Ushering in a New Networked Society

Norio Wada, President and CEO, NTT

Abstract

NTT is contributing to the government's "e-Japan Strategy" and exploring solutions for the current and future social issues by creating a resonant communication network environment. This article introduces the presentation entitled "Ushering in a New Networked Society" delivered by Norio Wada, President and CEO of NTT, at the NTT R&D Forum in February 2004.

1. Advent of a new networked society

The dawn of the 21st century saw Japan facing a variety of societal concerns: an aging population combined with a declining birthrate, environmental and energy issues, and a consequent increase in social costs. Effectively solving these problems is essential to sustained development and revitalization of Japan's economy and society (**Fig. 1**). As part of its effort to solve these problems, the Japanese government has formulated "e-Japan Strategy II", which aims to revitalize the economy and society through active use of information technology (IT).

NTT will contribute to the e-Japan Strategy, and to solving societal problems, by helping to initiate a new, networked society based on photonic technology, a society that we term a "resonant communication environment". We believe that both the raison d'être of NTT Group's business, and its future business opportunities, lie in these efforts.

2. e-Japan Strategy II

I am a member of the IT Strategy Headquarters (Chief: Prime Minister Junichiro Koizumi) and have been involved in formulating the national IT strategy. Key aspects of e-Japan Strategy II are briefly explained below.

As is shown in the green section on the left side of **Fig. 2**, the strategy has two major pillars. One is pro-

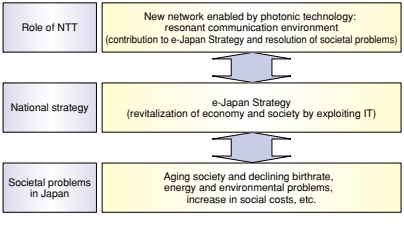

Fig. 1. Toward a new networked society.

motion of IT use through a series of drives in the areas of medical services, foodstuffs, lifestyle, financing of small to medium-size businesses, knowledge, employment and labor, and public services. The second pillar is reinforcement of efforts to expand the infrastructure for a new IT society. Five priorities have been chosen. They include development of a next-generation information communication infrastructure and an environment for secure and safe use of IT.

The blue section on the right of Fig. 2 shows a policy package designed to accelerate the progress of e-Japan Strategy II. On February 6, 2004, the IT Strategy Headquarters adopted six major policies, including an international strategy for the IT field and a strengthened security policy. What is unique about this list is the inclusion of "evaluation". It was decided to form a committee that will evaluate and analyze the progress of each item in e-Japan Strategy II and report its findings to the IT Strategy Headquarters. This signals a strong determination to prevent the situation of something being planned but never done. NTT, for one, is committed to contributing to these policies.

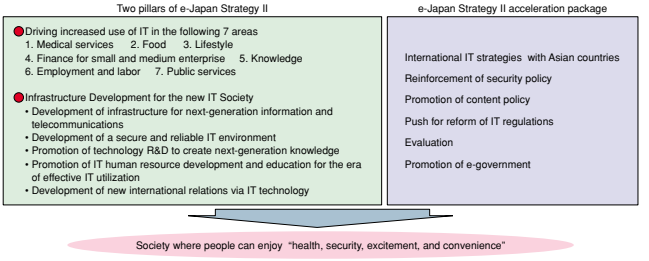

Fig. 2. e-Japan Strategy II (promotion of use of IT).

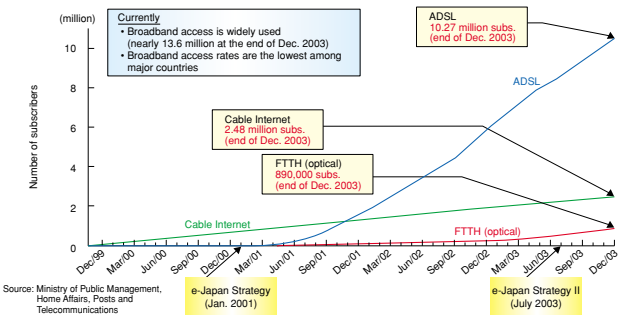

Fig. 3. Growth in broadband access.

3. Increase in broadband access

Figure 3 shows the growth in number of broadband access users. Driven by the e-Japan Strategy, usage of ADSL and FTTH is expanding rapidly. By the end of December 2003, the total number of ADSL, cable Internet, and FTTH access users exceeded 13 million. Over the year of 2003, the number of ADSL users increased 1.8 times, while that of cable Internet users grew 1.3 times. Over the same period, the number of optical access users increased 4.3 times to about 900,000 (December 2003), indicating that FTTH has finally taken off. At the same time, monthly rates for these services plunged, so that the price per megabit in Japan is now the lowest in the world. These figures indicate that Japan has become one of the most advanced countries in the area of broadband access.

4. NTT's approaches to broadband businesses

In light of this progress in broadband access, the NTT Group organized "NTT-Resonant Inc." in December 2003. This new subsidiary of the NTT Holding Company will bring together various NTT Group resources to develop pioneering video communication services and broadband portals, as shown in **Fig. 4**. In short, NTT-Resonant will provide the driving force to accelerate NTT Group's all-out efforts at developing broadband services.

5. Approaches to societal issues

How does NTT intend to address the societal issues that Japan will face in the future? The left-hand side of **Fig. 5** shows societal problems that Japan cannot avoid in the coming years: an aging population combined with a declining birthrate, and an acute need to reduce the environmental load. We believe that the provision of new video communication and video

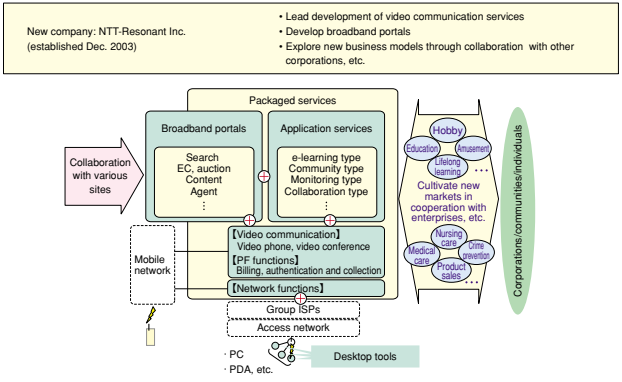

Fig. 4. How NTT Group approaches broadband business.

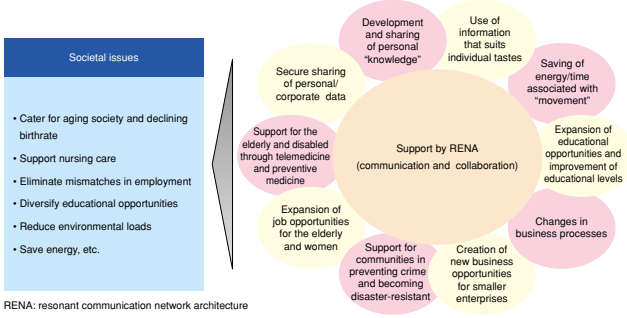

Fig. 5. How to cope with societal problems facing Japan.

collaboration environments over a new-generation optical network, which we call RENA (resonant communication network architecture), will contribute to resolving these problems, as shown on the right in Fig. 5.

Let's take as an example one of the most serious concerns—the aging population and declining birthrate. Japan's population is expected to peak in two years' time (2006), when it will reach about 128 million. From then on, the population will decline, with projections that by 2050 Japan will have about 20% fewer people than currently occupy the country. At the same time, the ratio of productive population (aged 15 to 64) to non-productive population is projected to become something like one-to-one. The proportion of people aged 65 years or older will increase by around 20%, to eventually constitute about 40% of the total population of Japan. Three examples of ways to ameliorate the effects of these changes are described below.

The first example is nursing care. When a new video communication environment becomes available, high-definition videos will enable medical specialists at nursing centers to check remotely, every morning and evening, the health conditions of elderly people receiving nursing care at home. This will not only enable health problems to be identified quickly and easily, reducing the workload of nursing family members, but will also reduce the social costs of nursing care for the elderly.

Next, the new communication environment will expand opportunities for senior citizens and non-career women to find jobs or receive higher education. The availability of collaboration between multiple sites through video communication will promote opportunities for teleworking. Senior citizens who have retired from active involvement in business and housewives at home will find it easier to work, or to participate in various social activities, without leaving home. This will make up for the decline in the workforce expected to result from the declining birthrate and will contribute to increased labor productivity by resolving the disparity between demand and supply for specific skills in the labor market. According to the Ministry of Land, Infrastructure and Transport, the proportion of teleworkers among Japan's total workforce in 2002 was 5.8%, compared with 8–11% in Scandinavian countries, where both population aging and IT penetration are more advanced than in Japan.

Video communication is already used for foreign language education and will increasingly be used for other distance learning, resulting in expanded and diversified opportunities for education. It also helps to conserve energy by reducing the number of business trips and other kinds of physical movement by people.

6. Five challenges to overcome in the future

While I have high expectations for the expansion in broadband access and greater use of IT, I also feel a strong sense of impending crisis. I believe that we must overcome five challenges to prevent such a crisis from occurring, as shown in **Fig. 6** and explained below.

The first challenge is how to keep pace with rapidly increasing traffic. The 2003 White Paper on Telecommunications reported that the traffic flowing through Internet Exchanges (IXs), which interconnect the networks of Internet Service Providers (ISPs), grew two to five times over the previous year. Increased circulation of video content is expected to produce further rapid growth in traffic. As is true in many areas, quantitative growth leads to a demand for qualitative growth. The next-generation network will be required to be of a high standard both quantitatively and qualitatively. However, current technology, not only for individual network elements such as switches and routers but also for the backbone network, may not be able to keep pace with the rapidly growing traffic or measure up to the high qualitative standard that users will increasingly demand. To cope with this problem, the Ministry of Public Management, Home Affairs, Posts and Telecommunications established the "Next-Generation IP Infrastructure Study Group" on February 3, 2004. Serious study will be required, not only into technical development but also into systemic measures such as the types of traffic that deserve higher priority handling and methods of restricting unlawful traffic.

The second issue is network security and cyberterrorism. Computer viruses can cause havoc, as evidenced by SQL Slammer (January 2003), MS Blaster (August 2003) and, more recently, MyDoom and its variants. With the Internet being a borderless communication phenomenon, it is vital that governments and service providers in all countries collaborate to implement coordinated measures on a global level to deal with security and cyberterrorism.

Another challenge is how to secure communication in the event of a large disaster, such as an earthquake. In the past, network providers were also service providers. In Japan, NTT (domestic) and KDD (international) controlled both networks and services. So, only these two companies were involved in ensuring continued operation of networks and services. Today, however, with the rapid expansion of the Internet and mobile phone systems, the networks of a diverse range of providers are interconnected globally and seamlessly in multiple layers. Traffic monitoring and control by a single provider is not enough to secure communication in the event of a disaster, and the boundaries of responsibility are not entirely clear. Therefore, we face the serious challenge of developing a mechanism for restoring the operation of this complex of interconnected networks in the event of a devastating disaster.

Furthermore, malicious use of networks, such as spoofing and infringement of privacy, fraudulent online trading, and rumor-mongering, is likely to increase. Looking around, we see many examples of young people who are competent in using IT but immature in social mores, seemingly thrown into the deep end before they have learned how to swim. This means that, in order to counteract malicious use, we must not only develop protective technology and legislation, but also combine these efforts with an edu-

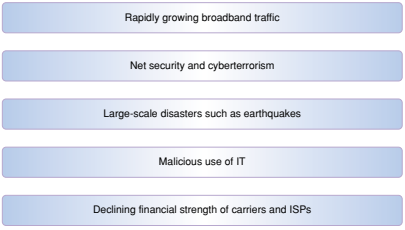

Fig. 6. Five challenges to be overcome.

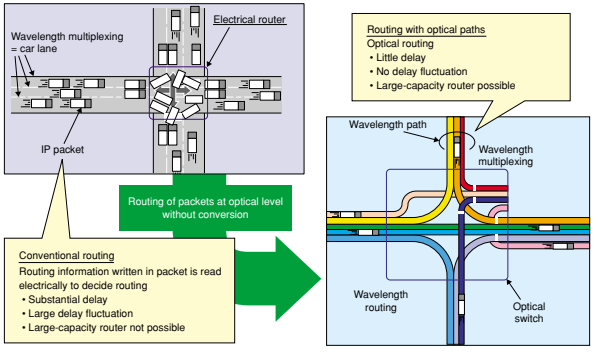

Fig. 7. Routing with optical paths.

cational approach that teaches people to acquire the ethics and appreciation of rules appropriate to an IT society.

As is evident from the above discussion, overcoming these challenges and building a safe and secure social infrastructure for greater use of IT will require tremendous energy and investment, not only for technical development but also for other approaches. However, most services currently available on the Internet are offered free of charge. No sound, profitable business models have been established. As a result, the financial power of providers to make the necessary investment is declining. Unless appropriate business models are developed and expanded, providers will not be able to recoup their investments, making it difficult to expand FTTH and broadband services, and leaving few resources with which to tackle the "dark side" of broadband communication.

7. Fruits of NTT's efforts

NTT's R&D is committed to meeting these challenges. I would like to introduce three specific examples of the fruits of our efforts.

7.1 Routing with optical paths

The first outcome is routing with optical paths. In conventional IP networks, even if optical fibers are used for transmission the main parts of routers are still electrical, as shown on the left in **Fig. 7**. Therefore, optical-to-electrical conversion of signals is required before routing and the reverse conversion is required after routing. These conversions increase fluctuations in delay and make it difficult for a router to handle a large volume of traffic.

The right-hand side of Fig. 7 shows technology for optical-path-based routing, in which optical signals are routed as they are, thereby solving the problems regarding delay and capacity. However, there is still significant work to be done before this approach can be widely used, such as further cost reductions and interface standardization. These cannot be achieved by NTT alone. We hope to overcome these challenges by collaborating with vendors and providers who actually use the technology.

7.2 Moving Firewall

The next technology relates to network security and protection against cyberterrorism. Conventional firewalls are employed in users' LANs to protect them against external attacks. One problem with this is that the firewall not only restricts malicious traffic but also holds up normal traffic for long periods until the attacks cease.

To solve this problem, NTT is developing a "Moving Firewall" (**Fig. 8**). This narrows down the sources

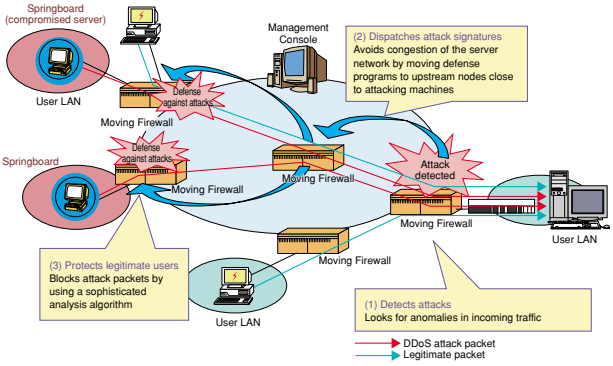

Fig. 8. Moving Firewall.

of attacking traffic and restores the flow of normal traffic by tracking the attacking routes in the network and restricting communication only on these routes. Specifically, when an attack is detected, (1) both attacking and normal traffic is restricted initially, but, as shown in (2) and (3), information about the attack is instantly transferred to adjacent firewalls, and the normal traffic restriction is lifted. Subsequently, attacking traffic is blocked while normal traffic is allowed to flow.

If Moving Firewall devices were to be introduced only in NTT's networks, then the effect would also be limited to our networks. This would not be effective at ensuring end-to-end safety across the entire IP network, which is made up of multiple layers incorporating networks belonging to many providers. We believe that other providers and vendors must also adopt this technology, collaborate in enhancing its functionality, and participate fully in ultimately building a framework that can protect the entire IP network from cyberterrorism.

7.3 Storage-centric network

The final example is what we call a "storage-centric network", which provides defense against large-scale disasters and malicious use of data (**Fig. 9**). This technology was conceived and perfected through cooperation between a partner having strong expertise in storage technology and NTT, whose strength is in networking technology. In this network, the data center (shown in yellow in the upper section of Fig. 9) holds the complete set of operating systems, applications, and user-created data. When a user wants to access any of these, the required files are downloaded to his/her terminal. Once the task has been completed, new or modified files are uploaded back to the data center: no user data files remain in the user's terminal. Even in the event of a localized large-scale disaster (1), the user can promptly restore the same business operation on another terminal, using the files stored in the data center. And if a PC is lost or stolen, there will be no leakage or malicious use of data because no user data is stored in the PC (2).

8. NTT's policy for overcoming the challenges

As I mentioned above, there is much crucial work to be done, such as standardization of a large-capacity interface for routing with optical paths and broad deployment of security technology in networks for Moving Firewalls. There is a limit to what NTT's R&D can do alone (**Fig. 10**). Furthermore, with regard to the storage-centric network, there will be an increasing need to cooperate with other companies

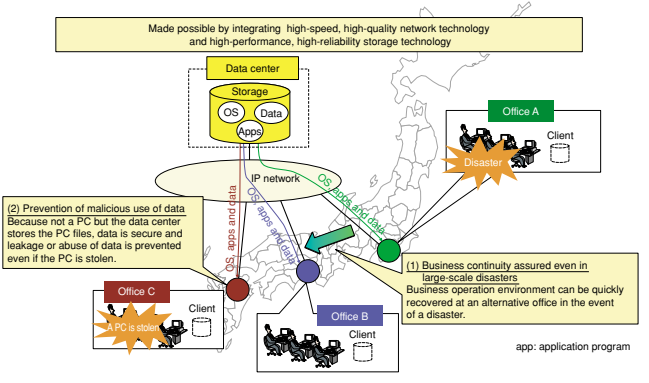

Fig. 9. Storage-centric network.

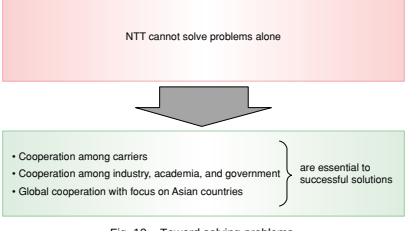

Fig. 10. Toward solving problems.

and partners in order to combine our respective strengths for R&D undertakings.

I further believe that, in order to solve the diverse problems facing us, it is essential to advance cooperation in various arenas and at various levels: between a broad spectrum of providers; between industry and academia; and between Japan and the rest of the world, with special emphasis on China, Korea, and other Asian countries. This policy will guide NTT in pressing toward a broadband-based, ubiquitous society.