Actions to Achieve a New Broadband Society

Norio Wada, President and CEO, NTT

Abstract

In November 2004, the NTT Group formulated its medium-term management strategy, which shows what the group intends to achieve by 2010 and thus points to the specific direction in which the group is heading. This article summarizes the keynote speech entitled "Actions to Achieve a New Broadband Society" given by Norio Wada, NTT President and CEO, at the NTT R&D Forum 2005 held in February 2005.

1. A time of great transition for information communication

1.1 Full-scale deployment of broadband networks in the U.S.A.

The information communication industry is undergoing a tremendous transition worldwide. In March 2004, in the U.S.A., President Bush announced an initiative to provide broadband networks to every home by 2007. Against this background, Verizon disclosed a plan to provide optical access for 3 million households by the end of 2005, while SBC plans to introduce optical access to 18 million homes by 2007. The U.S. government is pushing for evolution towards the next-generation network, which is characterized by the full deployment of IP (Internet protocol) and optical technologies. For example, in June 2003 the Department of Defense announced that it will make all its networks IPv6-based by 2008, and at the beginning of 2004 it set up an IPv6 Transition Office. As the move towards next-generation networks accelerates, the competition in providing broadband services is becoming stronger.

1.2 Convergence of telecommunications and broadcasting

In the U.S.A., while cable TV providers have begun to offer "triple play" services, which bundle telephone, high-speed Internet access, and TV services, telecommunication providers such as Verizon and SBC are considering the full-scale deployment of broadband services.

1.3 Reorganization of the information communication industry in the U.S.A.

As if to symbolize this major transition, SBC announced its purchase of AT&T, closing the curtain on AT&T, which has been the history of telephony itself over a period of 120 years. MCI is also receiving buyout proposals from Qwest and Verizon. Telecommunication providers, which have been strengthened by purchases and mergers, and cable providers are expected to commence a fierce battle with each other in providing attractive services.

1.4 Fixed-mobile convergence (FMC)

There is another type of convergence in progress in the information communication industry: the convergence of fixed and mobile telephony. This convergence is accelerating. Last year saw the establishment of a global body called the Fixed-Mobile Convergence Alliance (FMCA), in which NTT Communications, Korea Telecom, BT in the U.K., and other major global telecommunication providers are collaborating in developing services that will be made possible by FMC. Against this background, the NTT Group has started its onephone Service for corporate customers, which enables a single terminal to function as a cellular phone terminal (NTT DoCoMo's FOMA series terminal), an internal extension phone,

and a wireless LAN terminal.

1.5 Safety and security

There is also considerable renewed attention to the importance of safety and security. For example, the U.S. government is advancing its policy of Critical Infrastructure Protection (CIP). This move started with a Presidential Executive Order, "Critical Infrastructure Protection" (July 1996) during the Clinton Administration, which was followed by the establishment of the Department of Homeland Security (January 2003) in the wake of 9/11, and the announcement of the National Strategy to Secure Cyberspace (February 2003) by the Bush Administration. The U.S.A. sees active efforts by both public and private sectors towards maintaining information security regarding important infrastructures, such as finance, oil, and electricity.

1.6 Activities aimed at reducing the environmental load

Specific efforts at reducing various types of environmental load are expanding. For example, BT released its "Results of a Study to Evaluate the Influence of Information Technology on the Environment" in October 2004. In that report, BT advocates the use of videoconferencing, electronic commerce, and teleworking to reduce the environmental load. Here in Japan, as the Kyoto Protocol took effect in February, the country is placing increasing importance on facing the challenge of reducing emissions of carbon dioxide and other gases.

To summarize the position outlined above, in the midst of the major transition in the information communication industry, we can identify three particularly important key themes for the future: (1) the expansion of broadband networks through the full deployment of IP and optical technologies, (2) the convergence of telecommunications and broadcasting as represented by the offering of "triple play" services, and (3) fixed-mobile convergence. Moreover, we must not forget the need to protect critical infrastructures with regard to safety and security and reduce the environmental load by making the most of information communication technology (**Fig. 1**).

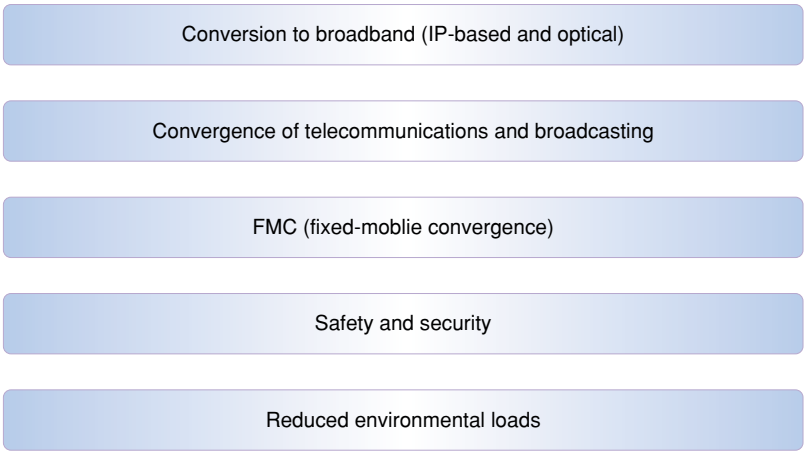


Fig. 1. Key themes for information communication during the transition.

2. NTT Group's medium-term management strategy

In the middle of the major transition described above, and as we contemplate what the NTT Group can do to contribute to the sustained development of Japan's economy and respond to customers' expectations from a medium- to long-term perspective, the group has formulated its medium-term management strategy with specific targets set for the year 2010. We are hoping to receive opinions from many people and see widespread discussion of this strategy.

The important managerial challenge for the future of the NTT Group is to achieve a smooth migration from the legacy of fixed telephony, metallic access, and second-generation mobile telephony, shown at the bottom left of **Fig. 2**, to the future lineup of IP, optical access, and third-generation mobile telephony, shown at the top. We believe that this migration will strengthen the group's competitiveness and financial base, which in turn will provide the driving force for its further development.

The next-generation network that we are aiming at will combine the *flexibility*, *simplicity*, and *economy* of the Internet with the *high quality* and *high reliability* of conventional fixed networks. This combination will provide *service diversity*, *safety*, and *security* and will enable us to apply ourselves fully to reducing costs in order to be able to lower the prices we offer to our customers.

If both metallic and optical access and both the existing fixed telephone and next-generation networks were to coexist, the cost of maintaining dual sets of infrastructure would overwhelm the group's business management, and, by extension, lead to higher costs for users. To avoid this, we plan to completely

convert the fixed telephone network into the next-generation network. The first step in this conversion will be to promote and expand optical access services so that they will be used by about 30 million customers by 2010. We intend to achieve this through a total capital expenditure of 5 trillion yen, which is roughly the same as the amount we would spend if we maintained the current level of annual capital outlay. At the same time, we will reduce the cost of providing the fixed telephony service by 800 billion yen. The second step is to determine, by 2010, the timing and specific ways of implementing the complete conversion, based on the actions and opinions of our customers and related providers in the intervening period.

2.1 Next-generation network

We aim to make the next-generation network IP-based from end to end, in a way that inherits the advantages of both the fixed telephone network and the IP network. It will consist of optical access links, edge nodes that guarantee quality and security, and an optical-wavelength-routed mesh-configuration network (**Fig. 3**). Even if the physical network has a relatively simple layout, the use of optical wavelength division multiplexing (WDM) lets us configure the transmission network in the form of a mesh. We also aim to make the next-generation network a common infrastructure for services based on FMC. Moreover, the expansion of optical access should reduce power consumption. A preliminary calculation reveals that it will reduce the total power consumed by NTT East, NTT West, and NTT Com-

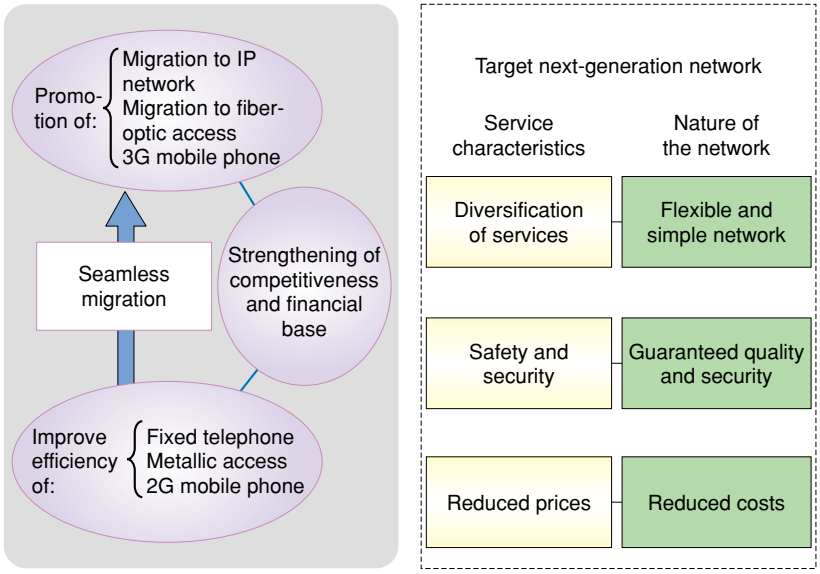


Fig. 2. Goals of NTT's medium-term management strategy.

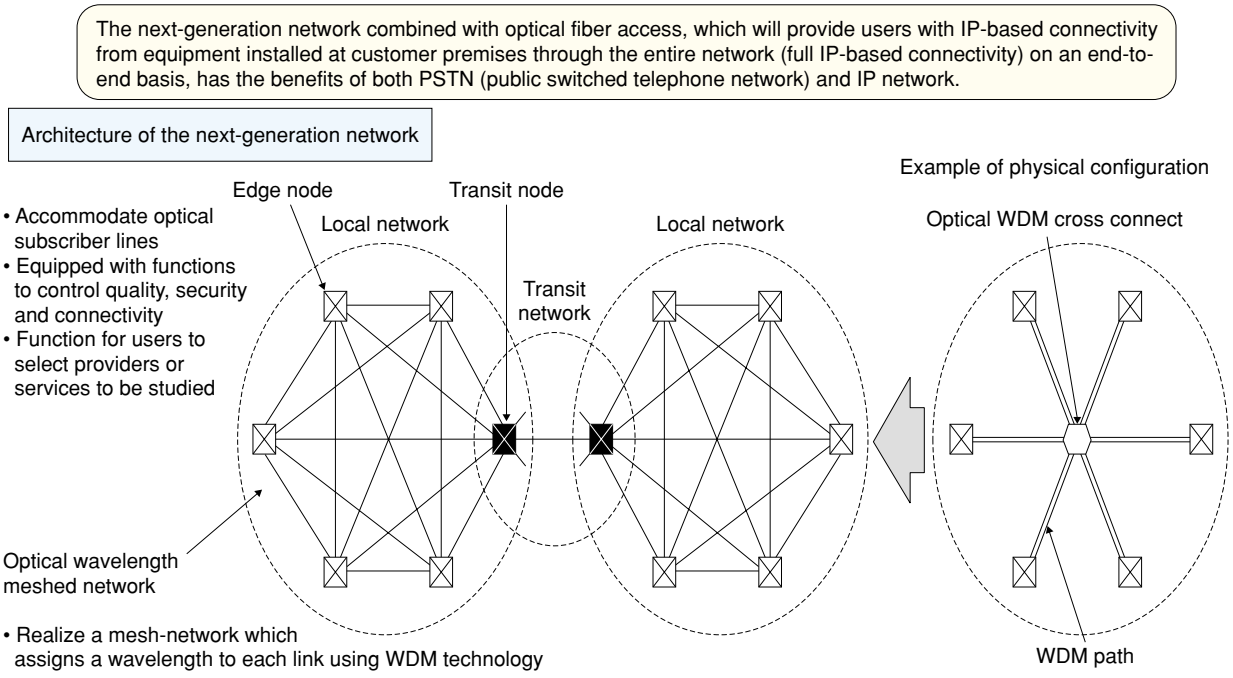


Fig. 3. Construction of a high-quality, flexible, and security-guaranteed next-generation network.

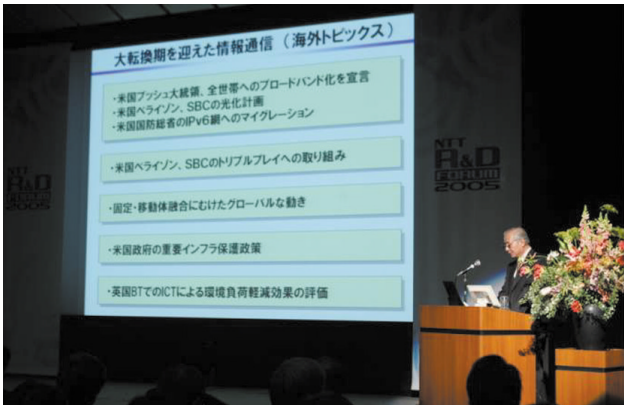
munications by approximately 7%, a reduction that will help NTT' efforts to build networks that generate a lower environmental load.

2.2 Social issues facing Japan

Japan is experiencing a declining birthrate and an aging population. We expect our next-generation network and the resonant communication environment operated on it to make a considerable contribution toward solving the various social problems that Japan will face (**Fig. 4**). For example, the number of elderly people at home in need of nursing care will continue to increase. The next-generation network will let an expert in a nursing care center remotely examine the health of such people using high-definition video. And teleworking, made possible by a video collaboration system, will expand the opportunity for women and senior citizens to continue to work, thereby alleviating the problem of a declining working population.

2.3 Various problems associated with the broadband society

As information communication has become increasingly broadband, with a greater number of people using broadband networks, various problems



have emerged (**Fig. 5**). One of the problems relates to traffic control and management in the face of an increasing traffic volume: specifically, which types of traffic should be given priority, and how should unlawful traffic be restricted? The second problem is how to ensure network security and deal with cyber-terrorism. The third is how to prevent the malicious use of the network, such as unauthorized transactions or the infringement of privacy in the network by *spoofing*, or ill-intentioned rumor mongering. Finally, there is the problem of how to cope with physical damage to the network in the event of an earthquake or other large-scale disaster. The tsunami triggered by the huge earthquake off the island of Sumatra last

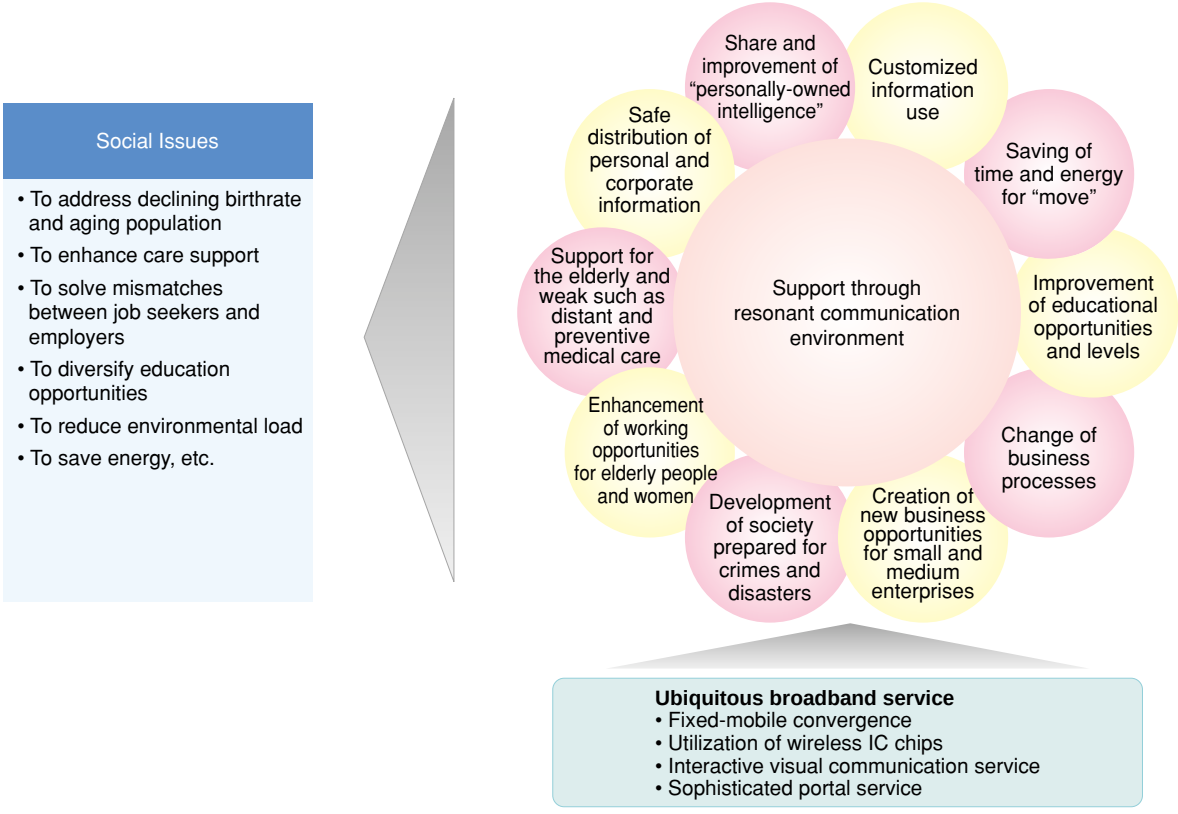


Fig. 4. Expectation towards solving Japan's future social issues.

December caused tremendous damage in Southeast Asia and other countries bordering the ocean. Last year also saw many powerful typhoons strike Japan and an earthquake devastate Niigata. These brought destruction to many parts of Japan and the networks also suffered damage.

Today, the networks, which provide essential support to society, belong to different providers and are interconnected across borders in a complicated manner as a result of the rapid expansion of both the Internet and mobile telephony. In the event of catastrophic damage to these intricately interconnected networks from an major disaster, it is a daunting challenge to restore them. Unless we manage to overcome these problems, even an excellently designed and built next-generation network will lose its shine. The NTT Group is determined to put every effort into solving these problems.

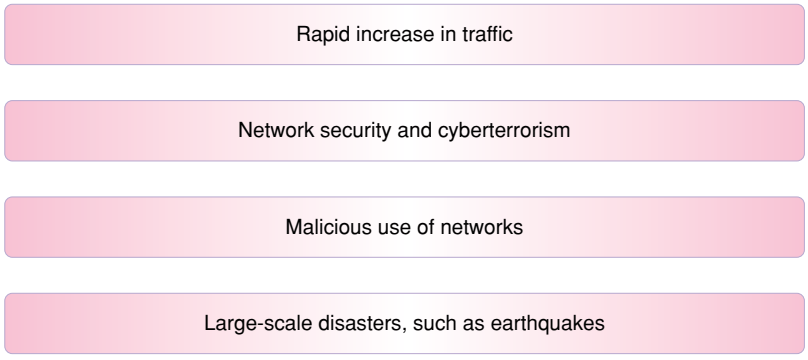


Fig. 5. Issues in the broadband society.

3. Examples of main R&D activities

The above sections have touched on some details of our medium-term management strategy. The following sections describe related R&D activities, specifically ones concerning optical access, the core network, network security, video communication and image processing, and portal technology.

3.1 Optical access

We have developed an improved optical fiber cord, which promises to facilitate the installation of optical fiber in the customer's home or office (**Fig. 6**). Since light, by nature, travels in a straight line, it has been a big technical challenge to get it to go round corners. When a conventional

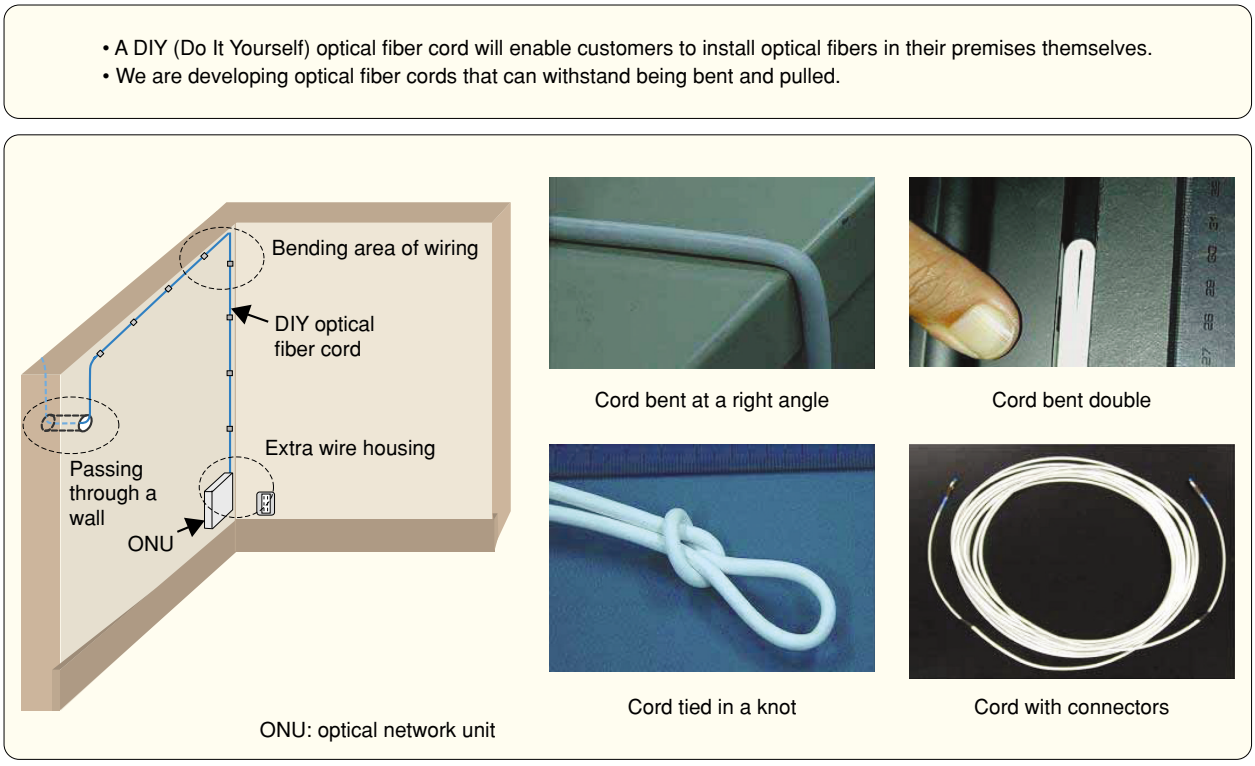


Fig. 6. Development of a DIY optical fiber cord.

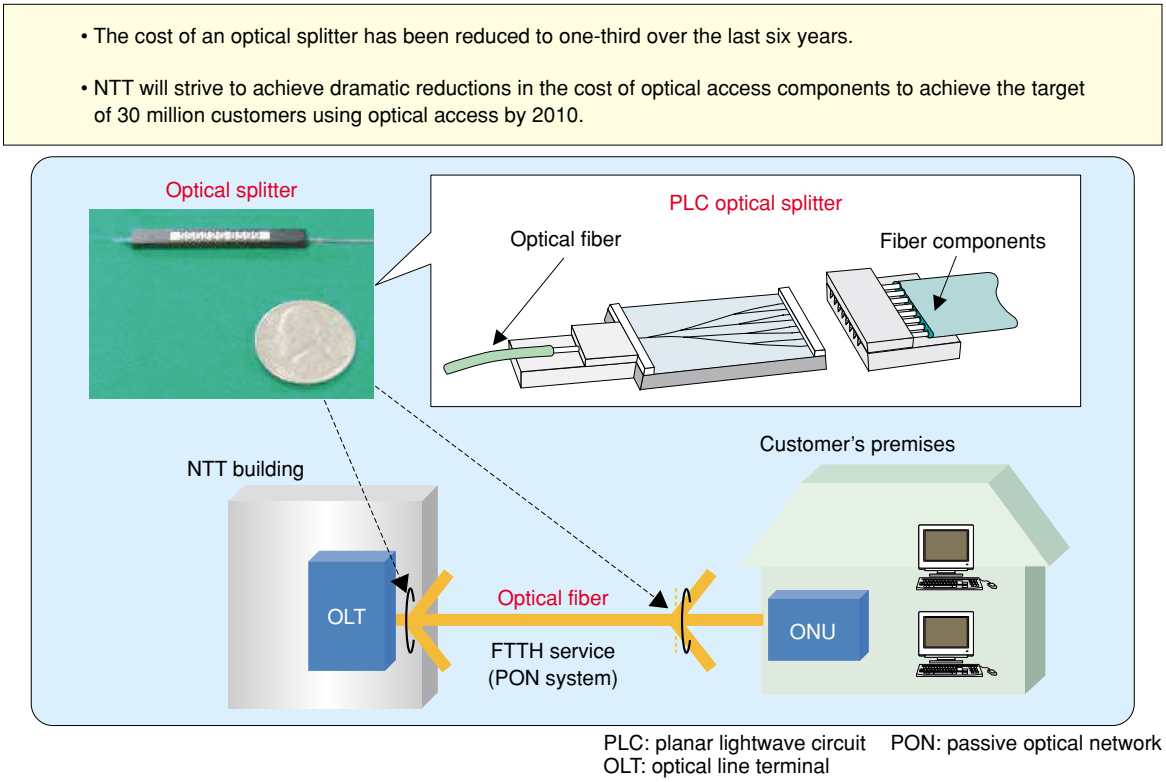


Fig. 7. Cost reduction measures for optical access components.

optical fiber is bent with any significant force, it may break or suffer increased optical loss. NTT has overcome these problems through its R&D and successfully developed an optical fiber cord that can withstand being bent at a right angle, tied in a knot, or pulled with considerable force. It will let customers easily install optical fiber within a building by themselves, which in turn will reduce the time and cost of optical fiber installation and support our efforts to bring optical fiber access to 30 million customers by 2010.

Figure 7 illustrates our R&D on optical components used for optical access. The key to succeeding in having 30 million optical access customers by 2010 is to achieve a dramatic reduction in the costs of the components used for optical access. For example, the cost of an optical splitter, used to enable several users to share a single optical fiber, has been reduced to one-third of its previous level over the last six years. Further cost reductions will require improvements in its mass production through further miniaturization and simplified assembly. We are now focusing on these goals.

3.2 Core network

A conventional switch converts optical signals into electrical signals before it can process packets; this results in a large delay in routing (**Fig. 8**). An optical routing switch does not require such optical-to-electrical conversion, so the delay is small and a large-scale switch can be constructed. We have been undertaking research to increase the reliability and reduce the loss and delay of optical routing switches and have successfully provided prototypes to scientific research institutes. Future efforts concerning optical routing switches, a solution to the rapid rise in traffic, and the need to achieve highly reliable communication will aim at further cost reduction and an increase in switching capacity.

3.3 Network security

One problem with the conventional security systems is that the higher the level of security required, the more complicated the user operations, such as authentication, become (to allow easy access to authorized users, even when they are away from their offices). To solve this problem, we have developed *Secure Enterprise Network Access Control System (SENACS)* (**Fig. 9**). We are currently developing a system that combines security technology with storage-centric network technology. It was introduced at the R&D Forum 2004. The aim is to have the operat-

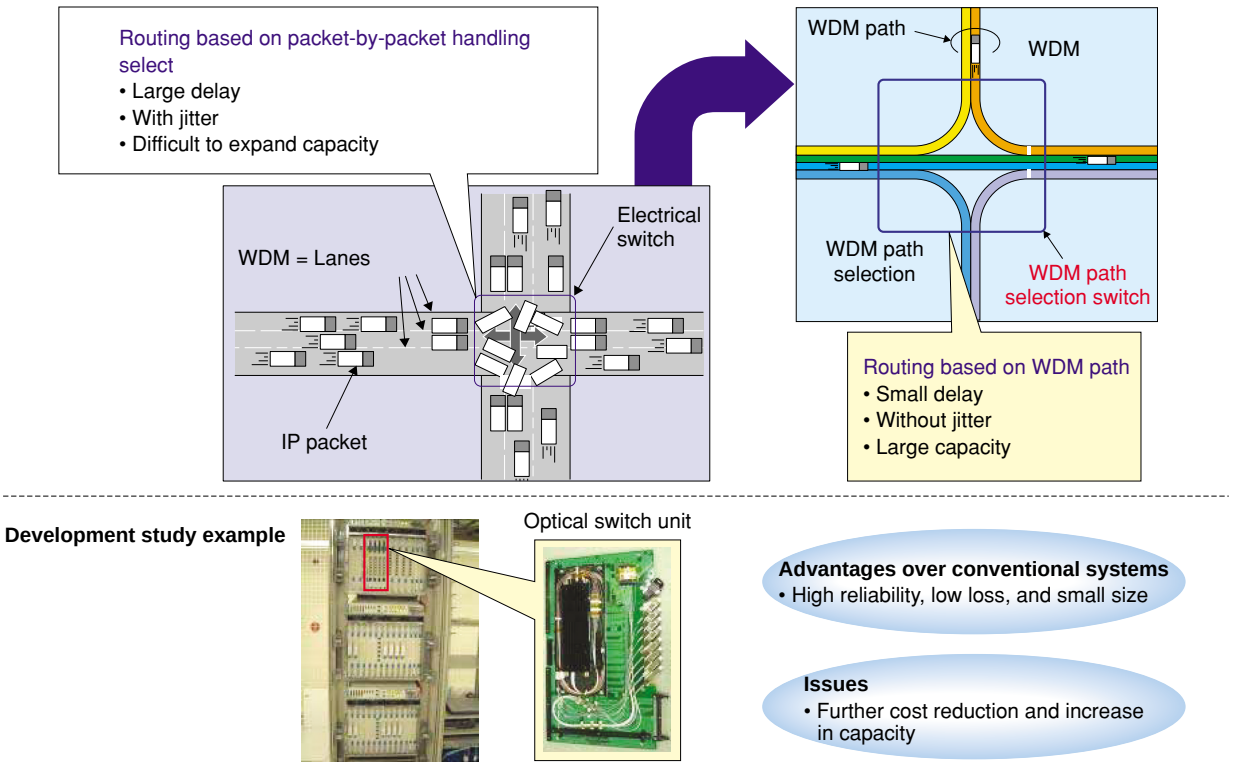


Fig. 8. Optical wavelength routing.

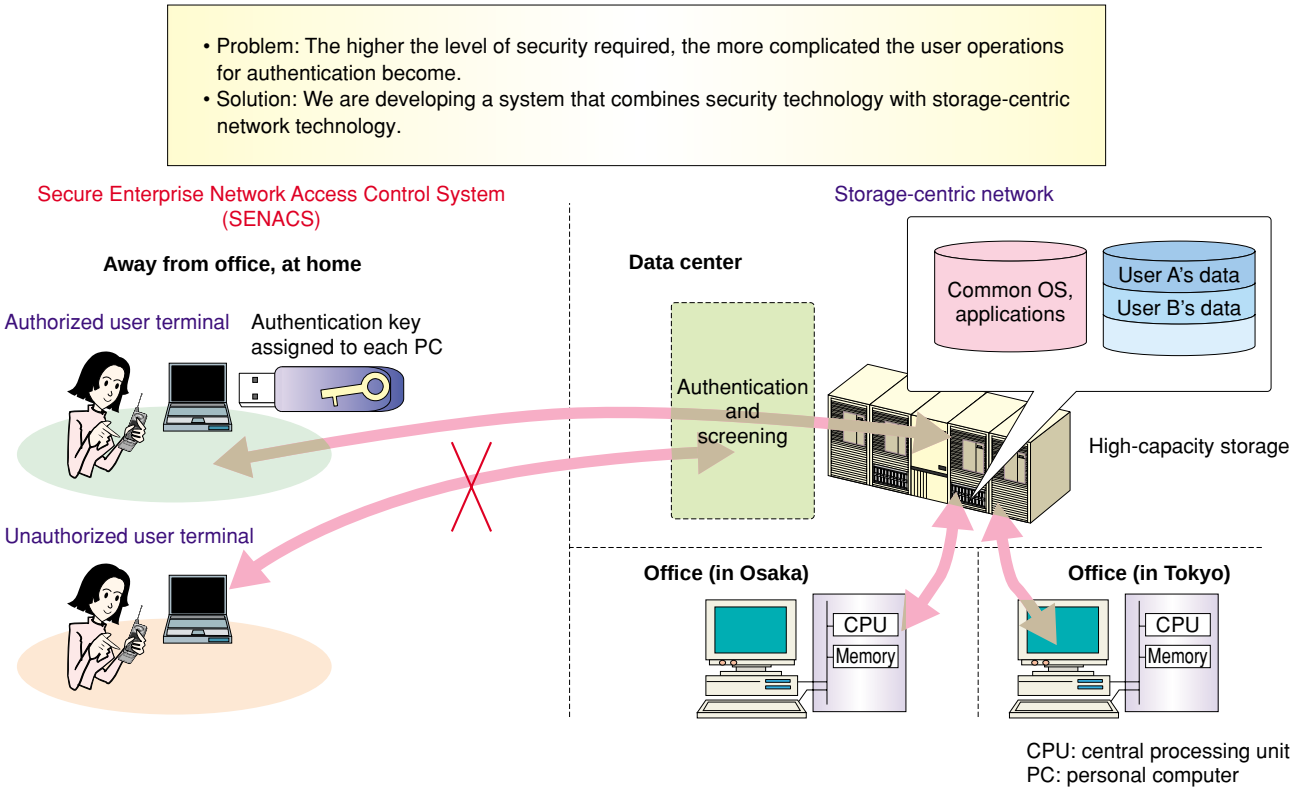


Fig. 9. Enhancement of network security (for corporate users).

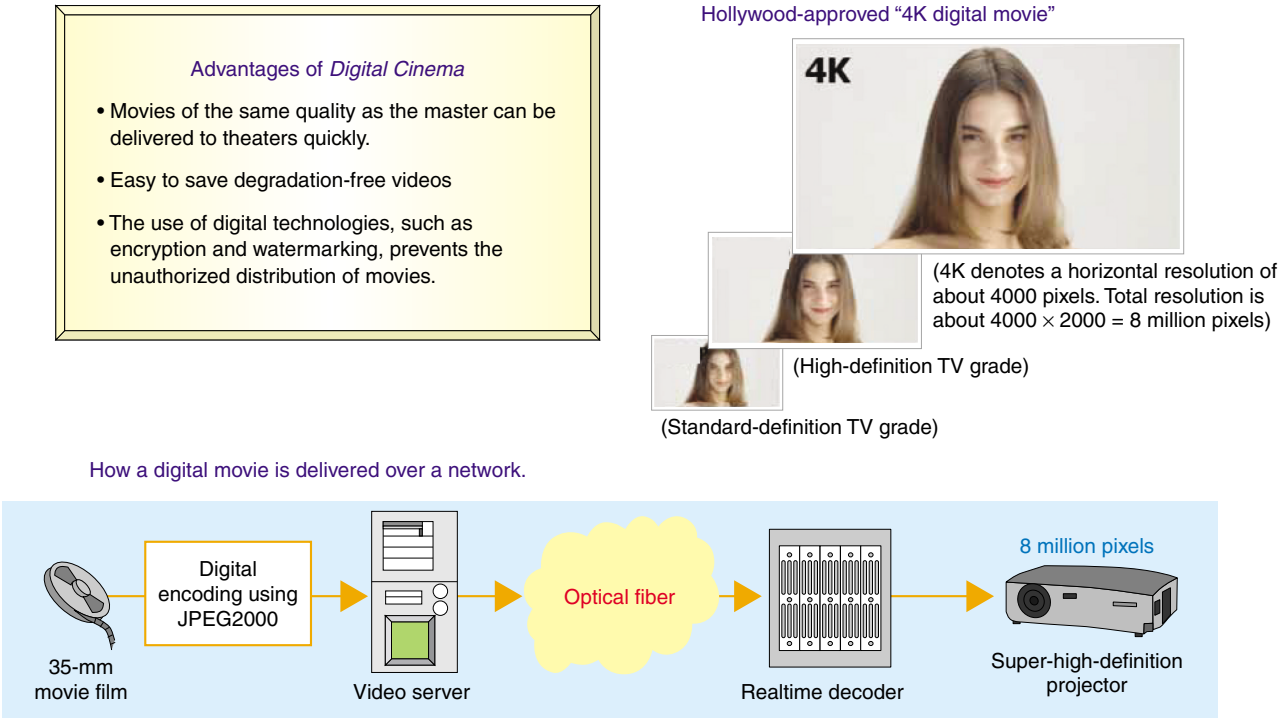


Fig. 10. Delivery of Hollywood-grade 4K digital movies to theaters over optical fiber.

ing system, applications, and data used by terminals held in and managed by a data center. This system will be introduced in the building housing NTT's Holding Company in Otemachi, Tokyo.

3.4 Video communication and image processing

Digital Cinema is a technology that can deliver digital video content to movie theaters over a super-high-speed network, such as an optical network, in a very short time (**Fig. 10**). In today's method of movie distribution, a number of copies are produced from a master reel of film and then distributed. This type of reproduction is prone to video quality degradation. In contrast, in *Digital Cinema*, the video on a master in Hollywood can be distributed directly to individual theaters as digital data, enabling rapid distribution to anywhere in the world with the same quality as the original master. In addition, digital video data can be more easily stored without risk of degradation over time, a serious problem for conventional films. The use of digital technologies, such as encryption and watermarking, can dramatically increase protection against unauthorized reproduction or distribution of movies. NTT has overcome technical difficulties associated with image processing and communication processing of Hollywood-grade high-definition movies. In October 2004, our technology was used at the Tokyo International Movie Festival, where digital movies were played at sites in Tokyo and Osaka to audiences who highly rated the video quality. For this excellent R&D work, NTT had the honor of receiving a technology award from the Digital Media Association on February 3, 2005.

Another key technology is for delivering broadcast videos over optical fibers. In 2004, Opticast, an affiliate of SKY PefecTV!, launched a service for delivering broadcast videos to condominiums in central Tokyo and Osaka via NTT's optical fibers and video delivery technology. **Figure 11** shows the next step: technology that will provide both super-high-speed broadband communication and broadcast video delivery on a single optical fiber extending all the way to the customer premises. We have already completed the technical development. WDM will enable broadband communication and broadcasting video delivery to be provided as completely separate services. We expect such a broadcast-grade video delivery service to overcome the problem of poor reception of terrestrial digital broadcasting experienced in some areas.

Video communication services over optical fibers are beginning to emerge in the market. The following is an example of the application of video communication technology to telemedicine. Japan has a short-

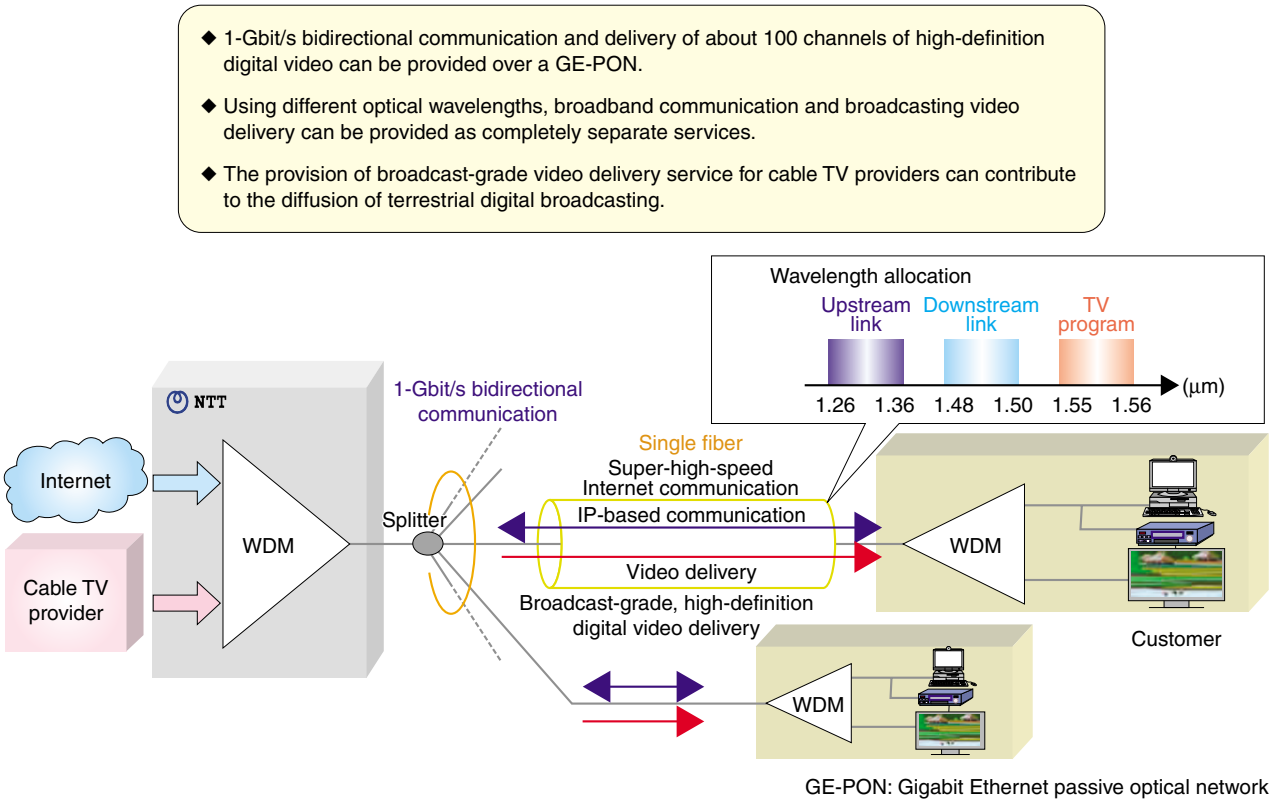


Fig. 11. Use of optical fibers for simultaneous broadband communication and broadcast program delivery.

age of pathologists, experts in diagnosing the presence of cancer cells, etc., who account for only 0.7% of all medical doctors in the country. Consequently, such experts can be found only in hospitals in big cities. So, specimens of suspect tissue cells are usually sent by post to a pathologist in a metropolitan city for examination, which results in diagnosis taking a long time. As a solution, some bigger hospitals are using expensive remote diagnosis systems relying on still images. However, the information from still images is too limited for a thorough diagnosis and even such a system still requires a considerable time for data transmission. Since November 2004, the NTT Group, in cooperation with Iwate Medical University, has been conducting a trial of a simple and low-cost remote pathological diagnosis system, which combines NTT's general optical access service B-FLET'S, a high-quality but low-cost video communication service called WarpVision, ordinary personal computers, and microscopes (**Fig. 12**). This has dramatically reduced the response time to about one-tenth of the time needed with the conventional system. In addition, the doctors involved rated the operability and practicality of the system highly because it allows them to manipulate and view the high-quality video from the microscope just as if they were handling the microscope directly. The big cost reductions that have been achieved make this system affordable for many medical institutions now.

3.5 Portal technology

A portal technology, called MultiMedia Meister, was announced to the press on February 23, 2005 (**Fig. 13**). Conventional image searching relies on text-based searching, using, for example, image titles and title context. With such a method, it takes a lot of time and effort to find a desired image if the database contains a large number of diverse images. In contrast, MultiMedia Meister uses images themselves as search keys. Therefore, it is possible to narrow down the number of candidates by looking for similar images. This is much more intuitive than conventional text-only searching. As broadband services become widespread, more and more items of video content will be distributed. MultiMedia Meister will be a great aid by enabling rapid searching for desired items of content. It is currently available in prototype form on NTT's portal Website "goo", where anyone can try it out.

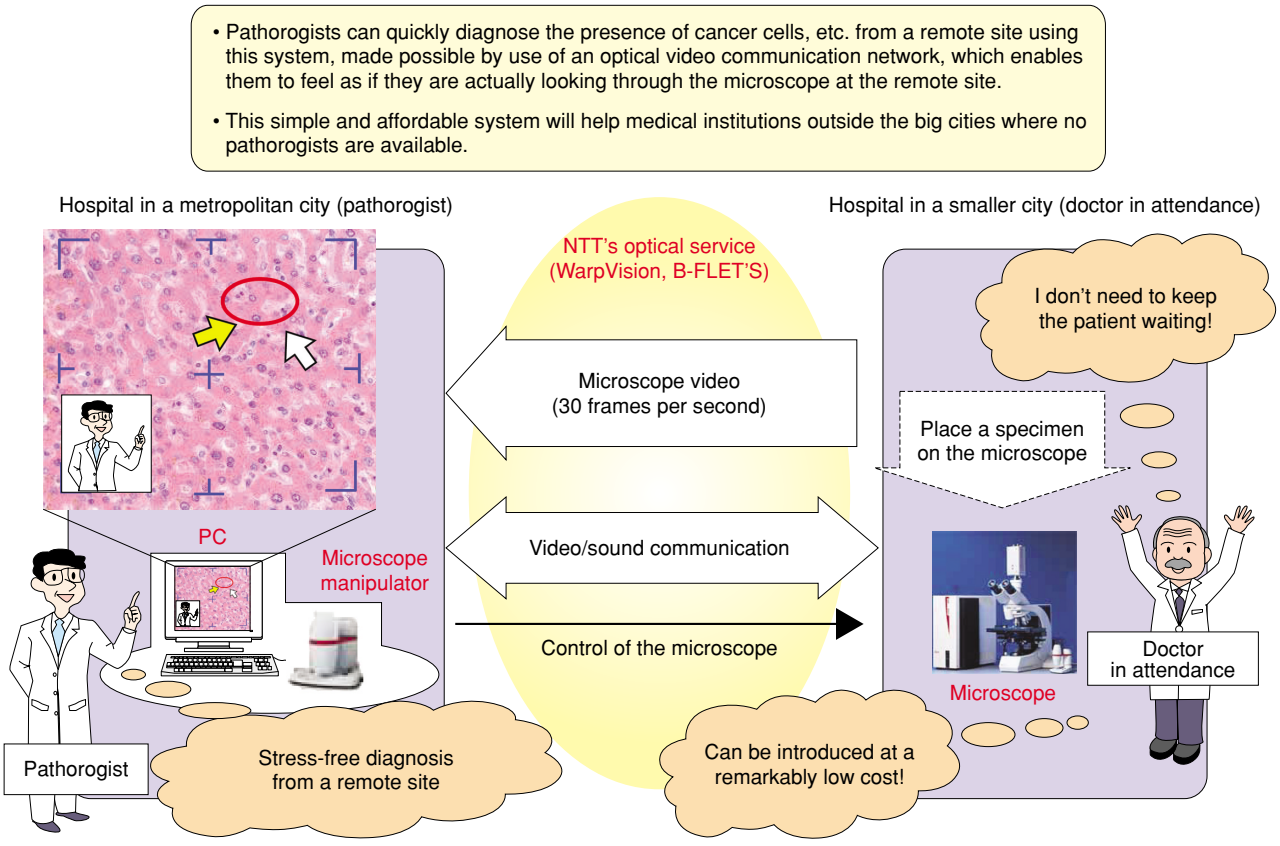


Fig. 12. Field trial of remote pathological diagnosis using a realtime video sent over a video communication network.

4. Pursuing solutions to challenging issues

Before a broadband and ubiquitous communication society can become a reality, there are various challenging barriers that must be overcome. The NTT Group cannot overcome them all by itself. We will tackle them one by one in cooperation with various providers, vendors, national and local governments, universities, and users, in line with our commitment to provide more and more useful services.

Fig. 13. New multimedia searching technology: MultiMedia Meister.