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Ubiquitous Networks: The New IT Paradigm

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The healthy balance among information technology (IT), the stock market and the macroeconomy, which had resulted from a virtuous circle of various innovations stemming from the combination of the Internet and business boosting the stock market, and which in turn brought intensive investment in IT and resultant improvements in productivity leading to a buoyant macroeconomy, came to an abrupt end in 2000, as share prices of dot-com businesses crashed on the Nasdaq market in the United States. Under such circumstances, the emergence of a new IT paradigm is hoped for.

The utilization of information technology by businesses had shifted from the era of mainframes to one of client-server systems in the second half of the 1980s. Then, from the mid-1990s onward, the Web computing paradigm has been taking root against the backdrop of the rapid spread of the Internet. Nevertheless, it is unlikely that the IT paradigm, which had evolved through these stages, would leap in one step to the world of exotic networks, which rely on the full utilization of wearable computers or paper computers. There is bound to be an interim IT paradigm before we reach exotic networks. Ubiquitous networks might be just such an interim paradigm.

Ubiquitous networks are an IT paradigm comprising (1) network infrastructures featuring broadband, mobile and constant Internet access, (2) diverse information equipment that provides access to Internet Protocol Version 6 (Ipv6), and (3) seamlessly linked interactive contents.

Japan is about to embark on the implementation of an ambitious e-Japan strategy, which aims to make it possible for 10 million Japanese households to use broadband networks of 30–100Mbps by 2005. This is thought to be an attempt to create a new IT paradigm, and ubiquitous networks can become a strong candidate for this new IT paradigm.

I The Stalled New Economy Paradigm

In retrospect, one may feel that the world economy was driven by the notion of the New Economy during much of the 1990s. One governmental report symbolizes this phenomenon. It is the Annual Report of the Council of Economic Advisers for 2001, which was presented to the US Congress in January 2001 as the last presidential economic report by Bill Clinton. It was in essence a declaration of victory for the New Economy, which the United States is believed to have built. The report is full of self-praising messages.

The Report says that it "defines the New Economy by the extraordinary gains in performance—including rapid productivity growth, rising incomes, low unemployment, and moderate inflation-that have resulted from this combination of mutually reinforcing advances in technologies, business practices, and economic policies." It describes in detail how the US economy has brought the New Economy into existence. Between the first quarter of 1993 and the third quarter of 2000, the real gross domestic product of the United States grew at an annual average rate of 4.0 percent. This growth was 46 percent faster than the average rate of growth achieved between 1973 and 1993. Since January 1993, US jobs have increased by 23 million while the unemployment rate has declined to 3.9 percent—the lowest figure in the past 30 years. The annual rate of productivity growth in the nonfarm private business sector jumped from 1.39 percent between 1973 and 1995 to 3.01 percent between 1995 and 2000, a period characterized by the acceleration of the information technology revolution. These are splendid achievements. Although the extent to which these achievements can be attributed to information technology is a matter of argument, there is no question that information technology has played an important role and triggered the transformation of the US economy.

It is now only barely six months after this glorious presidential economic report, however, and people feel that something has happened. Now perceptions of the US economy have radically changed. Many economists are discussing the shape of the economic recovery as V-shaped or U-shaped, or a checkmark shaped or even L-shaped. Such a radical change in perceptions can be traced back to the crash of the stock prices of dot-com companies on the Nasdaq market in March and April of 2000 and in September and October of the same year. It appears that the New Economy in the United States during the 1990s was created by favorable stock market performances, including aggressive waves of initial public offerings and a sustained rise in share prices, which acted as catalysts in linking information technologies, such as the Internet, electronic commerce (EC) and e-business, with a new business paradigm created by rapid innovation and the high performance of the macro-economy as reported by the presidential economic report. The stock market crash caused the macro-economy to stagnate, which in turn stripped the existing information technology paradigm of its flamboyant appeal of continuous rapid growth.

We can find an exact replica of this structure in the Japanese economy, although the scale and degree are different from these parameters in the United States. Up until 2000, the Japanese economy had also experienced Internet and electronic commerce booms, including an IPO boom and rapid increases in the share prices of dot-com firms. In fact, Japan's macro-economy had shown signs of recovery. However, as in the United States, the share prices of dot-com businesses have crashed, the macro-economy has stagnated and a sense of disappointment with electronic commerce and e-business has spread rapidly. Furthermore, there is an emerging view that the New Economy paradigm itself might have been a mistake. Even so, the Japanese economy has been unable to find another engine for economic growth and remains mired in economic stagnation. I suspect that the picture is more or less the same in the United States and Europe, and probably in some parts of Asia. We cannot allow this situation to continue.

Even without these new problems, the Japanese economy must solve at least two structural problems of nonperforming assets and the rehabilitation of government finances. The resolution of these problems in itself is extremely urgent for the Japanese economy. However, whatever measures may be taken to address these problems, they are bound to prolong the present stagnation, which we cannot allow to last. In addition to solving these structural problems, which are the drawbacks Japan accumulated during the 20th century, we need to concentrate our utmost efforts on putting the Japanese economy on a solid growth path.

One of the options for attaining these goals is to find an engine of growth that can replace information technology with other cutting-edge technologies. It seems that the United States is seeking that role in biotechnology and nano-technology. Japan is also moving in this direction, but one should understand that—unlike the Internet—these are not the type of industries that can have a broad and deep impact on the demand side as well as the supply side. For Japan, information technology is an important tool of structural reform that can untangle its rigid social system. It is undoubtedly one of the most important tools for pursuing the theme of improving productivity in the service sector as a whole (including government services), which has been the nation's priority since the last century.

The United States began to use information technology ahead of other countries and has improved the productivity of its economy as a whole over the last ten years or so. By contrast, the Japanese economy and businesses have come only half way toward making effective use of information technology. In my view, it is more important for the present Japanese economy to restructure the New Economy paradigm than to look elsewhere for another paradigm for new growth. The New Economy paradigm, which came into existence only in the twilight years of the 20th century, in itself appears to be going into a stall as the information technology revolution has stalled. What is necessary now is to find a new direction for the New Economy paradigm rather than letting it die.

In order to find a new direction for the new paradigm of the economy, it is necessary to find a new direction for information technology. The first wave of the information technology revolution started with the explosive diffusion of the innovative MOSAIC browser in 1993. It linked with business in 1995, and brought an electronic commerce boom following the e-Christmas of 1998. But, it may be coming to the end of a cycle following last year's crash of share prices on the Nasdaq. What we need now is to create a second wave of the information technology revolution to replace the first wave. For this purpose, we need a new information technology paradigm that is solid enough to support it.

II The Evolution of the Information Technology Paradigm and Ubiquitous Networks

1 The Evolution of Information Technology Paradigms

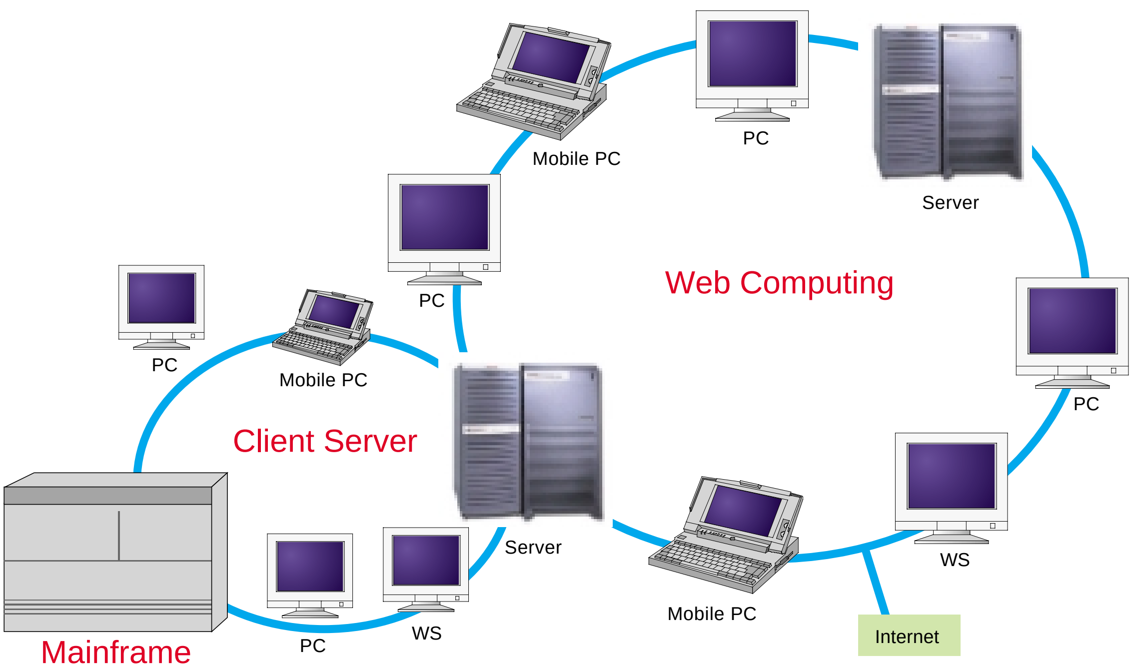
The predominant information technology paradigm of each era strongly influences the growth and evolution of the information industry. As the first and foremost private-sector company in Japan, Nomura Securities Company decided to introduce a mainframe computer from UNIVAC in 1955. In those days, the utilization of computers had been equivalent to the use of a mainframe computer. The lengthy period when the information industry exclusively organized systems and operations around mainframe computers started to come to an end in the late 1980s. Client-server systems began to spread quickly during the early 1990s, and systems that greatly reduced costs through combinations of workstations (WSs) and personal computers (PCs) rapidly replaced the systems then in use.

The world of the Internet began with the start of the commercial use of the Internet in 1991 and the explosive spread of MOSAIC browser software in 1993. Web technology continues to rewrite the computing paradigm. We can refer to the present computing paradigm that uses IP protocols to link PCs and servers as Web computing (Figure 1).

The Web computing paradigm is currently spreading by taking a form that can link PCs, WSs and even mainframe computers using an IPv4 network. Because the various systems now in place throughout the world can easily ride the IP protocol, users have eagerly begun connecting them to IP networks. These IP networks are spreading to every corner of the world, every corner of our society and even every corner of our lives at a staggering speed. With slight time lags and differences arising from the digital divide, this phenomenon is quickly spreading throughout the world and into various facets of social systems.

Are we to continue for the foreseeable future to use the Web computing paradigm that forms the core of the

Figure 1. Change in IT Paradigms



Source: Nomura Research Institute.

present Internet? Or will the shift to the next paradigm be just as swift as the speed at which today's PC-centered Web computing paradigm has spread?

The future evolution of information technology depends on advanced research laboratories where research continues. The Media Lab at the Massachusetts Institute of Technology, for example, is reported to be conducting research to produce paper computers by creating particle-like electronic parts and spraying them on paper, and wearable computers that are as comfortable to wear as clothes. The lab is also researching "inter-body signaling," which makes the human body into a telecommunications network that individuals can use as a means of communication.

The "Internet car" project led by Professor Jun Murai of Keio University focuses on turning automobiles into information-intensive media that gather information. Under this concept, a car will recognize the start of windshield wipers as a signal that it has begun to rain, or a decrease in the tire rotation speed on an expressway as a sign of traffic congestion, and combine such information with the Global Positioning System.

It is impossible today to even imagine that researchers can create paper computers and wearable computers that we will soon be able to use in our daily lives. But researchers are already working on such devices for the future of computing. These devices will certainly be connected to networks. We may call this type of IT paradigm exotic networks (Figure 2).

2 Ubiquitous Networks: The New IT Paradigm

Present information technology is at the stage in which it enhances the PC-centered Web computing world created on the Internet. An extension of this line of development is the world of exotic networks. It is difficult to imagine, however, that users will move in one leap from Web computing to a world of exotic networks, where everything becomes an object of computing and is connected to networks.

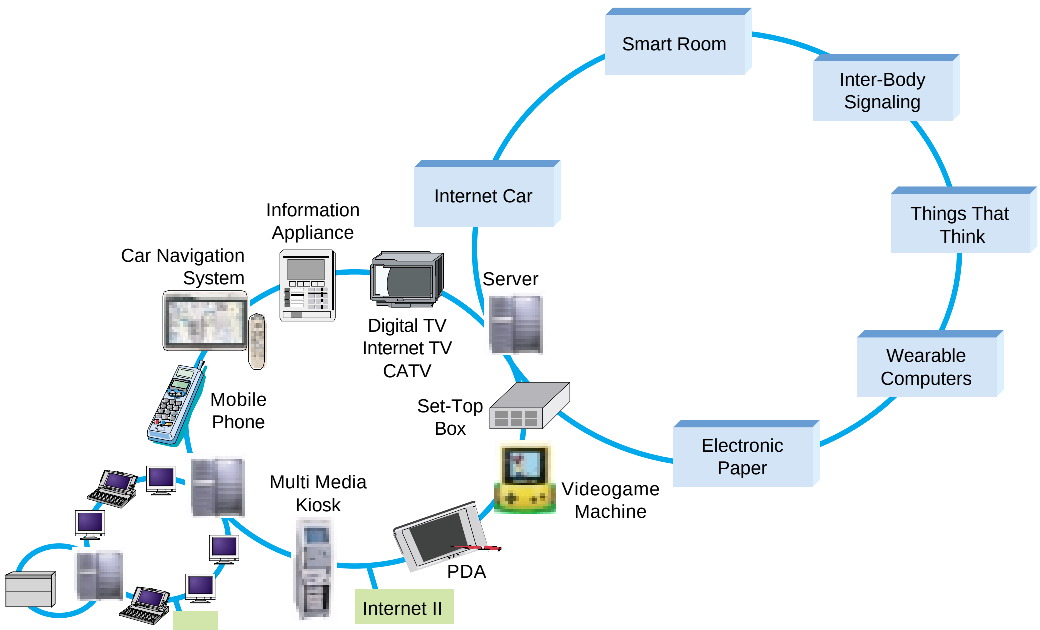
It is expected that there will be an intermediate IT evolution paradigm between these two worlds. That stage is the ubiquitous network paradigm (Figure 3).

In this paradigm, users do not rely on devices such as paper or wearable computers or exotic networks that do not yet exist. Instead of desktop PCs or mobile PCs, they will use existing information devices that are not yet fully connected to the Internet, such as cellular telephones, PDAs (personal digital assistants), video game consoles, set-top boxes, digital televisions, multimedia kiosks, car navigation devices and forthcoming information appliances (Figure 4).

All of these devices will be connected to much broader band networks than the present fixed telephone lines of today's Internet. At the same time, the networks must have multi-modal access to the Internet, perhaps by IPv6 protocol, from not only fixed telephone lines but also by mobile phone, xDSL, CATV, Fixed Wireless Access and, of course, fiber optic network. Networks will enable users to watch movies and listen to music as well as create and transmit their own works. The IT paradigm under such an environment will be ubiquitous networks.

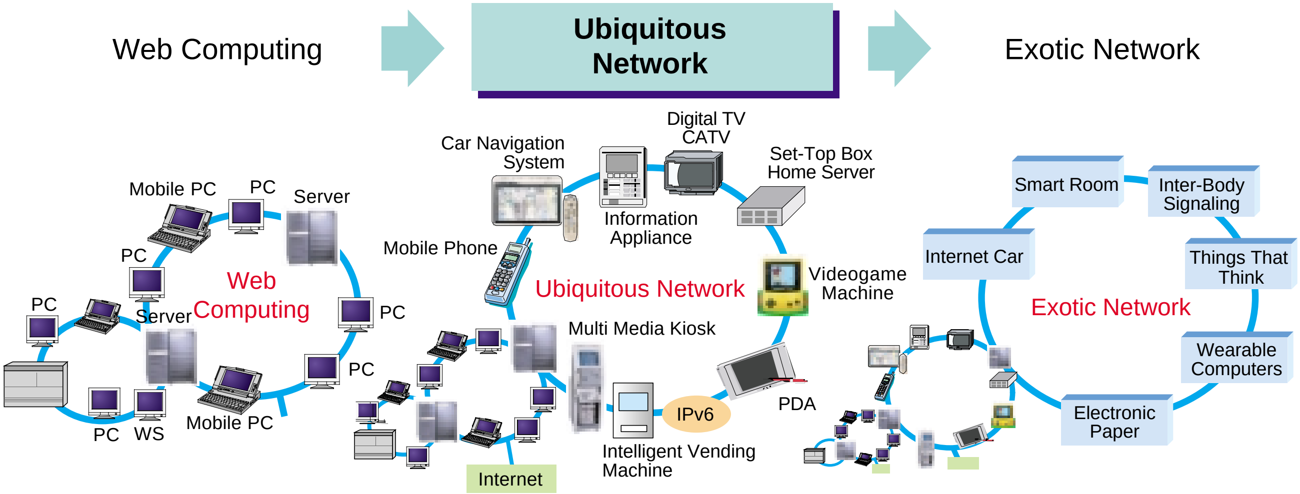
The word "ubiquitous" comes from the Latin word meaning "existing everywhere simultaneously." Ubiquitous networks enable consumers to access the Internet from anywhere and at any time. Although computer experts in Japan and the United States have occasionally used the word ubiquitous, the mass media have only re-

Figure 2. Exotic Network



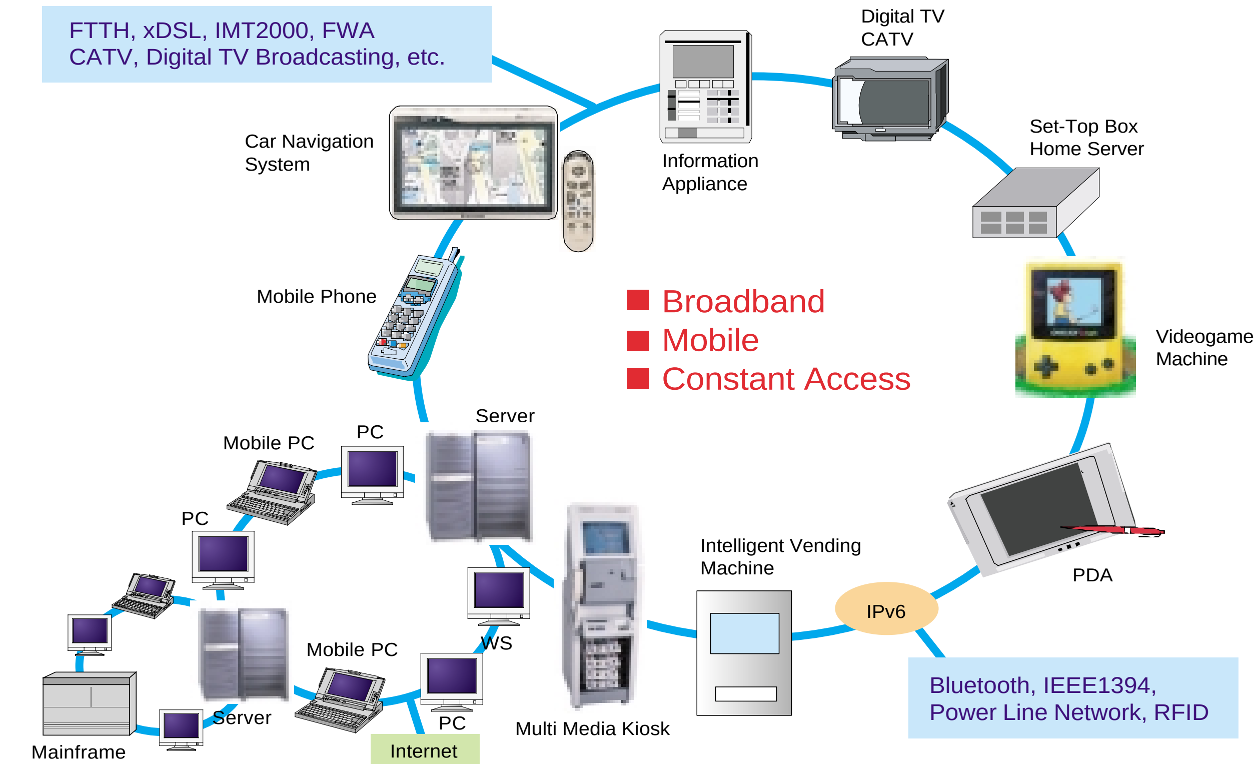
Source: Nomura Research Institute.

Figure 3. Changing IT Paradigms



Source: Nomura Research Institute.

Figure 4. Ubiquitous Network



Source: Nomura Research Institute.

cently begun to use this term. There are signs that its use is spreading widely in Japan.

When we use this word, we are referring to the ability of individuals to take advantage of high-quality digital media from any location, and to obtain greater power of expression. Users will be able not only to receive large-volume digital content such as music, images and even motion pictures on demand and without trouble, but also to edit and send long speeches, music and motion pictures they create on their own.

Adding the constant access function to this will fundamentally change our existing concept of Internet use. It will also change how we use telecommunications and broadcasting, how businesses operate, as well as styles of entertainment.

The ubiquitous networks we discuss in this paper are a concept for the IT paradigm that should be executed in the proposed form by or around 2005. The discussion here focuses on Japan, but this does not mean it is only applicable to Japan. It should be a universal IT paradigm.

III Ubiquitous Networks in Japan

1 Multi-Modal Broadband Networks

(1) Broadband

Although the ubiquitous network concept should not be discussed only in terms of bandwidth, the nature of broadband networks is nevertheless the starting point of discussion. The telecommunications infrastructure intended for final users in 2005 will undoubtedly involve a wider bandwidth than that currently available. But there are arguments over what specific Mbps level will or should be achieved. There is a wide variety of views, ranging from one that says speeds will not go above the same 64Kbps used in today's ISDN even in 2005, to one that envisions 30–100Mbps as called for in the e-Japan strategy. Much remains unclear, such as whether the bandwidth is one that will be usable at the household or single-building level, or whether the figure represents a high-end capability that ordinary households can use only by paying exorbitant prices.

For this ubiquitous network concept for 2005, bandwidth goals should be set from the users' side. First, we should make individuals the user unit. While the Internet has brought many innovations to the environment for information use, the largest single change has been that individuals with a desktop PC or mobile PC have become the units for receiving or sending information. Before the Internet brought this change, computer terminals had been installed at the organization or facility level. Our way of using computers involved one computer per department or division, or perhaps 10 terminals per building. The Internet and Intranets have greatly changed this, so today a ten-person organization probably has come to mean a ten-PC network. Similarly, in the future a four-person family will come to mean a unit of four individuals, each with a ubiquitous terminal. This means the capacity required when everyone in the group uses the terminals simultaneously should be discussed.

Second, on the point of constant access or on-demand access, constant access is indispensable for basic daily communications. We can point to various reasons for the difference between Japan and the US regarding the spread of the Internet. The diffusion of electronic commerce in the US can be attributed to the fact that users in the US have always been able to have constant access. Since 1998 in Korea, CATV Internet and ADSL connections have been spreading widely and quickly so that a great many household users now enjoy 1.5 Mbps constant access. In contrast to this, the user experience in Japan during the introduction period has had an immeasurable negative impact. Because of high telephone charges, users have been accessing only late at night in a poorly connected environment and are worried about their monthly telephone bills. These experiences may influence the future use of the network. Japan must not repeat this experience when it develops ubiquitous networks.

Third, while the greater the better would seem obvious in terms of bandwidth, this should also be determined by taking into consideration the cost and speed of diffusion. Quality will vary even if the bandwidth can handle music and animation without difficulty. Bandwidths from several dozen Mbps to several hundred Mbps per person will be required to enable users to download television broadcasting content and movies from the network instantaneously with absolutely no trouble so that they can view the files immediately. In contrast, users can adequately handle motion picture content even in the world of 384Kbps—which makes the IMT-2000 cellular telephone possible—if they adopt a tolerant approach about quality.

As the goal for the concept of ubiquitous networks envisioned for 2005, we recommend a benchmark of 6Mbps per person. At 6Mbps, users will be able to enjoy motion picture content with the quality of current television broadcasts or MPEG2-level content by using streaming-type software.

But this is strictly 6Mbps per person. To enable a family of four to simultaneously use the network without quality deterioration even when the father is enjoying an information-rich, interactive-type professional baseball network broadcast, the mother is using an online educational gardening program, the daughter is chatting on the videophone and the son is playing a network game, a total bandwidth of 24Mbps or more per household would be required. Moreover, a family unit watching motion pictures will require as much as 20 to 30Mbps to handle HDTV-quality data. It is probably unrealistic to expect an environment in which four people can simultaneously enjoy high-definition television by the year 2005. For example, if one family member is watching a HDTV broadcast and the other three are using 6Mbps constant access, a level of 38 to 48Mbps is necessary. Assuming we are talking about this type of user scenario, it would probably be appropriate to set the maximum bandwidth goal for each family unit of four at about 50Mbps.

With a bandwidth of 50Mbps, users can download a 70-minute long CD with MP3-class music quality in about ten seconds. At this speed it is possible to download a two-hour DVD movie in approximately 11 minutes. This drops to less than three minutes if VHS-quality images are satisfactory. At 50Mbps, users can independently and comfortably handle images and music through the network, whether the information adopts a streaming-type or accumulation-type format.

Fourth, views are divided with regard to whether the cost to users must be ¥2,000 or less per month, or whether a fee up to about ¥10,000 is acceptable. In the ubiquitous network environment this is the fee per person, so even a cost of ¥2,000 per month will come to ¥8,000 for a family of four. Moreover, when we add charges related to each telecommunications system, broadcasting system, cable system and wireless system, the expenses quickly mount to a considerable sum. There is also the opposite case where user fees are low, but subscriber terminal costs amount to several hundred thousand yen. Because competition and operator efforts can greatly change the costs, we recommend setting charges at an amount that “all people who need it” in 2005 can reasonably pay for a connection to a constant access, fixed-charge system.

The bandwidth goals expected for ubiquitous networks in 2005 therefore should be “constant access at 6Mbps or more per person” and “50Mbps or more for each family unit.” I believe that the bandwidth goals of 6Mbps per person, 50Mbps per family are not beyond the realm of possibility if technology develops at the current pace and market competition functions properly. Nevertheless, a total system that presupposes consumers will move freely between fixed and mobile phones, fixed lines and wireless, or telecommunications and broadcasting over this bandwidth will undoubtedly involve various technological challenges. Such challenging goals themselves, however, are also the wellspring that creates technical challenges.

(2) Multi-modal

Ubiquitous networks should be broadband, and at the same time, multi-modal. The goal should be to make it possible to receive information at 6Mbps not only over cable and fixed-point networks but also with portable terminals that permit mobile telecommunications via wireless systems that work even from automobiles. Moreover, even when completely interactive capabilities are impossible because of differences in the levels of information handled, we should design ubiquitous networks so that users can exchange information in various ways routinely by using storage media or devices that degrade information, whether it arrives via surface waves or satellite broadcasts. In other words, ubiquitous networks are multi-modal networks that can switch between fixed-point and mobile locations, cable and wireless, and telecommunications and broadcast network modes without undue difficulty.

The IP protocol for this multi-modal network should naturally be IPv6, which has already been widely discussed. As an IP address is required for each information appliance or automobile in ubiquitous-network configurations, we cannot rely upon IPv4, which is expected to face a shortage of addresses in the foreseeable future even for the networks currently in place.

Users can also take advantage of services using ADSL with the powerful broadband services now in place. ADSL is a technology that makes it possible to use existing telephone circuits to offer broadband services on one line at a maximum of 640Kbps for the uplink and about 9Mbps for the downlink. Its use is spreading rapidly in the United States and South Korea, particularly in the latter where several million households are already using it. In Japan, ADSL has spread only to several dozen thousand users and this has become an issue. Heated competition has started between new venture business entrants and NTT over ADSL service, and we expect this will increase the pace at which such service spreads in the future. But greater efforts are needed to realize the required stable, interactive, continuous service at 6Mbps or higher per user.

Like ADSL, CATV Internet is achieving broadband service by effectively utilizing existing facilities. Although we cannot compare its diffusion rate in Japan with that in the United States, CATV Internet has surfaced as one candidate for powerful broadband service. With the easing of the “one region, one operator” regulation, there is presently a sudden flurry of activity to shift to multiple-system operators as weaker players join forces to fend off stronger companies. We anticipate that by greatly increasing the scale of operations, operators will be able to raise the level of service from the current several hundred Kbps to a level of several Mbps by 2005.

Satellite Internet has begun high-speed Internet services for consumers. But the increase in the needs for constant access has led to financial problems for operators and efforts by providers to specialize in business uses.

Providers have made huge strides in the digitalization of broadcasting systems, including digital transmissions of satellite broadcasting. Additionally, ground wave digital transmissions are scheduled to begin in Tokyo, Nagoya and Osaka in 2003 and to be completed in 2010. Approaches from broadcasters to telecommunications carriers are limited, and instead the telecommunications carriers and related players seem to be more interested in providing broadcast-like services through their networks.

In wireless systems, NTT DoCoMo’s i-mode has started a cellular telephone Internet boom. The start of third-generation IMT-2000 mobile telecommunications service in 2001 is about to give this service another large boost. NTT DoCoMo will initially begin IMT-2000 with 384Kbps service. This would become an ideal ubiquitous network and terminal if NTT DoCoMo upgrades the service in the future to the Mbps level at a moderate price. Another development is Bluetooth technology, which can connect all devices within a ten-meter radius at speeds up to a maximum of 1Mbps. It could greatly expand PDA and cellular telephone capabilities.

Companies are also proceeding with research and development on other possible candidates for broadband networks. These include FWA (Fixed Wireless Access) networks or the wireless LAN-type access system. Another alternative is electric power distribution networks that directly use electric power lines instead of telephone or cable lines to form a network that connects information appliances.Of these, however, the most likely candidate for broadband service for household ubiquitous networks is an optical fiber FTTH (fiber-to-the-home) network. National policy has promoted steady progress in converting Japan's trunk-line grid to optical fiber, but the operating rate is still low. Not only NTT but also electric power companies and municipalities are participating and taking action to quickly build the world's most advanced, state-of-the-art telecommunications infrastructure. The potential for FTTH, which appeared to have been forgotten for a period, continues to increase. While FTTH has various problems, including its high cost structure and the immense time and costs required for the construction and placement of terminals, it undoubtedly holds the key to realizing ubiquitous networks that will restore Japan's international competitiveness.

2 Information Devices with Borderless Connectivity

In a ubiquitous network, consumers will possess an environment connected to the Internet wherever they are. This means users will require information devices connected to the Internet in whatever circumstances they find themselves.

The most basic information devices will probably still be desktop PCs, mobile PCs and PDAs. These tools provide the input devices, processing units, memory, display and other output components to utilize the Internet, and this situation is unlikely to change.

It is also certain that mobile telephones are taking on a new role as a terminal for Internet use. Surveys have confirmed that since the explosive spread of i-mode in Japan, there has emerged a large segment of mobile-Internet users who have never used a PC to access the Internet.

As described earlier, as Bluetooth's technology spreads, users will begin to directly connect information appliances with cellular telephones. Even without a cellular phone, they will be able to connect information appliances into a domestic wireless LAN system as well as to link them with PCs via connectors which use the IEEE 1394 standard that can simultaneously transmit voice and images at super-high speeds of 100Mbps or more.

By connecting an MP3 player to the Internet for music or a personal video recorder for images, users will be able to use program guide services and automatically record music and images.

Propelled by the diffusion of network games and the downloading needs of game software, it is hoped that the technology to connect video game consoles to the Internet will be developed and spread quickly. This includes not only stationary consoles, but also mobile game consoles linked to the Internet via mobile phones.

Providers and users may connect digital broadcasts from broadcasting systems to the Internet through television set-top boxes for electronic commerce uses called T business.

Moreover, by also connecting the multimedia kiosks and POS terminals in convenience stores, gasoline stations, train stations and other locations to the Internet to create click-and-mortar outlets, companies will change the distribution industry itself. When the information available through these locations becomes contents-rich on the broadband network, products and services offered at convenience stores and gasoline stations should also change rapidly.

Not only will we increase the connection of people to the Internet, we will also deepen the connection between automobiles and the Internet. With IMT-2000, we will be able to handle mobile telecommunications at speeds of 384Kbps, making it possible to incorporate information services from various external sources. We will also be able to receive various safety services and remote diagnostic services based on information sent via GPS or sensors and beacons installed on the car. Such information will mostly be managed by voice recognition technology. Automobile navigation systems linked with a high-speed, on-board LAN environment will give rise to new forms of use.

It is still uncertain whether such information devices will evolve into location-specific devices, such as "office formats" for the office, "living room formats" for the living room and "car formats" for the car, or whether they will evolve so that the functions of different information and telecommunication devices will be unbundled and re-bundled. What is certain is that they will evolve so that we can easily connect any device to any IPv6 network, and that they will take a format that enables us to be unaware of the borders between our various environments.

3 Seamless Portable Content

With ubiquitous networks, users will be able to move rich contents, such as voice or motion picture information, seamlessly between various network modes and information devices. This will not be a complete environment that will enable perfect real-time, one-source, multi-use access, but it will be possible to create a condition that is near enough to this goal.

We must develop ubiquitous networks that enable users to seamlessly use large quantities of electronic commerce content on the Web via information appliances, video games, or even on-board LANs for automobiles. Such networks will overcome many obstacles and limitations that consumers presently face in the existing EC or e-business systems. Ubiquitous networks will lead to an entirely new type of electronic commerce in which consumers can enjoy more freedom and comfort that could be called ubiquitous business or "u-business" instead of e-business. While Web-based product catalogs for e-business contain color photographs, u-business product catalogs are likely to be centered on motion picture content, by which Web-based presentations of products and services will become far effective than at present.

It is likely that with ubiquitous networks we will change our concept of Website homepages as well. We will transform them from homepages to some form of "home video clips," starting with motion picture commercials or videos, which are short and can directly appeal to our senses. We will also change our concept of information searches. New search engines that seek voices, pictures or images will also be required.

As we develop new forms of content, one large problem will be what to do with the still photographic content aimed at e-business that has accumulated on the Web. The emergence of u-business with its focus on video clips and motion picture content may well shorten the shelf life of the voluminous still-image contents in the e-business market.

The current premise for TV-related digital broadcast content is to use the content only once. Providers will quickly have to change so that they can use content repeatedly. Under an environment that can handle motion picture content without difficulty, such resources will become a valuable source of content for ubiquitous network communication systems.

But if this happens without a proper copyright management system, content providers and creators will face a nightmarish situation. Therefore it is necessary to establish a system for intellectual property rights that allows for seamless portability in the use of content on the Internet created by ubiquitous networks.

When we are able to freely move rich contents over networks at this level, we may at last see the emergence of digitally published electronic books. A world in which we can freely download and read past archives on the Internet may not yet be possible because of copyright issues. But we may be able to establish copyrights for newly written content published on ubiquitous networks in the future, and this may become a system for using ubiquitous networks to obtain permission to use books. This may cover not only text materials but also music content. Moreover, one may create a business model wherein written or music content is offered for multiple uses, perhaps increasing the frequency of exposure by making the content free of charge and earning profits from advertising.

The linking of ubiquitous networks with Bluetooth or RFID (radio frequency identification) technologies could radically change the structure of work at the outlets of distribution or financial establishments. Retail outlets changed dramatically with the introduction of the supermarket system, and they may once again go through revolutionary changes with ubiquitous networks. If the technology to instantly read a group of RFIDs attached to merchandise and a system that links mobile terminals equipped with personal identification function with a payment settlement system are developed, completely unmanned checkout counters are a possibility. Although it is not yet clear to what extent this would reduce the costs of operating a store, it is certain that the system would allow store employees to spend more time with customers to engage in more sophisticated interactions than they do today.

An environment with a multi-modal broadband network of ubiquitous networks, borderless connectivity of devices and seamless portability of content has the possibility of fundamentally altering the relationships among users, the creators of content, and the firms operating between users and creators.

IV The New Direction of the New Economy

Spurred by the shift to broadband that lies behind the rapid spread of CATV Internet in the United States and ADSL in South Korea, activities in Japan aimed at IT innovations have recently taken on a new urgency. Japan has begun intensive efforts aimed at building "the world's most advanced IT infrastructure by 2005." Japan's Diet has enacted the Basic IT Law and has set specific goals for the next five years. These include enabling 60 percent of all households to be connected to the Internet, 30 million households to utilize instantaneous voice communications, and 10 million households to enjoy real-time motion pictures. To execute this national strategy, the E-Japan Priority Policy Program was established in March 2001.

Recognizing that the information technology revolution now in progress will bring about a major historical transformation of society that is comparable to the Industrial Revolution of the 18th century, the program has five policy areas; namely, (1) the formation of the world's most advanced information and telecommunications networks; (2) the promotion of education and the development of human resources; (3) the adoption of steps to facilitate e-commerce; (4) the digitalization of administration and the application of information technology in other public areas; and (5) the implementation of measures to ensure the security and reliability of advanced information and telecommunications networks. The Japanese government plans to break down these five policy goals into more than 200 individual measures, assign them to different ministries and agencies, set milestones so that it will be clear what needs to be done by when and by whom, check the progress semiannually and feed back the results to the original plans. The implementation of such a vast scheme with the participation of all government ministries and agencies in itself is epoch-making. In this sense as well, the e-Japan strategy is a very significant undertaking.

Nevertheless, when we look at the e-Japan strategy at its execution level through such filters as the ubiquitous network concept and the next-generation information technology paradigm, we can see that it involves the risk of ending up as a combination of extremely ambitious network infrastructure plans on the one hand and modest electronic commerce and e-government infrastructure plans on the other. More specifically, while the program aims at building a broadband network infrastructure, it appears that the institutional environment for electronic commerce and the development of electronic government now envisioned presuppose the existing narrow-band infrastructural environment.

If broadband networks of 30–100Mbps are to be put in place by 2005, the concept for electronic commerce and e-government should be more ambitious. It should presuppose u-business rather than e-business, and the concept of electronic government should be based on broadband and mobile communications.

In the past, the Japanese government has conceived two very ambitious system-building plans: the New Media Plan in the 1980s, which aimed at realizing teletext, and the Multi-Media Plan of the early 1990s. Both plans were considered to be unsuccessful because the demand from the content and services side did not match the supply side of the communications infrastructure. In order not to repeat such mistakes, it is essential to undertake a comprehensive approach that takes into account demand-side innovation in both the information equipment connected to network, as well as content and services supported by a sustainable business model. They should at least start from the perspective of ubiquitous networks rather than merely broadband networks.

As I discussed in the first chapter, the New Economy paradigm can wither away if it is left alone. In order to help it survive, we need a new IT paradigm, and the e-Japan strategy is a governmental attempt to develop a new set of policies that will lead to establishing a new IT paradigm. Ubiquitous networks are, I believe, one of the most promising candidates in terms of an alternative IT paradigm.

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