Part I. Japan Team : 2. Beyond the IT Revolution: The Japanese Broadband Strategy

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Beyond the IT Revolution: The Japanese Broadband Strategy

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1. INTRODUCTION

The remarkable recovery achieved in the early 1990s and the resulting prosperity of the US economy is founded on the development of information technology (IT). IT has brought the US economy to an entirely new stage, which is referred to as the 'New Economy,' where not only have inventory cycles such as short-run economic fluctuations disappeared, but growth without inflation has also become possible by increased productivity. In early 2000, the stock prices of Net businesses or 'dot coms' turned lower, and this was the beginning of the end of the Net bubble. Currently, approximately one-tenth of Net businesses in the US have met with bankruptcy.

In Japan, on the other hand, the year 2000 marked the beginning of the Japanese IT Revolution initiated by then Prime Minister Mori. The Japanese IT Revolution was vital to the Japanese economy not only for it to catch up with other IT advanced economies including other East Asian economies such as Korea, Singapore, and Hong Kong, but also to promote growth during the long period of economic stagnation since the bursting of the bubble economy in 1991. Public funds had been invested so far in various IT projects and the construction of IT infrastructure.

Japan today, however, due to the effect of the bursting of the Net bubble in the US, has been suffering a recession in IT-related industries. Household appliances companies and PC manufacturers have already laid off several tens of thousands of employees and a large number of Net businesses such as e-marketplaces, online security companies, and Net-banks are in danger of going out of business.

Then has the IT Revolution come to an end? Definitely not. A second phase sooner or later will arrive, and when it does, the broadband will be the key factor for driving the revolution, since the broadband will be able to transmit a huge volume of data such as motion pictures at ultra high speed.[1] One reason for the dot com's shakeout is the technological shortcomings of the Internet, which will be discussed later. The current stage appears to be a preparatory one for this second revolution, and telecommunications infrastructures such as optical fibers, wireless access, and DSL (Digital Subscribers Line) compete for subscribers, and much efforts have been made to develop new technology, contents, and business models which will make the broadband a reality. Competition among these infrastructures has led to a decrease in users' charges, and this, in turn, has increased the number of users.

This paper focuses on the characteristics and issues of the Japanese broadband strategy, and analyzes how the second IT Revolution in Japan can be promoted. In the next section, we analyze why the bubble burst, and the kind of lessons to be learned from this. Section 3 provides the current situation of broadband infrastructures such as FTTH (Fiber To The Home), DSL, CATV, and FWA (Fixed Wireless Access), and discusses network (infrastructure) competition among them. This section also presents the National Broadband Network Initiative so as to create the most advanced nation in terms of broadband. Future application of broadband application such as medical care and education will be presented in section 4. Issues to promote the second IT Revolution in Japan will be discussed in the conclusion.

2. LESSONS LEARNED FROM THE NET BUBBLE

Here we present the current situation of the IT recession, and discuss the causes of the Net bubble. In order to prevent this in the coming broadband age, the kind of lessons to be learned from the bubble will be presented.

2.1. The IT Recession

In the 1990s, the US economy was driven by the rapid diffusion of IT technology in such a way that there was an increase in the capability of IT equipment and this caused their prices to be lowered. In addition, IT created new demand for telecommunications and information hardware such as PCs, equipment, and new business models. The growth of the information and communications industry can explain the 30 percent economic growth in the US since 1995.[2] This process can be called a 'revolution' of the same significance as that of the 18th century. Firms promoting this revolution were mainly venture businesses related to e-commerce, ISP (Internet Service Provider), and contents.

In 2000, however, the demand for Net businesses was expected to decrease, and this resulted in a pessimistic outlook in their future stock prices. This led to a retreat in funds investing in IT-related venture businesses, and this again caused lower stock prices, resulting in a vicious cycle. The exact causes will be discussed later, but the IT recession was triggered by this financial phenomena. This can be clearly described by the trend of stock prices, that is, the Bloomberg US Internet Index, which focuses on stocks of Net businesses, started to head lower in March 2000, and in October 2001 it dropped by 87 percent, which was lower than that prior to the bubble. NASDAQ stock prices also showed a similar trend, whereas that of the New York Stock Exchange, on which traditional big companies are listed, remained at the same level during this period. This implies that the IT recession was initiated by financial phenomena.

The aftermath of the bursting of the Net bubble in the US can be seen in the fact that in 2000, 225 and in 2001, 537, altogether 762 Net businesses and dot coms were shut down or declared bankrupt within the period of two years. It is said that there are 7,000 to 100,000 Net businesses in the US, thus nearly 10 percent went bankrupt. Among them, 226 were related to access, 284 content, 207 e-commerce, 130 infrastructure, and 46 professional services.[3] Since 2001, IT-related manufacturing has also been affected, as evident by the shipment of PCs, for instance, which showed negative growth, and the lay-offs which began in the IT industry. Telecommunications carriers, ISP, and DSL companies have also been suffering from lower demand and resulting lower profits.

2.2. The Causes for the Bursting of the Net Bubble

The bursting of the Net bubble can be summarized as follows:

(a) Overestimation of scale and pace. Since IT was an entirely new technology, it created an overestimation of the scale and speed of its diffusion. This overestimation of market participants, including investors and venture capitalists, created the bubble. IT must be supported by its consumers, but sooner or later the final demand reaches a saturation point. Let us take e-commerce as an example, which is one of the typical applications of IT and the Internet. Amazon.com, e-toy, and e-Bay are the most popular dot coms in this area, and they attracted a large number of customers. In the US, more than half of Internet users purchase goods from such companies. Approximately 8.9 percent of the users shop every week, and heavy users totaling 4.5 percent occupy nearly one-third of the total amount purchased (UCLA Internet Report). This implies that not all consumers are enthusiastic about Net shopping.

(b) Robustness of existing systems. All systems have their reasons and strong basis for their existence, and it is impossible to replace them overnight. E-commerce, for instance, is supposed to offer goods at a much cheaper price than established suppliers by getting rid of existing distribution channels. They, however, could not bypass them all. Moreover, they had to invest much more in the process of bypassing such channels, that is, they had to build their own distribution facilities. Amazon.com spent much in this regard, and thus its profit has always been negative in spite of its high stock price. Another example is the so-called 'Combini banks,' which have ATMs (Automatic Transactions Machines) installed at convenience stores and offer 24-hour cashing service. They were mistaken in their projection of demand and they have not been attracting as many customers as expected. The reasons are simple; there are already enough ATMs everywhere that do not have the extra service charges seen when cashing at convenience stores. In addition, combini banks have had to establish their own networks and supporting facility such as back offices. Again, these are costly.

(c) Immature technology. IT is new but its technological level is also far lower than what would meet customers' satisfaction. Internet telephony as well as video on demand via the Internet is not at a satisfactory level. Another example is e-commerce. One Japanese survey

presents the problem of shopping on the Internet. Among 3,641 samples, 78.5 percent of the responses were "Can't examine product by hand," and 49.8 percent were "Uncertainty about problems with payment."[4] It is obvious that IT cannot display the real goods, but it is certain that current IT fails to provide images with the same effect as face-to-face communication.

In sum, IT creates the demand for final goods, but it does it in a zero-sum way. That is, some of final users change to e-commerce use, but this decreases the same demand in traditional markets. In order to gain a net increase in final demand, IT needs further development. In what follows, we will show that this is broadband technology.

3. BROADBAND NETWORK INFRASTRUCTURE

As stated above, it is broadband that will initiate the second IT Revolution, or make a breakthrough in the current IT recession. In this section, we will present the broadband initiative which is designated to promote the Japanese IT Revolution.

3.1. Current State of Broadband in Japan

In order to discuss the broadband strategy, let us present the current situation of Japanese broadband. Japan lagged behind in Internet penetration, but due to the great effort made recently in promoting broadband and competition among carriers as well as ISPs, not only have the number of subscribers shown a remarkable increase, but users' charges have also decreased. Current broadband infrastructures are summarized into the following four accesses as being most important: (a) FTTH; (b) DSL; (c) CATV; and (d) FWA. All of these have the characteristics of flat rate charges and connecting to the Internet for 24 hours a day as well as high speed. In what follows, we examine these four accesses in more detail.

3.1.1. FTTH

FTTH aims to deploy optical fibers to each home, and its speed is the fastest among broadband alternatives such as 10Mbps to 100Mbps. Among the many alternatives of broadband infrastructures in Japan, telecommunications carriers as well as the public sector tend to focus on deploying optical fibers, whereas other economies give more attention to

DSL and CATV (cable modems), which are much cheaper than optical fibers. The current total number of business firms and individual subscribers of optical fibers in Japan is approximately 230,000 (as of September 2001), which is the second highest to the US's 376,000 (as of December 2000). As a result, broadband user charges have been decreasing due to competition among carriers.

In early 2001, a venture business called Yusen Broadnetworks began service and in August 2001, NTT started FTTH service. As examined in detail by Tsuji [2001], the density of the Japanese fiber optics network is at the highest level, namely, 95 percent in business, and 30 percent in residential areas, and the national average is 35 percent. Current subscribers are, however, limited mainly to businesses and SOHO in the metropolitan areas, but monthly charges have become low enough to be affordable to most households; namely, NTT locals offer FTTH called 'B-FLET'S' from US$30 to US$70 depending on the speed and type of house such as a condominium or single house.[5] Since the deployment of the optical fiber network is one of the key elements of the Japanese broadband initiative, it has been promoted and subsidized by the government.[6]

3.1.2. DSL

DSL is technology which uses existing telecommunications copper lines for Internet access. NTT originally had adhered to ISDN due to its business strategy as well as the technological difficulty of DSL.[7] After abolishing this policy and converting its facilities so that they are suitable to DSL, NTT locals now cover 85 percent of city areas for DSL service. Thus, giant NTT has been promoting its sale, and as a result competition among DSL operators has become intense, especially after Yahoo BB, an affiliated company of the largest search engine Yahoo Japan, entered this market with low charges such as US$20 for 8Mbps. NTT locals have also lowered their charges (see Figure 2.1). The number of subscribers has seen a remarkable increase (see Table 2.1).

Table 2.1: Number of DSL Subscribers

	Jan. 2000	June	December	June, 2001	November
Subscriber	19	1,235	9,727	291,333	1,204,564

Source: Ministry of Public Management, Home Affairs, Post and Telecommunications (MPHPT).

The areas covered by DSL and the number of DSL subscribers is increasing, but it still faces the following issues: (a) distance from telephone station. Users must be situated within 3km of the station. In rural areas, since the telephone station network is relatively small in number, it cannot cover the entire area;[8] (b) copper lines. DSL requires copper wire lines, and newly built condominiums and large apartment complexes in metropolitan areas are connected to telephone stations via optical fibers, thus DSL is not available; and (c) speed. DSL is of the best effort type, and its speed depends on many factors such as type of copper wire line, noise from other electrical equipment, and PCs. Thus, DSL is convenient but requires further technological development.

3.1.3. CATV

CATV was originally used for broadcasting, and its network can be utilized for Internet access. It is independent from NTT local loops. There are currently 243 CATV companies that offer Internet connection services. CATV utilizes coax in general, not optical fibers, so its speed is at maximum 8Mbps, and its users' charges are about US$40. Thus, cable modems are rather more expensive than DSL, so that the growth rate is smaller than DSL. The number of cable modems is shown in Table 2.2. The Japanese figures are internationally low, compared with those of the US and Korea; the former has about 4 million, and the latter 2.3 million. This is due to the fact that the size of Japanese CATV companies is small, and cannot afford to invest in new access service. Recent deregulation has been promoting the merger of CATV companies to strengthen their financial basis.

Table 2.2: Number of Cable Modems

(Unit: 1,000)

	Mar. 2000	June	Sept.	Dec.	Mar. 2001	June	Sept.
Modems	216	329	463	625	784	967	1,151

Source: MPHPT.

3.1.4. FWA

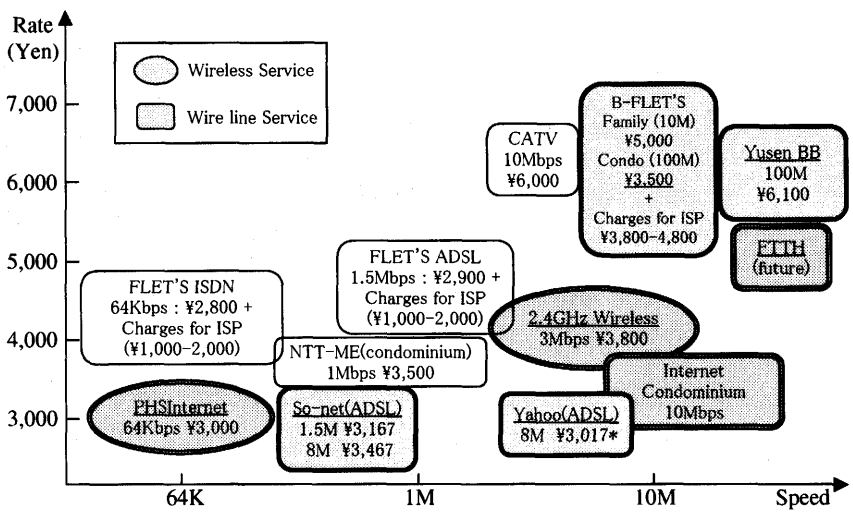
FWA does not require subscribers' wire lines such as fiber optics or metallic cables but replaces them with wireless local loops.[9] The speed of

access is about 3Mbps, and users' charges are about US$30, including charges for the provider. Access via FWA does not depend on the distance from the operational base, unlike DSL. So far, three major companies have started this service, and the number of subscribers is not large. One of the most important characteristics is that FWA does not require subscribers' lines so it is rather inexpensive to deploy, and its use can be expected to be suitable for rural areas.

3.1.5. Users' Charges

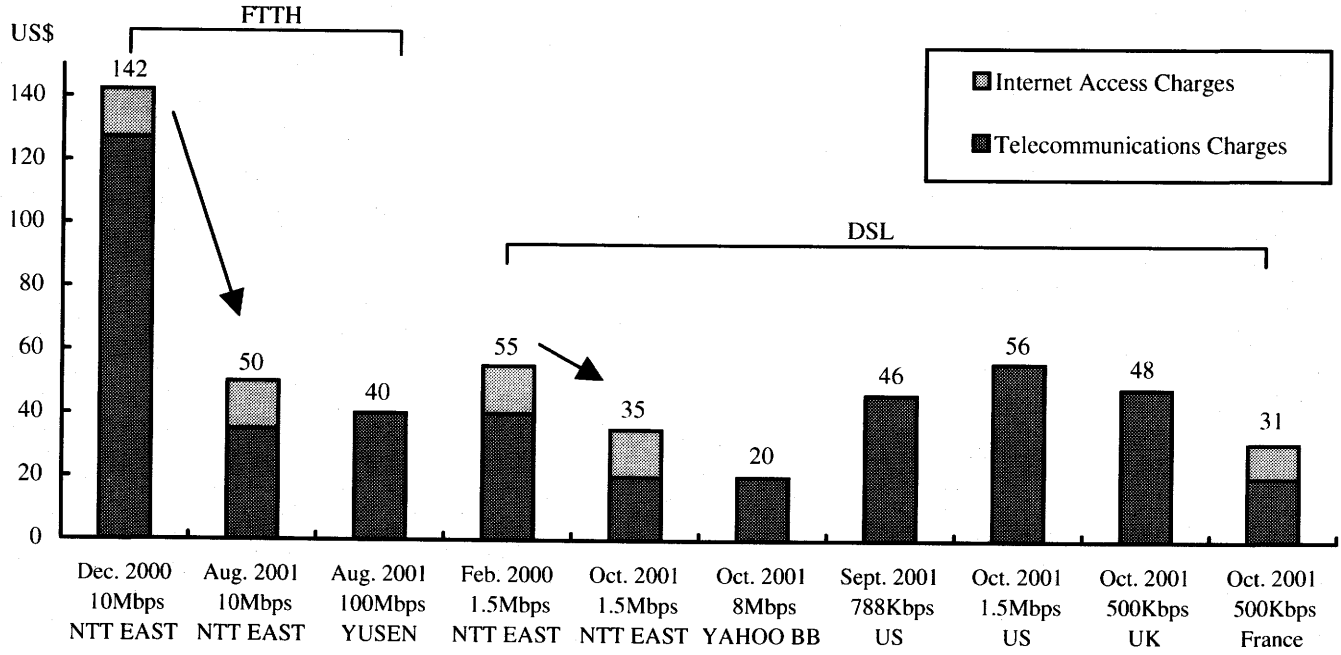
A marked increase in broadband subscribers is mainly due to the decrease in users' charges. Figure 2.1 indicates the charges of the different broadband alternatives. At present, there is no difference between ISDN and DSL. The low rates of DSL is symbolized by Yahoo BB, whose monthly charges are about US$20.[10] This is too low to cover costs at the current number of subscribers, but companies like Yahoo BB lower charges to attract enough subscribers in order to make a positive profit.

Figure 2.1: Broadband Charges



In addition, Figure 2.2 indicates that charges for FTTH and DSL have been lowered during the last two years due to increased competition and technological development. This figure also shows that Japanese charges

Figure 2.2: International Comparison of Broadband Charges



Source: MPHPT.

are no longer very expensive compared to other countries, especially for DSL which are lower than those of the US, where charges have tended to rise because of increased bankruptcy and the resulting decrease in competition in this industry.

3.2. National Broadband Network Initiative

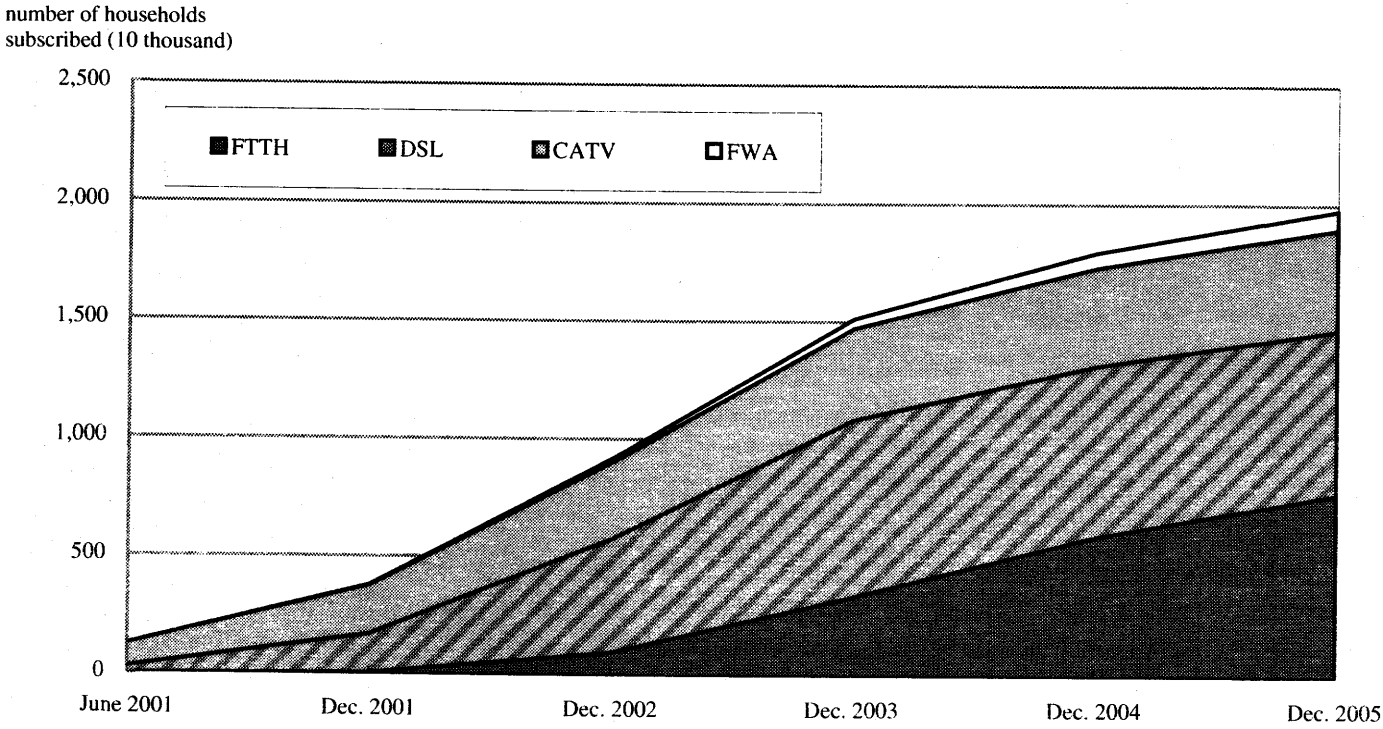
3.2.1. Estimation of Future Broadband Access

Thus, the basic four broadband infrastructures discussed have both merits as well as demerits, namely, FTTH transmits a huge volume of data at high speed, but it is costly, whereas DSL, CATV, and FWA are of a slower speed, but rather economical. Regarding the costs of deployment of infrastructure, the former requires high costs, on the other hand, the latter such as FWA are expected to be made available at low costs with the use of existing facilities. In order to establish infrastructures, we have to have a mixture of these four. As one such example, we present the e-Japan project which aims to provide broadband to all sectors of the economy.

The e-Japan project, which was announced in March 2001, sets the following objectives so as to establish the most advanced IT economy in the world: (a) by the end of 2005, at least 30 million households will have 24-hour connection to high speed Internet access networks, and 10 million to super high speed Internet access networks; (b) efforts will be made to prevent a digital divide due to geographical factors; and (c) by the end of 2005, regional public networks will be established that will be connected to all schools, libraries, public facilities, and hospitals. According to this plan, the government has set forth the "National Broadband Networks Initiative," which identifies the abovementioned four accesses – FTTH, DSL, CATV, and FWA – as being the most important for achieving those goals.[11] It also provides a schedule to realize broadband, and states the respective roles of government and the private sector, and the expected social benefits to result from broadband such as receiving high-quality public services, including those related to medical care, welfare, education, and culture.

The National Broadband Initiative has the following estimates as indicated in Figure 2.3, regarding the number of households which will be connected to the Internet with high-speed access as mentioned above.

Figure 2.3: Estimation of Broadband by the National Broadband Initiative



Source: MPHPT.

In more concrete terms, by March 2003, almost all metropolitan areas including the wards of Tokyo and prefectural capitals, and by March 2005, almost all other 623 cities will be covered by high speed access networks to the Internet, and at that time, the share of the four broadband infrastructures are expected to be FTTH-7,730,000, DSL-6,950,000, Cable modem-4,290,000, and FWA-800,000. The estimation of these figures is obtained by regression analysis on the basis of users' past trends.

The basic framework of this deployment is of the same idea as the US's 'National Information Initiative (NII),' that is, it is achieved through competition in the private sector. This however creates the issue of 'market failure.' Private firms cannot engage in business in unprofitable regions, thus a digital divide may be created. Particularly, depopulated and isolated areas characterized by geographical constraints will find it difficult to attract private firms to participate in the deployment of network infrastructure. In such cases, the public sector is required to take that role. The deployment of public networks such as public LANs will interconnect all public facilities and institutions in these areas for services related to education, administration, welfare, medical care, and disaster prevention.[12] Larger-scale LANs for a region are also referred to as WAN (Wide Area Network), which interconnects all agents in the region, whether public or private. Without public assistance, the above National Broadband Initiative cannot be achieved.

3.2.2. Issues of the National Broadband Initiative

One of the key factors for realizing the National Broadband Initiative is whether FTTH, CATV, DSL, and FWA will be given sufficient priority for realizing the project. DSL has issues regarding its availability. It is well known that DSL cannot be used for households which are located about 2 miles away from local NTT offices.[13] DSL is also available only for copper cables, not for ISDN or FTTH. It is sometimes affected by noise emitted from electric ovens or other electric appliances. Another issue related to FTTH, CATV, and DSL is the installment of networks in apartment complexes and condominiums. Although those recently built are already equipped to connect with the Internet, those without this capacity are burdened with additional installment costs. For this reason, there are cases where residents are unable to reach a consensus regarding installment. Digital divide is not a concept applicable only to depopulated areas, it occurs in metropolitan areas as well. New legislation or sub-

sidy schemes are required to cope with this issue.

Another issue is that the National Broadband Initiative provides only for the deployment of infrastructures, and is less related to applications. Without being utilized by the final users, broadband infrastructures have no meaning. FTTH has a maximum speed of 100Mbps, but there are only a few software and contents so far which can fully utilize such speed. Possible broadband applications such as contents, software, and business models will be discussed later.

3.3. Recent Broadband Development: From Last One Mile to Last Quarter Mile

Here we will examine the recent development of four broadband infrastructures in terms of competition. FTTH, CATV, and FWA have their own networks, and they are independent from NTT's local subscribers' line. Thus, the situation is referred to as network competition. Through competition of the four networks, broadband infrastructures have become closer to their users, so the issue of the 'last one mile' now becomes that of the 'last quarter mile.'

3.3.1. NTT (FTTH)

In 2000, NTT locals in Tokyo started high-speed Internet access service through the optical IP communication network, which was built specially for Internet connection service. The Internet is of the best effort type, and its quality is not guaranteed 100 percent, but it is designated for high quality service at 100 percent connection with fixed user charges. This service is called 'B FLET'S.' Since then, this service has been expanded to other large cities such as Osaka, Nagoya, and Kobe. The speed is from 10Mbps to a maximum of 100Mbps, depending on the region. This service makes it possible to realize the FTTH dream, that is, each house is connected directly to an optical fiber network. It costs about US$300 per month for business users, US$75 for the basic type, US$40 for the family type, and US$30 for the condominium type.[14] These are almost the same as DSL. Although this network still has technological and content problems, Japanese Internet usage leads many other economies. NTT locals are also making the effort to promote B FLET'S in such a way that if there are at least thirty subscribers in an area, NTT will expand optical fibers from their terminals (nodes). This is a big shift from their past

marketing strategy which deemed such service to be appropriate only if a sufficient amount of users, much larger than thirty, could be identified around the NTT local office.

3.3.2. Yusen Broadnetworks (FTTH)

Yusen Broadnetworks is another firm which provides FTTH with a maximum 100Mbps (best effort), and it started service in Tokyo in March 2001.[15] At the end of 2001, it will begin providing services in other metropolitan areas. Yusen Broadnetworks has a unique marketing strategy for providing service, that is, it concentrates on only populated areas such as those containing more than 3,000-4,000 households within a diameter of 2km. Yusen is able to provide services at rather low cost, since it makes use of existing telephone poles and power lines. It also is not required to provide universal service, since it is a private firm; that is, it provides service only to profitable areas.

3.3.3. K-Opticom (FWA)

Electric companies own power plants, distribution networks, and other facilities, and the aim of the networks is to control and operate their systems related to the generation, transmission, and distribution of electric power, and securing a stable supply. Since these networks have a sufficient level of quality and reliability, they can be utilized as the public switched network for telecommunications. The characteristic of this network is that it can play the role of subscriber lines, and this is why electric companies have started providing telecommunications service.[16]

K-Opticom is an affiliated company of Kansai Electric Company, which is a regional monopoly in the Kansai area. In June 2001, K-Opticom started a new service of high-speed Internet access through their electric wire lines. Its service is based on the optical fiber networks of Kansai Electric Company, which currently owns 10,000km of backbone networks and 6,000km of access networks. It will expand the network to 36,000km by March 2002. K-Opticom has a very simple IP network consisting of one Network Operation Center, eight regional centers, and thirty-seven local centers. All are connected by double links for security. Business firms can use this for IP-VPN (Virtual Private Network), and utilize high-speed communication at low cost. The Internet access service for individual subscribers is called 'EO' and its

speed is from 64Kbps (EO 64 Air) to 10Mbps (EO Mega-fiber). From November 2001, it will start a new wireless service called "EO Mega-air," which is 2.4GHz.[17] Service charges are US$25 for EO 64 Air, US$24-US$32 for EO Mega-fiber, and US$36 for EO Mega Air. There is no charge for IPS, which is a characteristic of K-Opticom.

3.3.4. iTS Communications (CATV)

CATV companies are also strengthening competitiveness by increasing access speed to the Internet, but their speed is limited to about maximum 8Mbps. iTS Communications located in Yokohama, formerly Tokyu Cable Television, has been providing various broadband services since 1998. It will soon start high-speed Internet access services such as 30Mbps, and this is about four times faster than DSL. This high speed is realized by adopting the optical-coax hybrid network such that optical fibers are used for the trunk lines and coax for access lines. This enables it to distinguish its services from DSL, which is its competitor. DSL has a shortcoming such that the quality level of images is not very high, particularly for HDTV (High Definition TV), which requires at least 20Mbps.

4. POSSIBLE APPLICATIONS OF BROADBAND: CASE STUDIES

One of the most important issues of broadband is application. Entertainment such as games, *Karaoke*, movies, animation, and e-commerce like shopping are the main targets. Sony Pictures, for instance, plans to distribute movies through the Internet, and users can enjoy movies at home by downloading them. Here, we present possible applications of broadband in the areas of medicine and education as case studies. The cases discussed here pertain to the application of narrowband, not broadband, but the projects have been successful. Some of them are considered rare examples in the world. If they are replaced by broadband, much more fruitful results can be expected.

4.1. Telecare[18]

4.1.1. Definition of Telecare

Telecare is one category of telemedicine and implies the use of electronic signals to transmit medical information on patients living in remote areas. This is a real-time and two-way interactive transmission of information of large capacity such as images and data. Telecare differs from telemedicine in the sense that the persons who transmit and receive medical information are not medical doctors, but the patients themselves and their families, nurses, care-takers, home-helpers, medical technical experts, and so on. Consequently, under the current level of technology, telecare cannot provide advanced medical treatment and services, and focus is on primary care and mental care such as diagnosis of the patient at home by examining the images on PC or TV screens and by observing health data transmitted by the system.

The telecare system in effect today in Japan can be broadly categorized into three groups in terms of aim, nature of medical information, equipment, and type of network as follows: (a) tele-home-care; (b) telehealth; and (c) community health and welfare management type. In what follows, let us examine the first two as the future application of broadband.

4.1.2. Tele-Home-Care System

This system aims at providing telecare, for example, for bedridden patients and patients stricken with terminal diseases who require medical care. The characteristics of this system are the real-time and two-way interactive transmission of motion pictures via video-conference systems or videophones. This system is classified into three subcategories according to network type: (a) CATV-Broadcast; (b) CATV-LAN; and (c) ISDN. The CATV network is utilized by (a) and (b) which can transmit a high definition motion picture of 30 cells per second using a color digital (CCD) camera with 360,000 elements. As far as the system is concerned, (a) uses the broadcasting network, and (b) the LAN network. As for working examples of (a), the systems of Goshiki Town in Hyogo Prefecture and Kamaishi City in Iwate Prefecture are two in operation. As for (b), there is the care-at-home support system called "*Anshin-netto*" in Minami-Shinano Village in Nagano Prefecture which is the

only working example of the LAN type.

The ISDN type (c) of tele-home-care utilizes ISDN 64Kbps as its network and image information is transmitted by the videophone system. As for quality of image on videophone screen, the motion picture is 10 to 25 cells per second, and it is inferior to that of the CATV type. On the other hand, in the case of ISDN, correspondence such as the exchange of messages among patients can be easily accomplished, and families of the patients exchange information through ISDN. This type of system is in operation in twenty regions such as Bekkai Town in Hokkaido, Mogami Town in Yamagata Prefecture, and Mitoyo Region in Kagawa Prefecture.

4.1.3. Tele-Health Type System

The tele-health type and community health and welfare management-type systems differ from the previous tele-home-care type in that both do not use image information. The aim of the health system is not to treat patients' illnesses but to regularly observe the health condition of elderly residents or patients, for instance, after they have been released from hospital.

The system consists of the following devices. First, at the patient's home, a camera, PC, and remote monitoring, which is also called remote sensor, are installed, which measure temperature, blood pressure, pulse, heartbeat, electrocardiogram, and amount of blood oxygen as part of patient observation. The medical information obtained through these instruments is then transmitted to medical institutions such as the local health center via the telecommunications network which include public telephone lines, leased circuits, ISDN, and the CATV network.

This system is a simple device, but when it is used continuously, the condition of the illness such as a chronic disease is shown in graphs, which are then used for diagnosis and consultation. The system is also effective for encouraging patients to take more interest in their health condition. Some of the terminals are equipped with a simple voice function, and the doctor can examine the condition of the patient's health by talking with the patient. There are seventy-six local governments across Japan which operate the tele-health system including Tadami Town, and Nishi-Aizu Town in Fukushima Prefecture, and Nanmoku Village in Gunma Prefecture. The total number of devices amounts to more than 8,100 as of August 2000.

4.1.4. Effectiveness of Telecare

We conducted a field survey on the users of a tele-health system in Nanmoku Village, Kamaishi City, and Katsura Village, and obtained the following results regarding the effects of tele-health systems: (a) stabilizes the condition of diseases; (b) raises health consciousness; (c) decreases anxiety toward health; and (d) decreases medical expenditures. Health data sent to the medical institution is simple, but basic. By examining the medical data each day, medical staff are able to recognize changes in health condition, and give advice to the users. By reading their data records, users begin to want to improve that data. Thus, they pay more attention to their own health. Users can communicate with medical staff via the system, and as they realize there are connected to the medical staff 24 hours a day, this decreases their feelings of anxiety. According to replies to our questionnaires, about 20 percent of the users claim their medical expenditures declined after their use of the tele-health system. This is a rather surprising result, and we have to prove this hypothesis by other methods of research.

Regarding assessment by users in our survey, in three regions more than 90 percent of users recognize the system to be useful, and they want to continue its use. More than two-thirds of the users were satisfied with the function of the device and replied that there was no need for improvement. Most of the users are the elderly and they replied that the devices are easy to learn how to operate. In sum, we can conclude that the three systems surveyed are supported by their users.

4.2. Distance Learning: Setouchi Town, Kagoshima Prefecture[19]

4.2.1. Objective of Distance Learning

In 1995, the Ministry of Education started to apply telecommunications and multimedia to further develop education in rural areas. The aim of this project is to interconnect schools, from elementary to high school, in isolated islands or mountainous regions with urban areas, via ISDN and satellites. In addition, another project for hospitalized school-age children has also been started to interconnect schools in the hospitals and the schools they are registered at.

These projects interconnect two to three schools via optical fibers with the speed of transmission of either 64Kbps or 1.5Mbps. The schools

share the same lectures and participating schools are the principal and branch schools, or schools in the same prefecture. There are currently twenty-two schools in ten prefectures involved in these projects. As an interesting example among the author's field research, let us introduce the project at Setouchi Town, Kagoshima Prefecture.

Setouchi Town is located at the southern tip of Amami-Oshima Island, Kagoshima Prefecture, and consists of three other isolated small islands, namely, Kakeroma, Koishima, and Yoro Island. The population of the town is 12,017, and it has been showing a decreasing trend since there is no big industry in the town, except for fishery.

4.2.2. ISDN Network

The tele-education system of Setouchi Town interconnects three town elementary schools and the Education Research Center of Kagoshima Prefecture by ISDN (64Kbps and 1.5Mbps). They are Koniya School on the main island, Hyo School on Kakeroma Island, Ikeji School in Uke Island, and Yoro School on Yoro Island. Each elementary school is equipped with a videoconference system, with 29- and 50-inch monitor TVs, an electric board, and a camera to show the textbook and educational materials on the teacher's desk, which is operated from the teacher's table. There are six other cameras at Koniya School to show the classroom to other schools. One camera shows the teacher, the other the entire classroom, and the other four, which are fixed in the classroom, shows the students in the classroom. The screen of the 50-inch monitor TV can be divided into either four or nine frames according to the situation; for instance, to see the classrooms of the other schools at the same time. All schools are thus interconnected via fiber optics with the three other schools, and they share the same lecture together. In addition, the speed of transmission can be selected from 128Kbps, 384Kbps, and 1.5Mbps: e.g., for transmission of the classroom, a high speed with a high quality of images and voice can be selected, and for a videoconference of a teachers' meeting, a low speed.

4.2.3. Effectiveness and Issues of Tele-Education in Setouchi Town

The systems are designed to be operated by either the teachers or pupils. The main aim of tele-education in this town is to unify the feeling of the teachers and pupils on the isolated islands. On the other hand, there are

the following problems related to the system. When the 50-inch monitor TV is divided into nine frames, each frame is too small to see clearly; in other words, the figures of the pupils and teachers are too small. When many schools participate, the speed of transmission becomes slow, and the voices lag behind the images.

4.3. International Distance Learning[20]

Here, an experimental international distance-learning project via ISDN is presented as a case study, which is called the Human Resource Development Project for Vietnam.

4.3.1. The Project

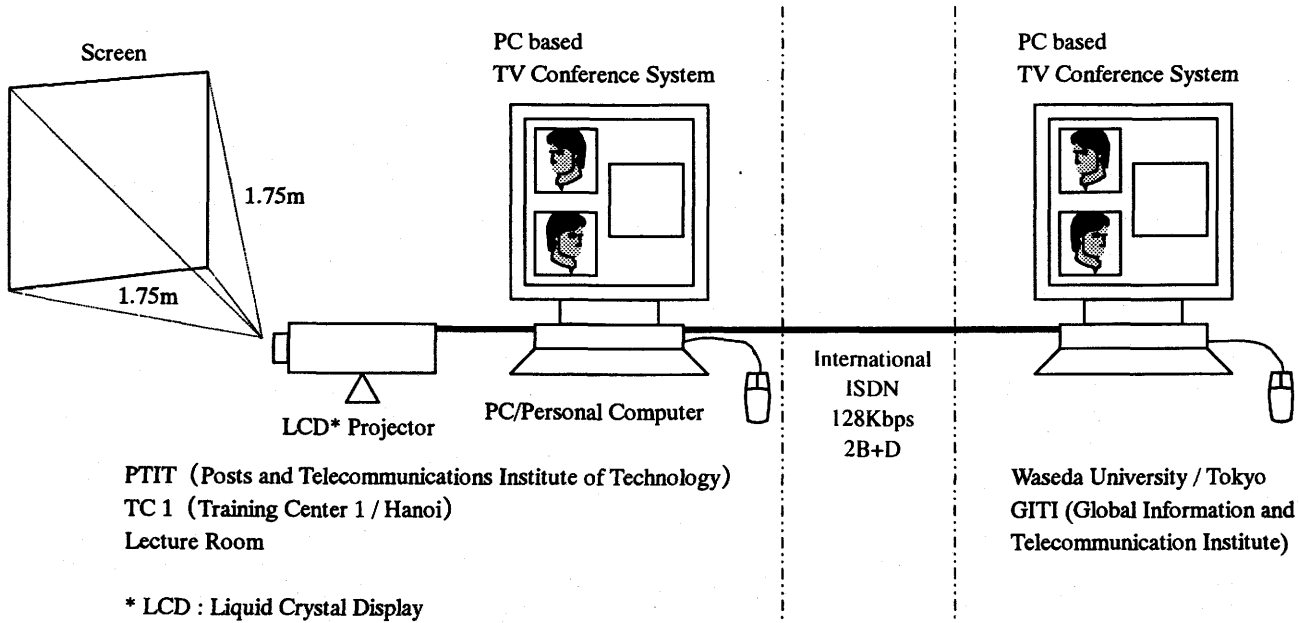
Three foundations — the Hoso Bunka Foundation, or Broadcasting Culture Foundation (HBF), the International Communication Foundation (ICF), and the Telecommunications Advancement Foundation (TAF) (all three referred to hereafter as HIT) have been engaged in carrying out joint projects for human resource development (HRD) in both the telecommunications and broadcasting fields.

The International Distance Learning Project (hereinafter, the Project) was planned as one of the HRD projects, using a TV conference system via international ISDN between the Global Information and Telecommunication Institute of Waseda University and Training Center No. 1 of the Posts and Telecommunications Institute of Technology (PTTCI) of Vietnam Posts and Telecommunications. The Project was successfully implemented in 1998 with three series of lectures and terminated in February 2001. Courses related to multimedia and telecommunications were offered from Waseda University, and each session lasted 90 minutes, including interactive questions and answers. Lecture documents were distributed one week in advance and participants were expected to prepare for the lecture.

4.3.2. Network Configuration of the Project

The international ISDN link between Vietnam and Japan was established at the end of 1997 for the TV conference service. ISDN was considered very attractive from the viewpoint of cost and timesaving. Figure 2.4 shows the actual implemented network configuration of the Project. The

Figure 2.4: System of International Distance Learning



ISDN circuit between Waseda University and KDD is connected through NTT's network in Japan. It extends to Vietnam via KDD's International ISDN. The circuit between Japan and Vietnam is routed through Asia Pacific Cable (APC), Asia Pacific Cable Network (APCN), and Thailand-Vietnam-Hong Kong Cable (TVH). These optical fiber cables are interconnected via Hong Kong.

The visual signals transmitted from Waseda University were received by the PC-based TV conference system in PTIT Hanoi, and projected on an enlarged screen by a liquid crystal display (LCD) projector connected to the PC.

4.3.3. Assessment of the Project

The results were highly evaluated by recipient institutions in Vietnam, and considered more satisfactory than initially expected. The factors which led to such a conclusion may be analyzed as follows:

(1) Compared with a satellite circuit set up by VSAT, ISDN, if available, can much more simply and economically implement an international distance learning program between two points if lectures are transmitted in regular intervals such as one week or so.
(2) The recent PC-based TV conference system enables high quality transmission and voice presentation together with clear video images of class scenes and lecture documents in a sufficient resolution to the receiving side. If lecture documents are prepared so as to fulfill their functions, quite satisfactory results will be achieved in international distance learning over ISDN circuits even at a low speed of 128Kbps.
(3) With the combination of a projector with a high degree of brightness and PC, online distance learning can be easily realized in a class of twenty students or so.
(4) The contents and subjects of lectures were negotiated and selected so as to interest recipient institutions and to contribute to resolving the regional information gap.

5. CONCLUSION

Thus far, we discussed how broadband has been introduced to the Japanese economy, and now due to technological development and competition among Internet access companies, broadband charges have been decreasing. Therefore, it can be said that the recent increase in CATV

and DSL subscribers has been triggered by a 'technology-push' and 'cost-push.' Consumers, however, are not necessarily satisfied with the existing content. According to the Nikkei Survey conducted in April 2001 asking what will be the driving-force of broadband contents, 45.5 percent replied visuals (excluding movies), 38.8 percent games, 31.8 percent movies, 29.5 education, 27.3 percent music, etc. At the current stage, none of them are being widely provided. Items purchased through the Internet are mostly conventional commodities such as books, clothing, computers, foods, music CDs, DVDs, video cassettes, accessories, etc.[21] Without introducing the 'killer contents' mentioned earlier, competition between broadband and existing e-commerce will end up with the zero-sum game, that is, broadband will only replace e-commerce. Further development of broadband requires a 'demand-pull.'

Measures to cope with the digital divide are also necessary for, as discussed in detail, it will occur not only in rural but also urban areas. According to MPHPT, more than one-third of the total 44,210,000 households in Japan live in apartment complexes or condominiums; particularly in the Tokyo and Osaka metropolitan areas, more than half live in such housing. Those newly built are already equipped with broadband, on the other hand, existing ones are not. They must bear the cost for conversion. Since there is no firm legal basis to introduce broadband to those buildings, suitable legal as well as financial schemes are necessary.

Japan has the densest network of optical fibers, as pointed out by Tsuji [2001], and in order to fully utilize these networks, it plans to make it possible for everyone to be able to have equal access. Theoretically, this is ideal, however, if it is to be realized, who will construct the network? Even if Japan has the densest optical fiber networks, they are not sufficient. An incentive scheme is still required to deploy optical fibers at the current stage of broadband development.

Notes

1 Broadband is defined in general as having a high speed of more than 200 Kbps in the reports of various governments as well as international organizations, but in business it is much faster such as more than 1Mbps.

2 For economic analyses as to how IT contributed to the growth and economic activities of the US, see Choi & Whiston [2001], and US Department of Commerce [2000], for example.

3 See http://www.webmergers.com.

4 InfoCom Research [2001], p. 114.

[5] In addition to monthly charges, US$250 to cover initial service fees is required.

[6] In the fiscal 2002 budget, for example, funds are planned to subsidize half of the costs of local governments for deploying optical fiber networks around public facilities such as schools, town halls, and hospitals.

[7] Regarding these issues, see Tsuji [2001], pp. 47-49.

[8] In the case of NTT East, there are about 3,000 telephone stations, and less than one-third have been converted to DSL.

[9] The term fixed implies that receiving terminals such as wireless antennas are fixed to houses, for instance. If terminals are mobile, then they are called mobile access.

[10] It is estimated that in order for Yahoo BB to break even at this amount, it has to attract a couple of million subscribers. This is based on the theory of dynamic pricing.

[11] For more details, see http://www.soumu.go.jp/joho_tsusin/eng/Release/Telecommunications/news/011016_1.htm.

[12] Japan has a tradition of deploying infrastructures by public funds in such a way that the central government subsidizes the local government. This situation is referred to as 'public-public partnership' by Tsuji [2000].

[13] The areas where DSL is available is indicated in the homepage of NTT locals, but it is said that nearly 50 percent of households within an available region are unable to have access to the Internet due to one reason or another.

[14] In addition to these costs, users have to bear the initial costs for installment which amount to about US$230.

[15] Yusen Broadnetworks listed its stock on NASDAQ JAPAN in April 2001.

[16] Tsuji [2000] discussed their telephony service in the local call market using TTNet as an example.

[17] EO Mega-Air is categorized as FWA, since it is utilized inside a house or office and access to the Internet is through wireless LAN.

[18] This part is based on Tsuji [2002].

[19] This part is based on Tsuji *et al.* [1999].

[20] This part is based on Tsuji *et al.* [2002].

[21] Survey conducted by InfoCom Research; see InfoCom Research [2001], p. 111.

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