronic Frontier Foundation has even cooperated to break a DES key in 22 h and 15 min. So triple DES was developed and demonstrated to be practically secure[13]. As for as the encryption system, there are mainly two kinds which are a symmetric encryption system and asymmetric encryption system. Now DES is an international standard drawn up by the National Institute of Standards and Technology. The encryption technology is relatively mature, which lays the foundation for the security of e-commerce development.

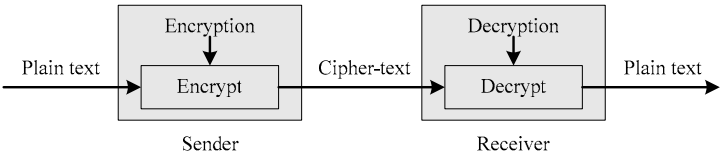


Fig. 6.6 Encryption/decryption system with two keys

6.1.4.3 Digital Signature

In commercial activities, the two parties to the transaction need to sign a document for it to have the force of law. Once the document is signed, it means that both parties agree the content of the document and they are both willing to enjoy prescribed rights and fulfill corresponding responsibilities. Thus the signature should be credible and verifiable. It requires that the signature cannot be counterfeited and modified after the document is signed. But during e-commerce, two parties cannot sign the contract face-to-face so that the signature has to be digital and electronic. Then, how to find a secure and efficient way to make both

parties sign electronic documents becomes a problem. To solve this problem, many digital signature algorithms, such as RSA (Fig. 6.7), DSA and a discrete logarithmic algorithm have been released[14]. Through those digital signature technologies, the receiver can distinguish the sender and find out whether the document was altered in transit. In order to make sure of the electronic signature's legal significance, many countries have issued relevant laws such as the United States, India and some members of the EU[15]. Now a digital signature is widely used in e-commerce.

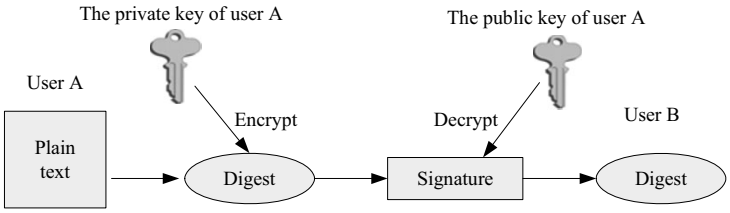


Fig. 6.7 RSA digital signature algorithm

6.1.4.4 Authentication Technology

Authentication technology is used to confirm the operator's identity in the computer network and ensure the operator is the right person. All the information including user identity information is expressed by a specific group of data in the computer network. The computer can only identify the users' digital identity. All the authorization is specific to the authorization of digital identities. So how to guarantee the operator's digital identity becomes important and the identity authentication has a pivotal role as the first gate for protecting Web properties.

The authentication technology can be divided into digital authentication and biological authentication. Digital authentication is using encryption to realize the authentication and the most common authentication is the password. But just using a password is not secure so that a digital signature is usually used to implement the authentication. As far as biological authentication goes, there are a series of ways to achieve this such as face ID Authentication, fingerprint ID Authentication, iris ID Authentication, palmprint ID Authentication, voice ID Authentication and manual signature ID Authentication, etc. [16].

6.1.4.5 Firewall Technology

The firewall is a security system between an Intranet and the Internet which offers access control of the transmission of information between the two networks. The firewall would prevent important information on the Intranet from flowing into the Internet and doubtful information on the Internet from flowing into the Intranet. So the two networks can be safely separated and connected. The firewall technology is to determine what kind of information can pass through the firewall.

The firewall can be divided into two kinds: packet filtering and application proxy. The packet filtering determines whether the packet should be passed according to the packet source address, destination address, port number and protocol category. Because the packet filtering works on the network and transmission layer, the applications do not need to be modified. It makes the packet filtering universal and effective. On the contrary, the application proxy works on the application layer[17]. It can be seen as the middle process between the client and server providing special businesses. The proxy server performs all communications with the Internet. External computers only see the IP address of the proxy server and never communicate directly with internal clients. The application proxy examines the packets more thoroughly and is considered more secure, but uses more memory and processor resources.

6.1.4.6 Secure Payment Technology

SET protocol is widely used in the e-payment process. It was jointly developed by Visa and Master-Card in order to ensure electronic payment security. Besides authenticating a consumer's credit card, SET also authenticates the vendor's identity. In addition, the customer's information is packaged or encrypted and sent to the bank so that the vendor cannot see the account or password of the customer, which makes SET more secure. The customer, online store, bank, e-currency issuer and certification authority are all major participants in the SET protocol. Among them, the certification authority (CA) is a key organization for issuing and managing certificates according to X.509[18]. The data interchange processes of SET protocol are shown in Fig. 6.8.

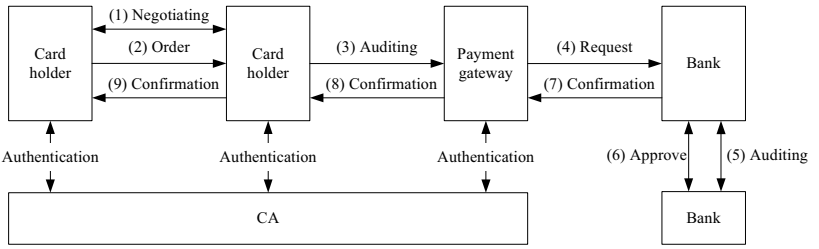


Fig. 6.8 Data interchange process of SET protocol

Security is the key element in the development of e-commerce. Although the Internet is very open, the security problem has been solved to some extent. Because the Internet is very open, people should use two or more secure measures to let them supplement each other. Besides secure technologies, proper security management is necessary. People should pay more attention to network security when using e-commerce. In addition, cooperates should formulate their own security strategies and provide relevant security training programs for the staff.

6.2 Mobile Communication Technology

The development of e-commerce brings us lots of benefits. Among them, m-commerce is a typical one. M-commerce, also known as mobile-commerce and m-business, is not merely a variation of existing Internet services but an extension of e-business with the rapid growth of mobile devices. There is no precise definition of mobile commerce. In fact, it appears that m-commerce is e-commerce or e-business done in a wireless environment, especially via the Internet.

M-commerce is the perfect combination of the Internet, mobile communication technology and other technologies. Technologies to realize m-commerce include 3G, 4G, wireless application protocol (WAP), mobile IP technology, Bluetooth technology, general packet radio service (GPRS), and the Mobile Positioning System (MPS).

6.2.1 Mobile Communication

6.2.1.1 WAP

The WAP system includes WAP gateway, WAP content server and WAP mobile terminal (Fig. 6.9). The WAP gateway plays the role of the translation and transmission of protocol and it is the bridge which connects the radio communication network and the Internet. The communication between the gateway and server is based on Internet communication, namely communicating by HTTP protocol. This means that the service provider does not need to change contents as long as network equipment is added. Then an information service can be provided to mobile users. The content server of WAP stores a great deal of information for access, inquiry and browsing by WAP mobile phone users.

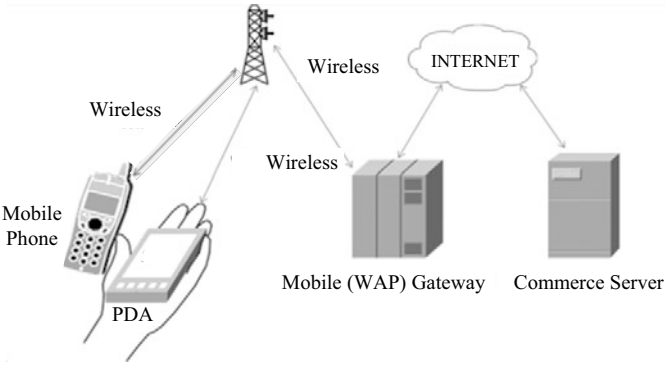


Fig. 6.9 WAP architecture

6.2.1.2 3G Mobile Communication

Compared with an analog mobile phone of the first generation (1G), and GSM and TDMA of the second generation (2G), the mobile phone of the third generation (3G) is the new generation of the telecommunication system that combines wireless communication and the Internet, which is called multimedia communication. It can process various media forms of image, music, video flow and provide various information services including a Web page browser, conference call, e-commerce, etc. In order to provide these services, the wireless network must support different data transmission speeds, that is to say it can support transmission speeds of 2 Mbps, 384 kbps and 144 kbps respectively indoors and outdoors as well as in the moving car. Different from those of the first generation and the second generation, the main features of the 3G system can be generalized as a system of global popularization and global seamless roaming. There are four kinds of 3G standards in the world: WCDMA, CDMA 2000, TD-SCDMA and WiMax. In May 2000, WCDMA, CDMA 2000 and TD-SCDMA were approved by ITU as the three main 3G standards and WiMax was also approved by ITU in 2007. CDMA (Code Division Multiple Access) is the fundamental technology of 3G technology. The 1G system adopts the analog modulation of Frequency Division Multiple Access (FDMA) but its spectrum utilization is very low with lots of signaling interference in voice services. The 2G system adopts the digital modulation method of Time Division Multiple Access (TDMA) which greatly improves the capacity and uses an independent channel. But the capacity of the 2G system is still limited and handoff performance is not perfect. As for CDMA, it has a series of advantages such as simple frequency planning, large capacity, strong anti-multipath capacity, good communication quality and soft switching, which brings great development potential. WCDMA, also called Wideband CDMA, is the original and most widespread radio interface, which was developed from the GSM network and launched by Europe. Its supporters mainly are European enterprises as well as some Japanese enterprises. CDMA 2000 is especially used in North America and Republic of Korea, sharing infrastructure with the IS-95 2G standard[19]. Although supporters of CDMA 2000 are less than those of WCDMA, its development is the fastest. WiMax (Worldwide Interoperability for Microwave Access), also called 802.16 Wireless Metropolitan Area Networking (MAN), is another wireless connection solution. It quickly obtained recognition from enterprises because of low cost. TD-SCDMA was totally independently developed by China and is only offered in China. Now China has comprehensively taken up 3G deployment. Three telecoms—China Mobile, China Unicom and China Telecom are allocated to developing 3G businesses. Among them, TD-SCDMA is deployed by China Mobile while WCDMA and CDMA2000 are deployed by China Unicom and China Telecom. In order to develop TD-SCDMA，China has allocated the biggest telecoms operator in the world, China Mobile, to TD-SCDMA. It can be seen that TD-SCDMA will achieve fast development in the future. China had almost finished the technological testing in 2010. It was estimated that the deployment pilots in six

cities of China would be completed in 2011[20].

The most powerful features of m-commerce are faster download speeds and the extension of cellular connectivity to mobile devices such as phones. High data transmission rates are illustrated in Table 6.2. All 3G networks aim to offer efficient spectrum utilization and worldwide connectivity or global roaming. There is great potential for 3G to change the way mobile devices are used and to dramatically increase m-commerce applications and activities.

Table 6.2 Comparison of 2G and 3G in communication bandwidth [21]

	2G	3G
Bandwidth	30 to 200 kHz	15 to 20 MHz
Connectivity	Dial up	Always on
Hardware	Telephone handset	Mobile computing device
Speed	9.6 to 384 kbps	144 kbps to 2 Mbps
Download delivery time:		
E-mail file (10 kb)	8 s	0.04 s
Web page (9 kb)	9 s	0.04 s
Text file (40 kb)	33 s	0.2 s
Large report (2 Mb)	28 min	7 s
Video clip (4 Mb)	48 min	14 s
TV quality movie (6 Gb)	1,100 h	5 h (approximately)

6.2.1.3 4G Mobile Communication

4G is the fourth generation of cellular wireless standards. It was developed based on the 3G and 2G technology. A 4G system is expected to provide a comprehensive and secure all-IP based mobile broadband solution to laptop computer wireless modems, smartphones and other mobile devices. In 2008, the ITU-R (ITU Radio Communication Sector) [1] specified the IMT-Advanced (International Mobile Telecommunication Advanced) requirements for 4G standards. In the specification, the ITU-R set the speed requirement for 4G services at 100 Mbps for high mobility communication and 1 Gbps for low mobility communication[22]. Very fast speed makes 4G systems able to satisfy any wireless requirement. Through 4G systems, people can get ultra-broadband Internet access services, IP telephony, gaming services and streamed multimedia services. People can smoothly watch movies or play games in a wireless environment.

The network structure of a 4G system can be divided into three layers: physical layer, intermediate layer and application layer. The physical layer provides the access and routing function which is achieved by the connection between wireless network and core network. The intermediate layer offers functions such as QoS mapping, address transformation and complete

[1] ITU-R: one of the three sectors of the International Telecommunication Unit (ITU) which is responsible for radio communication. Its role is to manage the international radio-frequency spectrum and satellite orbit resources and to develop standards for radiocommunications systems for ensuring the effective use of the spectrum.

management. The APIs among three layers are all open so that developing new applications and services becomes possible. The Ogonal Frequency Division Multiplexing (OFDM) technology is the core technology of the 4G system. Because OFDM has high scalability, good anti-noise and anti-interference, fast wireless data transmission, 4G can provide more efficient wireless telecommunication services.

Compared with 3G, 4G has brought greater online experience. The greatest advantages of 4G are fast communication speed and high voice quality. 3G systems can only reach the transmission rate of 2 Mbps while 4G is expected to reach between 10 to 20 Mbps. It can be seen that 4G is about 10 times faster than 3G. In addition, the frequency spectrum of 4G is wider than that of 3G. According to AT&T, each 4G channel will take up the spectrum of 100 MHz which is 20 times more than that of WCDMA (one kind of 3G system). Fast speed and high transmission quality, something that cannot be achieved in 3G systems, can all be achieved in 4G systems. Even in those services 3G has provided, 4G can also provide better services, not only in the quality but also in convergence and price. The 4G system can provide great wireless multimedia communication services, especially videos at fast speed with high quality. Through 4G systems, people can also obtain a great deal of wireless value-added services such as Wireless Local Loop (WLL) and Digital Audio Broadcasting (DAB). In addition, because APIs of 4G systems are all open and 4G systems can be connected with other networks, 2G and 3G systems can smoothly transit to 4G systems without great investment. So 4G systems can be established based on the infrastructure of 3G systems and fees of 4G systems can be greatly reduced. It is said that some services of 4G systems, such as instant wireless connection, are cheaper than 3G communication.

There are several kinds of 4G candidate systems. Mobile-WiMAX, LTE, IEEE 802.20 and Flash-OFDM have all been considered as 4G candidate systems. But they do not meet the requirement of ITU-R IMT-Advanced[22]. Now only "LTE-Advanced" and "WirelessMAN-Advanced" have met ITU-R IMT-Advanced requirement and both of them will be the mainstream of ITU standards. LTE-Advanced is an enhancement to LTE, and it can reach a peak speed of 1 Gbps download and 500 Mbit/s upload. Its evolution track can be described as: GSM → GPRS → EDGE → WCDMA → HSDPA/HSUPA → HSDPA+/HSUPA+ → LTE → LTE-Advanced. In the development process, some steps in the evolution track can be skipped. WirelessMAN-Advanced is still under development. The ability of 1 Gbps for stationary reception and 100 Mbit/s for mobile reception is still not achieved.

Now China has independently developed its own 4G standard called the TD-LTE – TDD (time division duplex) version of LTE. In May 2010, China Mobile, the developer and operator of TD-LTE, launched the world's first trial TD-LTE network at Shanghai World Expo, using Huawei's E2E network solution. It was said that the download rate of the network was ten times faster than existing 3G networks and a series of HD video services such as video conferencing, VOD and live broadcasting could all be provided on the network[23]. Now China's TD-LTE has been listed as one of the two international 4G standard candidates[24].

More than twelve international telecoms operators in Europe, Asia and North America are willing to adopt TD-LTE as the 4G standard[25]. China Mobile has signed a cooperative agreement on TD-LTE with nine foreign operators and planned 26 TD-LTE trials in the world. It is expected that other countries and regions will start commercial deployment of TD-LTE in 2011. India and Japan have clearly declared they would start TD-LTE deployment [26]. Meanwhile, China will continue to increase the investment in TD-LTE. According to HIS iSuppli, the investment in TD-LTE in China may reach $100 million in 2011, $300 million in 2012, $600 million in 2013 and $1.3 billion in 2014[27]. It can be seen that China's homegrown TD-LTE is likely to occupy advantages in the 4G era.

With the commercial use of 4G systems, wireless speed and transmission quality can be highly improved. As for e-commerce, people can buy commodities online anytime they want and have more convenient shopping experiences than with 3G systems. Meanwhile, consumers can smoothly watch videos online such as advertisements and demos just with small-sized terminals they can carry along at any time. But there are still some challenges for 4G systems. The development of 4G terminals falls behind that of 4G networks. Although the deployment of 4G networks has been completed, people still can not enjoy the pleasure 4G has brought without proper terminals. In addition, there is no global unified standard for 4G systems. Moreover, 3G commercial use is still under development. Now just over 25% of the population in the world has adopted 3G networks[28]. It is estimated it may still need at least ten years to achieve popularity and wide commercial use of 4G technology.

6.2.1.4 Mobile IP Technology

Mobile IP technology can help realize mobile computer roaming seamlessly on the Internet by changing the IP protocol in the network layer. Mobile IP technology makes switching from one link to another possible without changing the IP address and without changing communication under way. Mobile IP technology can well support the application of m-commerce to a certain extent.

The mobile IP technology in the wireless access makes it possible for the global network to connect to multimedia, which meets the demands of the popular computing age. However, the existing mobile IP technology still has many deficiencies and the IPv6 solution is not perfect. But we can be sure that it must be a trend to combine the third generation mobile communication system based on mobile IP technology with the Internet to provide multimedia communication business with high speed and quality.

6.2.1.5 Bluetooth Technology

Bluetooth technology is a kind of short-range radio communication technology. Bluetooth technology can effectively simplify communication among PDAs,

laptops, mobile phones, and other mobile communication terminals. It can also successfully facilitate the communication between the equipment above and the Internet, and make data transmission between modern communication equipment and the Internet quicker and more efficient. Thus wireless communication is expanded.

6.2.1.6 Mobile Positioning System

One application domain of m-commerce is business based on the location. It can provide information for tourists and employees on business trips, such as local news, weather and hotel information, etc. This technology will bring great business opportunities to local tourism, the retail trade, entertainment and restaurants.

6.2.2 Wireless Telecommunications Networks

All mobile devices need to connect with a telecommunications network or with another device. How they do this depends on the purpose of the connection, the capabilities and location of the device, and connection options available at the time. There are four levels of telecommunication networks (Fig. 6.10): (1) personal area networks for device-to-device connections up to 30 feet; (2) wireless local area networks for medium-range connections, typically up to 300 feet; (3) wireless metropolitan area networks for connections; and (4) wireless wide area networks for connecting to a network from anywhere with cellular phone coverage. 3G and 4G described above both belong to the fourth kind of telecommunications network.

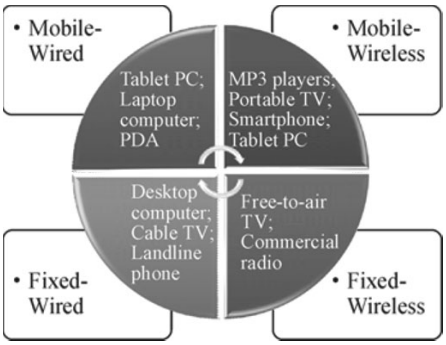


Fig. 6.10 Categories of telecommunication networks

6.2.3 Technical Limitation of Mobile Communication

The technical limitation of mobile communication is shown in Table 6.3.

Table 6.3 Technical limitation of mobile computing[21]

Limitation	Description
Insufficient bandwidth	Sufficient bandwidth is necessary for widespread mobile computing, and it must be inexpensive. It will take a few years until 3G and WiMax are available in many places. Wi-Fi solves some problems for short-range connections
Security standards	Universal standards are still under development. It may take 3 or more years for sufficient standards to be in place
Power consumption	Batteries with long life are needed for mobile computing. Color screens and Wi-Fi consume more electricity, but new chips and emerging battery technologies are solving some of the power-consumption problems
Transmission interference	Weather and terrain, including tall buildings, can limit the reception. Microwave ovens, cordless phones, and other devices in the free, but crowded, 2.4 GHz range interfere with Bluetooth and Wi-Fi 802.11b transmissions
GPS accuracy	GPS may be inaccurate in a city with tall buildings, limiting the use of location-based m-commerce
WAP limitations	Many mobile phone users find that WAP is expensive and difficult to access
Potential health hazards	Potential health damage from cellular radio frequency emission is not known yet. Known health hazards include cell phone addiction, thumb-overuse syndrome, and accidents caused by people using cell phones while driving
Human-computer interface	Screens and keyboards are too small, making mobile devices uncomfortable and difficult for many people to use
Complexity	Too many optional add-ons are available (e.g., battery chargers, external keyboards, headsets, microphones, cradles). Storing and using the optional add-ons can be a problem

6.3 E-Commerce Emerging Technology

A wide variety of innovative technologies applied to e-commerce makes e-commerce easy to adopt by an increasing number of consumers. However, sometimes innovative ideas are other ways to approach the success of the business. Adopting simple and easy-to-use tools in different ways may lead to unexpected achievement. One of the typically innovative technologies is IPTV and one of the typically innovative ideas is SNS. Both of them will be discussed in the following paragraphs. In addition, cloud computing is a new trend in the age of data expansion. With the development of RFID and 3S technology, the Internet of Things will have a great impact on the logistics.

6.3.1 IPTV

IPTV (Internet Protocol Television) describes the system where a digital television service is delivered to subscribing consumers using the Internet Protocol over a broadband connection. Simply, IPTV is television content received through technologies used on the World Wide Web instead of being delivered through a traditional format.

IPTV primarily uses multicasting with Internet Group Management Protocol (IGMP) version 2 for live television broadcasts and Real Time Streaming Protocol for on-demand programs. Compatible video compression standards include H.264, Windows Media Video 9 and VC1, DivX, XviD, OggTheora and the MPEG-2 and MPEG-4.

The IP-based platform offers significant advantages including the ability to integrate television with other IP-based services like high speed Internet access and VoIP. These features make e-commerce applications available. For example, IPTV service providers can add applications to their IPTV offering, such as interactive gaming and information services, including providing weather and stock information. Moreover, IPTV offers the possibility for interactive and targeted advertising to ensure that consumers only receive the information or advertisements relevant to their personal profiles. Consumers can click on advertisements for further information and potentially order advertised products online [29]. Meanwhile, with the development of IPTV, people can also buy things or services by TV. IPTV will provide a platform in favor of consumers and merchants. E-commerce in the form of telephone ordering and cash on delivery will come to the IPTV platform. In this way, e-commerce can expand to more households and consumers can more conveniently make deals.

Now a great many countries have actively developed IPTV and reached some achievement. IPTV has expanded across the globe. At the end of 2009, the number of homes that received IPTV services was 26 million. That number was expected to reach 70 million worldwide by the end of 2014. Revenue from IPTV will rise accordingly from $4.6 billion in 2009 to $12.2 billion in 2014, although only 5% of the world's TV households were expected to subscribe to IPTV platforms by the year 2014.

In 2005, Verizon launched the first IPTV services in the United States and gradually extended IPTV services to other parts of the country,, beginning the prelude to the development of IPTV in America. In 2011, the United States will have 4.8 million IPTV users, accounting for 11.68% of global IPTV users. The United States will have 15.5 million IPTV users by 2013. But the total number of IPTV households in the United States only accounted for 5% with a low penetration level in 2009 [30]. There is great potential for IPTV to develop.

Asia is expected to be the largest region in terms of IPTV subscribers, especially China. It was forecast that IPTV subscribers would reach 28 million by the end of 2014 while global subscribers would reach 70 million. China would contribute 13.7 million, becoming the leading country[31]. Now IPTV is still in an early stage of development. But the government of China is committed to

promoting the three network convergence and preparing for the development of IPTV. Now 12 trial cities such as Shanghai, Beijing, Shenzhen, Qingdao, Xiamen, Dalian, Mianyang, Changsha, Harbin, Nanjing, Wuhan and Hangzhou have finished the construction of an IPTV integration platform[32]. Republic of Korea is also a fast developing country for IPTV. In 2010, Republic of Korea had 3.6 million subscribers and will become the sixth leading country for IPTV in 2014[33].

Although IPTV has great development potential, IPTV still lacks an efficient profit model and a reasonable fee structure. There are also a number of policy barriers and other issues. Along with the demand for interactive services on television, IPTV is still an upward trend. In addition, IPTV in terms of digital ecosystems adapting to the environment of converged content and the new need to switch quickly to a service-oriented content has enhanced and improved product competitiveness in the global emerging markets. Therefore, IPTV still has a long way to go.

6.3.2 SNS (Social Network Service)

A social network service (SNS) is an online platform that focuses on building and reflecting social networks or social relations between people. A social network site often includes each user's profile such as interests, activities and social links [34]. With SNS, people can interact over the Internet by e-mail, instant messaging and so on.

The concept of SNS was brought about by Frigyes Karinthy's six degrees of separation theory. Six degrees of separation refers to the idea that any two people can on average be connected by approximately six steps. One of the first SNS sites called Six Degrees started in 1997. Then a lot of successful SNS sites were established in the United States. Friendster was founded in 2002. In 2003, an SNS site focusing on facilitating business contacts called LinkedIn was founded. Now it has over 50 million users. Google followed the SNS trend and established its own SNS site called Orkut in 2004. In the same year, the most popular SNS site in the world was established too. It was Facebook. In April 2010, about 41.6% of the U.S. population had a Facebook account. The number of Facebook's active users increased from 400 million in February 2010 to over 845 million in February 2012[35].

Fig. 6.11 shows the Facebook profile. There are also some other famous SNS sites in the United States. MySpace has been one of the most popular SNS sites for younger users. YouTube is famous for its video sharing. Twitter has an advantage for short messages and has attracted a great number of users.

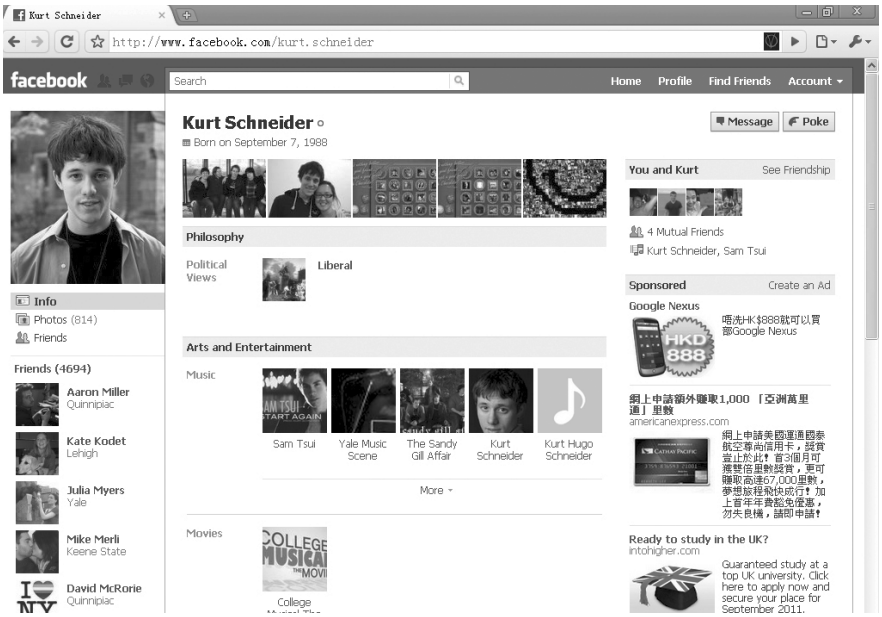


Fig. 6.11 Facebook: an example of an SNS website

Although there are a lot of different SNS sites around the world, the SNS framework can be divided into three layers in general (Fig. 6.12). The bottom layer is the profile which describes users' properties and behavior. The profile can be divided into three. One contains the users' social properties such as names, age, profession, sex and graduation situation. One contains community extended properties such as growth levels, nickname, and virtual career in a community. The last contains implicitly derived properties which the system finds out after deep analysis of all kinds of user tracks in the SNS sites. For example, if a user has much interest in makeup and baby accessories, we can roughly infer the user is a woman with a child. Different SNS sites have different abilities for collecting and analyzing the information. The interlayer is the relation. It can be represented by the relationship between person and person, the relationship between the person and a group and the relationship between different groups. There are two kinds of relations called strong relations and weak relations. The strong relation often refers to friendship. If one person follows another one, we think the two have a weak relation. In an SNS site, the relation is the core. Only when there are many users and rich relationships, can the SNS site grow in popularity. The upper layer is the content and application. The content is composed of official content and UGI. The UGI refers to user generated content such as blog, pictures and instant messages. Applications are the other important resource of SNS sites including tools, games, videos and other interesting apps. Different from apps in other Websites, applications in SNS sites always invoke the information in the profile and relation layer. For example, if we want to develop a group game, we

would invoke basic information about users in the profile layer and users can invite friends to join the game through the relation layer.

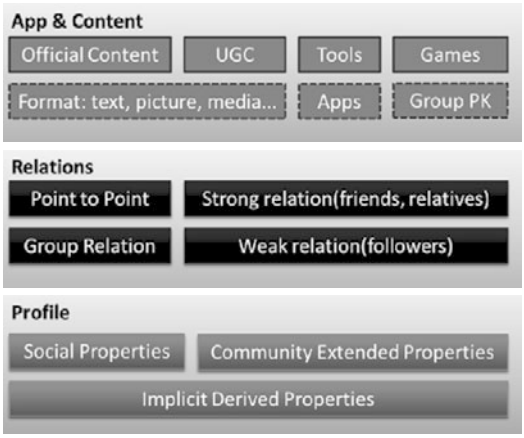


Fig. 6.12 Three typical layers of SNS framework

Meanwhile, the profile, relation and contents are related to each other. The profile will gradually evolve. Users often put many UGCs on the site, browse personalized content, join favorite communities or play interesting games. All these activities will provide much useful information to give the user a much more precise profile. In addition, users will strengthen the relationship by the interaction in apps. Users can also expand their friends circle by six degrees separation. Moreover, the more interesting and useful the contents and Apps, the greater the number of users and potential users.

With the fast development of SNS, there are more and more SNS users. The architecture of an SNS site has to evolve to satisfy the heavy load requirement. Fig. 6.13 shows the evolvement of MySpace.com. Before, MySpace was simply composed of an SQL server and Web servers, just supporting 500,000 users. However, as the number of users increased, the SQL server was limited by I/O speed. So the database was designed in vertical segmentation mode. Different databases served for different functions such as login, customer information and blog. The storage devices were connected with the database through the SAN (Storage Area Network). The SAN connected all the devices together and interacted with the database. In this mode, MySpace.com could support 1.5 – 2 million users online. Then MySpace.com evolved its architecture to support over 10 million users. The SAN was used to store the data according to the capacity in the logic and bundled to different disks instead of a special disk. There was also a data caching layer between the Web server and SQL server, which would be the transcript for the data frequently requested in the memory. The SQL server was also upgraded to 64-bit.

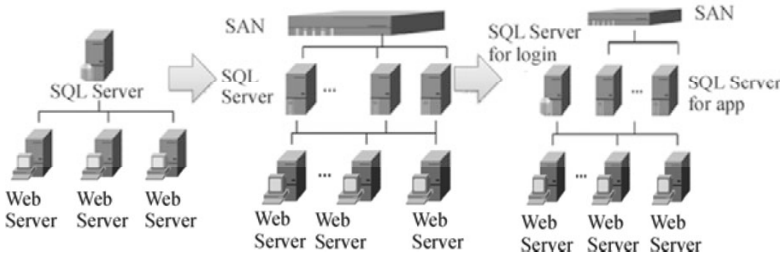


Fig. 6.13 MySpace.com architecture

Now SNS has gradually mixed with e-commerce. SNS strengthens the user viscosity of e-commerce sites and provides a new marketing channel. For SNS sites can take an accurate marketing positioning by analyzing user profiles. Thus e-commerce can achieve effective marketing. In addition, the recommendation from friends plays a decisive role in product evaluation. Most SNS sites have interactive features such as sharing. Users can have their own trading platform similar to Taobao with their linked SNS accounts. Meanwhile, users can update the information, publish their own shopping experiences, and share experiences with friends. It can be seen that SNS is a typical sort of viral marketing and the product information will be fully expanded. Now SNS has developed very well around the world. According to iResearch, SNS users in the United States will reach 150 million with a year-on-year growth rate of 9.9%. Its penetration rate among all netizens will reach 63.7% (Fig. 6.14). According to eMarketer, the number of users was estimated at 160 million, up 4.1%.

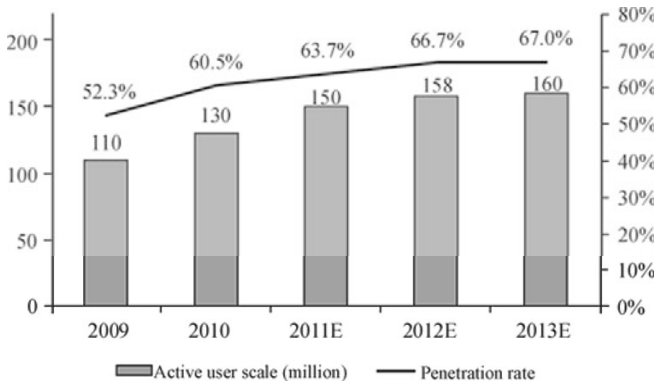


Fig. 6.14 Active user scale in the United States

As the biggest market, China has achieved fast development in SNS. According to iResearch, the SNS market size has grown from 1.21 billion RMB in 2008 to 4.38 billion RMB in 2011. The market size was estimated to reach 9.64 billion RMB in 2014 (Fig. 6.15). The number of SNS users in China reached 370 million in 2011 and it was estimated to reach 510 million in 2014 [36].

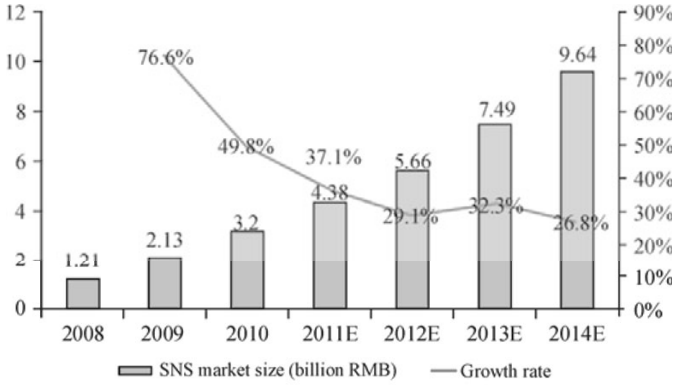


Fig. 6.15 SNS market size in China

In conclusion, the SNS model will be an important channel for network marketing in the future. In the SNS network and other fun sites, users can use their resources to create new business models to build a brand and establish an online trading platform in order to achieve profitability. On the one hand, operators of e-commerce sites and SNS sites will use existing channels to expand their influence. On the other hand, they will develop their own SNS community to strengthen cooperation.

6.3.3 Cloud Computing

Cloud computing is Internet-based computing, whereby shared resources, software and information are provided to computers and other devices on demand like the electricity grid. Cloud computing is a natural evolution of the widespread adoption of virtualization, service-oriented architecture and utility computing. Details are abstracted from consumers, but consumers no longer need expertise in, or control over, the technology infrastructure because the "cloud" will support them. Cloud computing describes a new delivery model for IT services based on the Internet, and it typically involves over-the-Internet provision of dynamically scalable and virtualized resources.

It is a byproduct and consequence that it easily has access to remote computing sites via the Internet. Frequently users can use Web-based tools or applications through a Web browser. The term "cloud" is used as a metaphor for the Internet, based on the cloud drawing used in the past to represent the telephone network and later to depict the Internet in computer network diagrams as an abstraction of the underlying infrastructure. Typical cloud computing providers deliver common business applications online through another Web service or software like a Web browser, while the software and data are stored on servers.

Most cloud computing infrastructures consist of services delivered through

common centers and built on servers. Clouds often appear as single points of access for consumers' computing needs. Commercial offerings are generally expected to meet quality of service (QoS) requirements of customers, and typically include service level agreements (SLAs). The major cloud service providers include Amazon, Salesforce and Google. Other large IT firms that are actively involved in cloud computing are Fujitsu, Microsoft, HP, IBM, VMware, NetApp and Dell.

A community cloud may be established where several organizations have similar requirements and seek to share the infrastructure so as to realize the benefits of cloud computing. The community cloud is more expensive than a public cloud but may offer a higher level of privacy, security and policy compliance. Examples of community cloud include Google's "Gov Cloud".

Cloud computing is generally considered as a kind of distributed computing which automatically splits a large computing network into numerous small subroutines, then hands over information between server systems through an extensive search, and analyzes the results back to the user. Now we can find cloud computing in Web services such as the search engine, Web mail and other services. Through this technology, network service providers can make the information available to tens of millions or even billions of service providers in seconds [37-39].

6.3.4 The Internet of Things

The Internet of Things, also known as the Internet of objects, refers to a self-configuring wireless network of sensors such as RFID, infrared sensors, GPS and laser scanners to achieve intelligent acquisition between things and humans. There are two meanings. First, the Internet of Things connects things to the Internet and the Internet is the core. Second, the client can expand to any goods, and the exchange of information and communication can also be achieved between things and things [36].

The essence of the Internet of Things is to perceive. The perception includes signal collection from sensors, intelligent networking, cooperative processing and information services. In fact, the Internet of Things can be described as the integration of the Internet, sensor network and mobile communication network. Among them, the sensor network is used to achieve the perception and the connection among things. The mobile communication network is for achieving the transmission of the information and achieving the connection among people while the Internet is for achieving the sharing of virtual information. In general, the Internet of Things works in the following steps. First, tag properties of objects by RFID technology and store the information in the RFID chip; second, recognize properties of objects through mobile or fixed RFID sensors and convert the information about properties into a proper data format suitable for transmitting on the Internet; last, use terminals such as mobile phones and computers for real-time tracking, monitoring and managing the goods. The structure of the Internet of

Things is shown in Fig. 6.16. The Internet of Things is composed of RFID tags, readers, Savant Server, the Internet, ONS server, PML server and other databases. In the Internet of Things, people put RFID tags which store the Electronic Product Code (EPC) of each product on the goods, and the reader reads the EPC information. The information on the tag is transmitted to the ONS server through the Internet. The ONS server can find further information about the object through a matched URL or IP-address with the EPC. A distributed savant system is used to process and manage a series of EPC information. The savant system transmits the EPC information to the ONS and the ONS uses the PML server that stores the product files to find matched information.

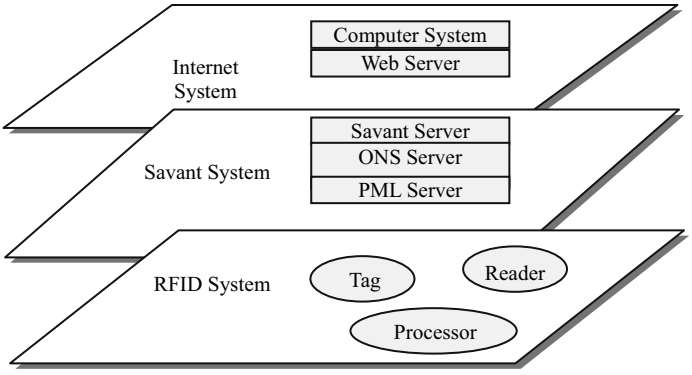


Fig. 6.16 The structure of the Internet of Things

The concept of the Internet of Things was first proposed in 1999 and was called the sensor network at that time. In 2006, the ITU officially proposed the concept of the Internet of Things. Since then, the Internet of Things has received great attention from governments and enterprises. In 2008, IBM released the concept of "Smarter Planet" emphasizing how the world's system and industries were becoming more instrumented, interconnected and intelligent and that people should pay more attention to the application of perceptive technology [41]. In 2009, Obama put the sensor network as a critical technology for economic prosperity and national security and "Smarter Planet" strategy rose to national strategic level. In the same year, the European Commission submitted *The Internet of Things—An Action Plan for Europe*. In *The Internet of Things—An Action Plan for Europe*, the EU emphasized establishing the leadership of the Internet of Things by developing critical resources, standards, relative programs and pilots [42]. Japan also launched "u-Japan" strategy in 2004. The "U" meant ubiquitous. Japan expected to develop wireless infrastructure by 2010 so that exchange of information would be possible anytime, anywhere and from any appliance. The convergence of telecommunications, mobile technology, broadband and digital broadcasting as well as the development of sensor technologies were the key. In August 2009 China also launched the concept of "Sense China" and established a

sensing information center in Wuxi to develop sensor technologies. In November 2009, the Premier of China, Wen Jiabao, delivered a speech called "let the technology lead China's sustainable development". In the speech, Premier Wen emphasized developing sensor networks and the Internet of Things, and making use of information technology to promote industrial upgrading. Now the Internet of Things is just at the early stage of development. It has not completely achieved the interconnection among things and people. According to SRI, it would need some time for the Internet of Things to totally become a physical-world web[39]. The roadmap of the Internet of Things is shown in Fig. 6.17.

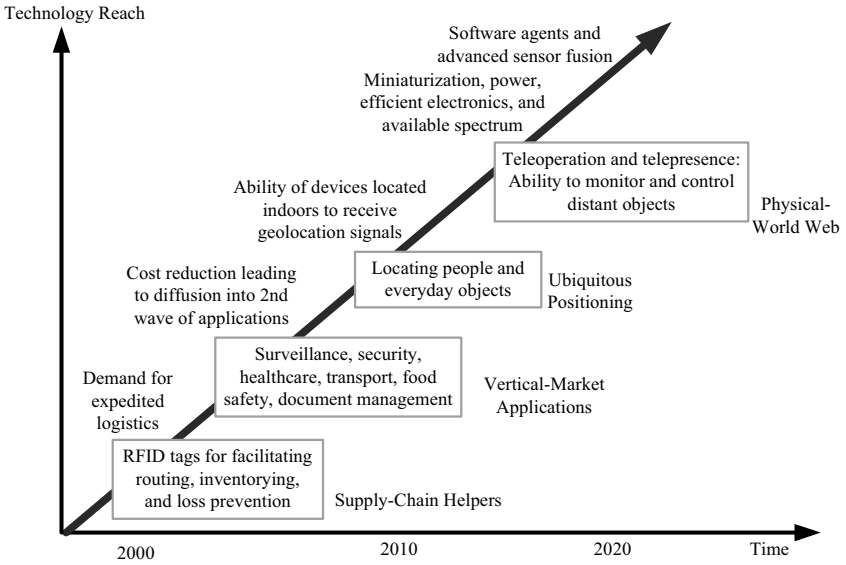


Fig. 6.17 Technology roadmap: the Internet of Things (SRI Consulting Business Intelligence)

In addition, the Internet of Things will greatly promote the development of e-commerce in the fields of logistics, quality control and supply chain management.

- To enhance the quality of logistics services

Now there are always many unsatisfactory situations in logistics services such as sending the product to the wrong destination, inability to query the logistics situation and late delivery. All of them are mainly because enterprises and consumers cannot achieve real-time control of the logistics. However, real-time monitoring of the logistics process can be achieved once the Internet of Things is adopted. The Internet of Things can unify the EPC for each product, imbed an EPC tag in the parcel, read EPC information by RFID technology and transmit the information to the processing center so that enterprises and consumers can make real-time queries. In this way, the quality of logistic services can be greatly improved and consumer satisfaction with online shopping can be greatly enhanced.

- To improve the control of product quality

Through the Internet of Things, the whole process from production to distribution is recorded in detail. When people shop online, they can query all the information from the material to the product as well as the sales situation according to the EPC tag of the product, so that they can get enough information to decide what to buy. In addition, enterprises can easily find out what has gone wrong once there is a product problem.

- To improve the supply chain management

Through the Internet of Things, enterprises can control in real-time each product and the logistics system. In addition, enterprises can not only achieve the control and information sharing of the supply chain, but can also analyze and forecast a potential situation in the future according to the information at different stages of the supply chain. Through the forecast, enterprises can predict future trends and estimate the probability of an accident so that they can take remedial measures in advance. In this way, enterprises can greatly enhance their responsiveness to the market.

6.4 Technology: Strategic Issue of E-Commerce

As referred to above, there are several kinds of technologies in the e-commerce field. These technologies laid the foundation for the development of e-commerce. The birth and development of e-commerce could not progress without the development of e-commerce technology. At first, e-commerce was born based on the Internet and EDI. Then, the development of security technologies such as data encryption technology, digital signature and authentication technology ensured the safety of online transactions so that people were willing to try online purchasing. Now technologies are developing in the mobile environment and e-commerce will enter a mobile era. It can be said that every time the technology is innovative, there will be new changes in e-commerce. In order to grasp e-commerce technical strategy, we have to understand the development trend of e-commerce technologies. Meanwhile, different technologies influence each other. For example, the development of 4G cannot proceed without IPv6 technology and the advantages of 4G technology cannot be seen without the support of IPv6. When formulating e-commerce technical strategy, enterprises should pay attention to the interdependence of different technologies. Moreover, the technology roadmap is another important factor that should be considered when formulating e-commerce technical strategy. Some technologies may not be popular at the time but will be the mainstream in the future. Enterprises should give close attention to technical evolution and develop important technology at an early stage. Otherwise, enterprises will fall behind other enterprises or spend more effort to catch up with others.

Now e-commerce technology is being transformed from stationary computing to mobile computing, from intensive data to mass data and from a fixed to a

distributed environment. Beforehand, the terminal for e-commerce was only the computer. People had to connect with the Internet to get the information and make an electronic exchange. But now the wireless network is developing very fast and mobile devices continually come out. People can easily connect with the network with small mobile devices such as mobile phones and PDAs. Then they can easily make online transactions in the same way as they do on the Internet. With the maturity of the wireless network, relative supporting technologies, especially mobile computing, make transactions through mobile devices as efficient as those on the Internet. There is no doubt that e-commerce will transfer to mobile devices what is more convenient. In addition, with the popularity of online transactions, there will be more and more relative information. Gradually, how to efficiently find useful information, store the information and analyze the information becomes a problem. Then mass data processing becomes important. Meanwhile, in order to improve the efficiency of data storage and data processing, a distributed system is launched. A distributed system consists of multiple autonomous computers that communicate through a computer network[40]. These developing technologies gradually make e-commerce transactions become more and more efficient. E-commerce enterprises can make use of those technologies to efficiently position target consumers. In the end, these technologies will improve e-commerce in different fields such as logistics and marketing, even bringing new e-commerce models.

It can be seen that technologies have a great impact on the development of e-commerce. In fact, technologies and e-commerce both influence each other. E-commerce innovation can be divided into technology innovation and application innovation. Details of e-commerce technology and applications are shown in Fig. 6.18. As far as technologies are concerned, the Web has entered the Web 3.0 age which means a "Web of data" including transferring the www into a generic database, cross-browser content transfer and request mechanism, artificial intelligence, a semantic net and so on[41]. The development and implementation of Web technologies result in mass data on the Internet to analyze, store and request which leads to cloud computing. In addition, mobile technologies such as 3G or even 4G technologies lead to the birth of mobile shopping. The security technology is becoming more and more mature which makes people feel safer to purchase online. Moreover, the 3S technology (GPS, GIS and RS) gives more opportunities for e-commerce and modern logistics. Meanwhile, these new applications in e-commerce put new requirements on the technology. Take mobile shopping as an example. As more and more people adopt mobile terminals to buy commodities online, they will need more bandwidth and faster network speed on the wireless network. What is more, how to protect the security in a wireless network becomes a problem.

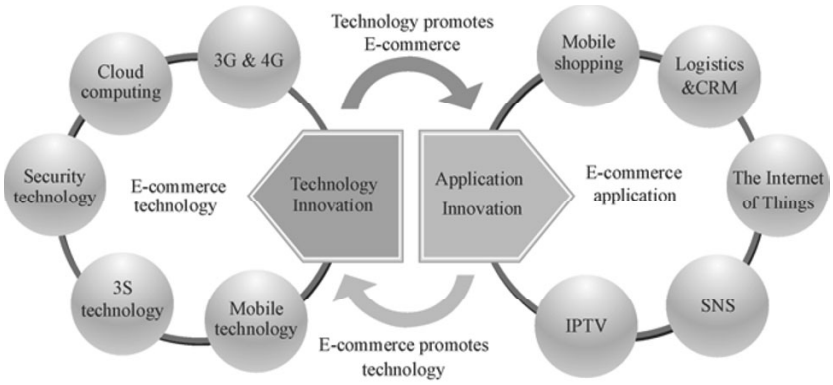


Fig. 6.18 E-commerce technologies and applications

Undoubtedly, the technology is a strategic issue for e-commerce development. By applying proper technologies in e-commerce, the efficiency will be highly improved. As referred to before, IPTV and SNS are two emerging trends. With the development of IPTV, traditional TV will merge with the Internet,, and people can either buy things on the Internet or the TV. It will bring dual influences. On the one hand, IPTV will capture some customer resources which originally belonged to e-commerce. On the other hand, e-commerce can absorb more TV customers such as old people and extend its marketing channels. In addition, e-commerce websites are presenting an SNS trend. Many e-commerce websites have established their own SNS sites for people to communicate and make friends with each other.

Moreover, mobile technologies are developing very fast which promotes e-commerce to develop into m-commerce. Before, e-commerce was mainly based on the Internet. With the development of mobile technologies, people can purchase things just by using mobile devices so that they can make a deal only if they have mobile devices and have access to a mobile network. All of this makes e-commerce more convenient. Customers can use these wireless devices to perform quick searches, compare prices, use a shopping cart, order, and view the status of their orders. Wireless shoppers are supported by services similar to those available for wired shoppers. Cell phone users also can participate in online auctions. For example, eBay offers “any-where wireless” services. Account holders at eBay can browse, search, bid, and rebid on items from any Internet-enabled phone or PDA. The same is true for participants in Amazon’s auctions.

Meanwhile, mobile technologies and 3S technologies really extend marketing channels. Before, shoppers and enterprises used to prompt on the TV or in large markets, or paste advertisements which people can easily find. But through mobile technologies and 3S technologies, shops and e-commerce enterprises can easily discover the real-time location of mobile users and their preferences or surfing habits so that they can send user-specific advertising messages to wireless devices. Location-sensitive advertising (using GPS) to find where a customer is can inform

a potential buyer about shops, malls and restaurants close to where the mobile device owner is. For example, Expedia (expedia.com, the largest online travel company) sends SMSs to target segments of frequent travelers offering incentives to enter the Web site which cell phone users can choose for free services and the information will be delivered to their phones[7].

3S and RFID technologies also have a great impact on modern logistics. Logistics is a fundamental component of e-commerce because it is the ultimate realization of the value of goods and services. If the logistics is not handled properly, the value of previous links cannot be demonstrated. In e-commerce, a great percentage of commodities have to be delivered by real logistics while only some commodities and services such as electronic publications and information consultation can be completed directly through network transmission. So how to properly arrange and inquire about the logistic situation is really important. Through 3S and RFID technologies, the situation and location of any goods can be easily found and it is easy to arrange the logistics and for buyers to understand the distribution situation. Meanwhile these logistics situations can be easily delivered to the relevant person by mobile technologies. Moreover, the development of artificial intelligence can help people analyze the information. Through automation tools, accurate and timely logistics information that monitors the logistics process can accelerate the speed, improve the accuracy, reduce the inventory effectively and shorten the production cycle.

CRM can also be influenced by the development of technologies. Call centers have proved a success at handling volumes of non-face-to-face interactions with customers in e-commerce. A call center (also known as a contact center) is an interactive value-added service system providing assistance to customers through interactive call navigation, CTI (Computer Telephony Integration) technology and human agent communication. Customers can access a call center using a phone, FAX machine, wireless device, or computer. Currently the latest e-commerce call centers are based on Internet Protocol (IP) and combine a variety of servers such as CRM, CMS (Content Management System), CTI (Computer Telephony Integration) and IVR (Interactive Voice Response). Traditional voice communication is being extended to multichannel contact services with technologies such as VoIP, E-mail and instant message (IM).

Above all, we can see e-commerce and technologies influence each other. The development of technologies has promoted many kinds of innovation in e-commerce. In addition, technologies are the foundation of e-commerce. E-commerce is built on the basis of technological advances. When developing e-commerce, the development of technologies should not be ignored. Moreover, we should pay attention to the development trends of computer science and analyze the influence it will bring to e-commerce. When we do not seize on the right trend, it is possible to fall behind. Now, with the appearance of mobile communication technology, mobile positioning systems and others, mobile commerce is becoming a new trend because of its flexible and convenient features. Therefore, mobile technologies should be a top priority. And RFID and 3S technologies will bring great benefits to the logistics. With the development of the

Internet and mobile networks, there will be data expansion which will make mass data processing important in the future, so that cloud computing will greatly help e-commerce enterprises store and analyze their own transaction data.

However, commerce is still the main objective while the technology is only the tool. When developing e-commerce, technical support should be taken as a strategic management issue. But a good business model is more important. Besides grasping the right technologies, e-commerce should pay more attention to how to transfer the technology into a feasible business model. Now mobile commerce is a new trend of e-commerce and is only at the initial stage. There are lots of new opportunities for businesses. E-commerce enterprises should grasp this precious opportunity and develop well their own e-commerce strategy.

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