

## NTT Aims for a Ubiquitous Broadband Society

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### Abstract

In November of last year, more than 20 years after converting from a public to a private company, NTT announced an action plan for the entire NTT Group embodying its Medium-term Management Strategy toward the creation of a ubiquitous broadband society. This article is based on an address given by Norio Wada, President and CEO of NTT, at the NTT Group Communication EXPO held in 2005 from December 20 to 22.



### 1. Transitions in telecommunications

The history of telecommunications in Japan began with telegram services in 1869. This was followed by steady expansion with telephone calls eventually replacing telegrams as the dominant service (**Fig. 1**). In just the last 10 years, however, this expansion has begun to accelerate due to the appearance of the Internet and the cellular phone. In the midst of market upheavals like this one, NTT has had to face three major transitions in its history. The first was the liberalization of the telecommunications industry in Japan and the privatization of NTT itself in 1985. More than 20 years have passed since that memorable year. The second was the reorganization of the company in 1999 that placed NTT's fixed-line communication business under a holding company while allowing NTT to enter the international communications market. At that time, fixed-line telephony was still the dominant means of communication, but today, telecommunications is diversifying as mobile and Internet services and other means of communication continue to expand, creating rapid changes in the market. In other words, information-communications

is entering a period of great change, which is creating the third major transition. This period can be characterized by three major movements as follows.

- (1) Expansion of broadband communications in the form of optical services in the fixed-line system and the spread of 3rd-generation cellular phones such as FOMA handsets in the mobile system
- (2) Convergence of services, convergence of fixed

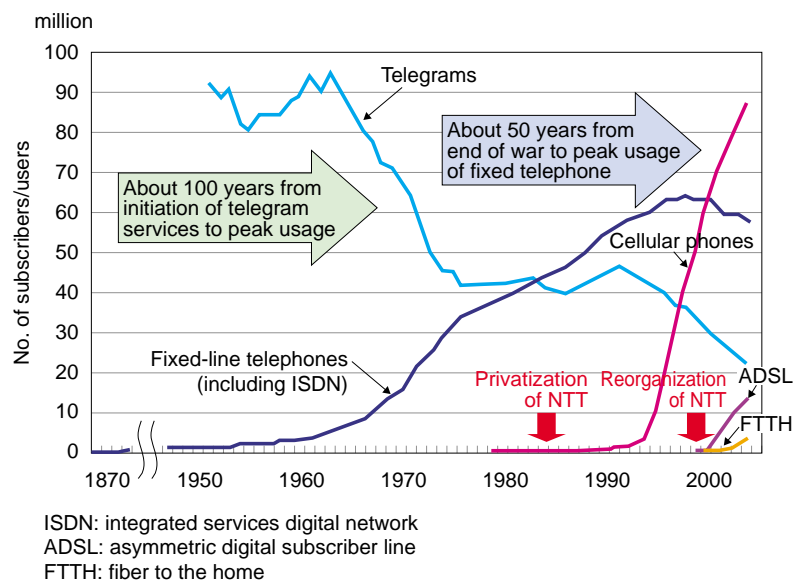


Fig. 1. Transitions in telecommunications.

and mobile communications, and convergence of communications and broadcasting through technical innovations

- (3) Expansion of new Internet business formats such as blogs (Web logs), social networking sites (SNSs) originating from blogs, and affiliate-marketing sites

To accommodate this conversion to broadband and IP (Internet protocol) systems, telecommunication operators both inside and outside Japan are making radical changes to their business structure through mergers and acquisitions and other means. This is a transition of global proportion.

If we examine the telecommunications infrastructure, we can see that the conversion to IP and broadband systems is moving forward around the world. In the USA, the obligation on local carriers to open up optical fiber has been abolished, and in return, telephone companies are announcing plans for optical deployment one after another. There is also a plan in the USA for the federal government to adopt IPv6 as the core of its Next Generation Network (NGN) by 2008. China, as well, is working on implementing the IPv6 standard by the Beijing 2008 Olympic Games. It appears that 2008 will become a milestone for information-communications. And in Korea, the deployment of mobile WiMAX (WiBro) as a new mobile broadband standard is scheduled for this spring.

In addition to these trends in the telecommunications infrastructure, the move toward advanced and sophisticated services and achieving convergence among them is quite active. A lot of effort is being devoted to providing “quatro-play” services (the bundling of voice, video, Internet-connection, and mobile-communication services) that will enable a user to receive and exchange video at any time and from any location using the Internet, IP telephony, television, and a cellular phone. Development work in this regard is taking place not only in Japan but also in the USA and Europe, so there is much competition in this area.

Tie-ups between major media companies and computer/Internet enterprises are also accelerating. In the USA, Apple Computer has teamed up with ABC to deliver television shows for a fee, and as you know, Apple has been successful at integrating

hardware, software, and services through its iPod player and iTunes music store.

The Internet advertising market is booming as well—they say it is fast approaching the scale of magazine advertising! In this area, Google is in the lead, and their business model of offering a variety of free services while generating most of their revenue from Web advertising has become mainstream. Microsoft too provides some software and services at no charge via the Internet with the aim of converting to a new profit model based on Web advertising and subscription fees.

## 2. Role of ICT and targets

Here, I would like to discuss the role of information and communication technology (ICT) and associated issues. The role of ICT is not only to solve technical problems associated with production and distribution, but also to improve the quality of life and create business opportunities. Some of the many issues that ICT is expected to help with are illustrated in Fig. 2. These include dealing with the aging society and health care, making efficient use of energy resources, solving environmental problems, and improving productivity.

At the same time, the influence and importance of Internet companies in society has grown. As a result, cyber terrorism poses a great threat, but incidents of network abuse are on the rise. There is also the problem of how to deal with physical damage to the network caused by large-scale disasters such as earthquakes, storms, and floods.

On the government level, policies like the IT New

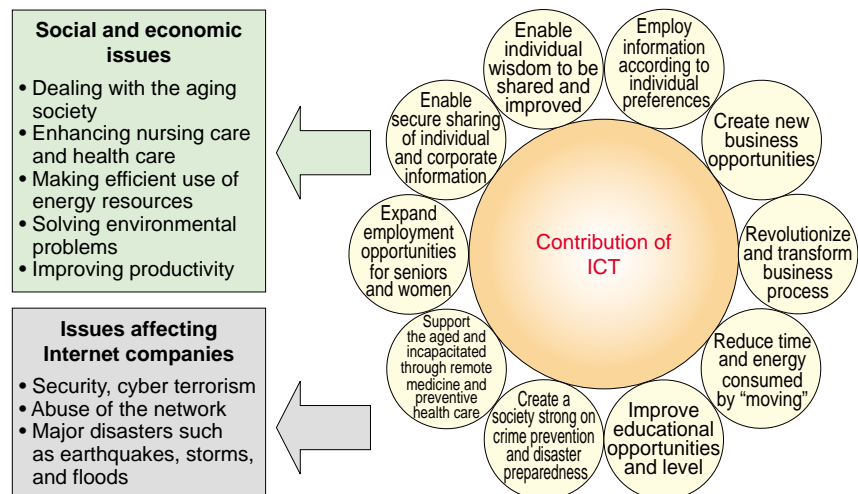


Fig. 2. Role of ICT and issues.

Reform Strategy and the u-Japan initiative are being established with the aim of using ICT to solve social problems. NTT also recognizes the importance of using ICT to the fullest to help solve these problems especially through a broadband and ubiquitous infrastructure.

### 3. Promoting NTT's Medium-term Management Strategy

NTT's Medium-term Management Strategy considers what contributions the company can make in the face of market changes and the social issues that I just described [1]. This strategy has come to be embodied by the slogan "Onwards to the Future". In short, it is NTT's desire to help achieve a society with broadband and ubiquitous services, build a rich communication environment for both individuals and communities, make business activities more efficient, and create new business opportunities. To this end, NTT will set out to construct an open network environment to enable various players to use the NGN and provide diverse services while the NTT Group works to form positive alliances with key enterprises. The following describes specific measures that we are undertaking in promotion of the Medium-term Management Strategy.

#### 3.1 Roadmap for constructing the NGN

If the Internet is known for "flexibility and simplicity" and the fixed-line network for "high quality and high reliability," the NGN is a "safe, secure, and convenient" network that incorporates the best of these two worlds (Fig. 3). It will have a layered-structure model to accommodate technical innovations and advanced and diverse services, and its service control functions will conform to standards established by the International Telecommunication Union (ITU). The roadmap for constructing the NGN is divided into three main steps (Fig. 4). Step 1: Begin field trials in the

second half of fiscal 2006 and start construction of the NGN relay network

Step 2: Deploy edge nodes and service control functions in the second half of fiscal 2007 and begin genuine provision of NGN services.

Step 3: Achieve seamless interconnection with the mobile network.

A matter of great importance in constructing the NGN is to take an "open door" approach. The NGN will be an open network that provides mutual interconnection with other telecommunication carriers and Internet service providers (ISPs) and that ensures secure communications. In accordance with this policy, information-appliance manufacturers and application service providers (ASPs) will be asked to participate in upcoming field trials, and the interfaces to other carriers and ISPs will be disclosed.

#### 3.2 Expansion of broadband and ubiquitous services

NTT will develop and provide diverse broadband and ubiquitous services as a base for the NGN (Fig.

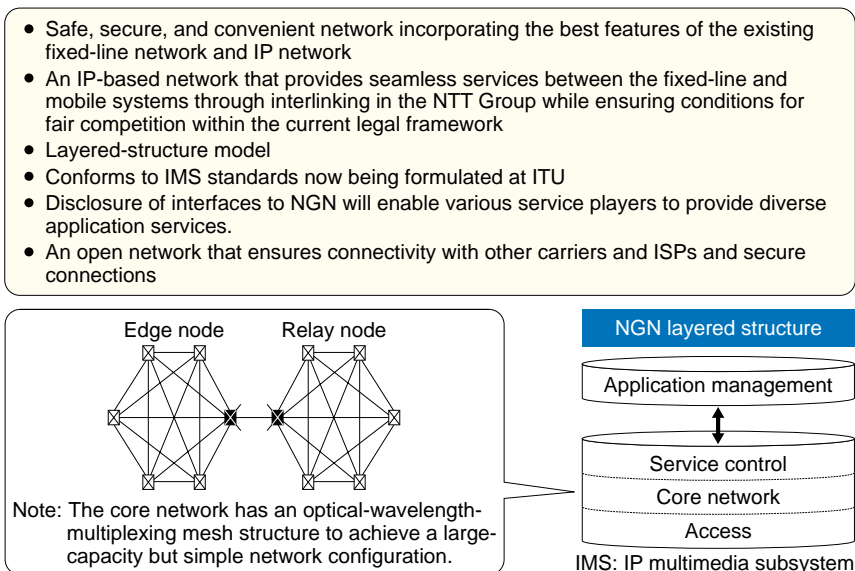


Fig. 3. Basic concept of NGN.

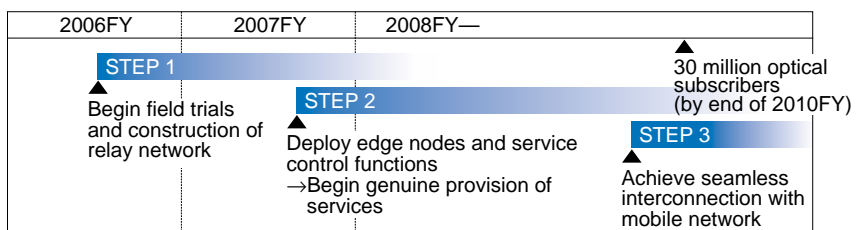


Fig. 4. Roadmap to NGN.

5). Here, special attention will be given to promoting fixed-mobile convergence (FMC) and communications-broadcasting convergence and to supporting international business expansion. As I explained earlier, the convergence of services can be expected to accelerate as the transition to IP continues. In particular, the demand for FMC, that is, for services that combine fixed and mobile systems, is expected to rise significantly.

NTT is already offering a “One Phone” service for corporate users that enables a single handset to be used for both FOMA mobile and IP telephony services, as well as a video communication service that provides a videophone connection between FOMA and an optical-fiber-based telephone. From here on, we will strengthen our total solutions for linking fixed and mobile services and expand our One Phone service to general users.

We will also promote the convergence of communications and broadcasting. Such a convergence, however, is not without its problems. These include dealing with copyright issues and developing a cooperative relationship with the broadcasting industry. But we expect these problems to be solvable in due course provided that there is customer demand for such combined services and technical solutions can be found. We feel that it is important to add new value and to “expand the pie” by creating good opportunities for both the communications and broadcasting sides.

At present, NTT is working with broadcasting companies to expand multi-channel broadcasting over optical fiber and services related to handset-targeted “one-segment” broadcasts (using one of the 13 segments making up the bandwidth designated for terrestrial digital broadcasting in Japan) that are scheduled to commence this year.

- Network services
  - Provide high-functionality and high-reliability optical services
  - Provide high-speed and high-functionality mobile services and multi-function terminals
  - Promote FMC
- Provide extensive upper-layer services (Internet connections, portals, etc.)
- Provide extensive corporate services
- Promote convergence between communications and broadcasting
- Facilitate international business expansion
- Provide one-stop service
- Work to achieve a safe and secure society in line with the IT New Reform Strategy and the u-Japan initiative

Fig. 5. Expansion of broadband and ubiquitous services.



In addition, the IP-resending of digital terrestrial broadcasts that is now being promoted at the government level will help to increase the value of the NTT Group optical infrastructure, and we are actively participating in related surveys and research being conducted by the Ministry of Internal Affairs and Communications (MIC).

Finally, to expand international business, NTT wants to increase synergy among NTT Group companies and enhance ties with equipment manufacturers to create new business opportunities overseas and to contribute to internal standardization activities. We are focusing our attention on the Asian market including, of course, China and India. In December of last year, for example, NTT DoCoMo announced that it would purchase a stake in KT Freetel (KFT), a Korean mobile-communications operator. Such a move is also in line with NTT Group strategy.

#### 4. R&D achievements

Here, I would like to mention two R&D results related to the NGN that I consider to be important to NTT’s future.

##### 4.1 Free-bending optical fiber cord

The first is a free-bending optical fiber cord (**Fig. 6**). NTT has developed an optical fiber cord that can be bent at right angles, folded back on itself, or tied in a knot. We began deploying this cord for our customers early this year. The free-bending optical fiber cord is so easy to use that even ordinary users can set up optical cabling in their homes. This development will not only speed up optical-fiber installation but will also bring down installation costs.

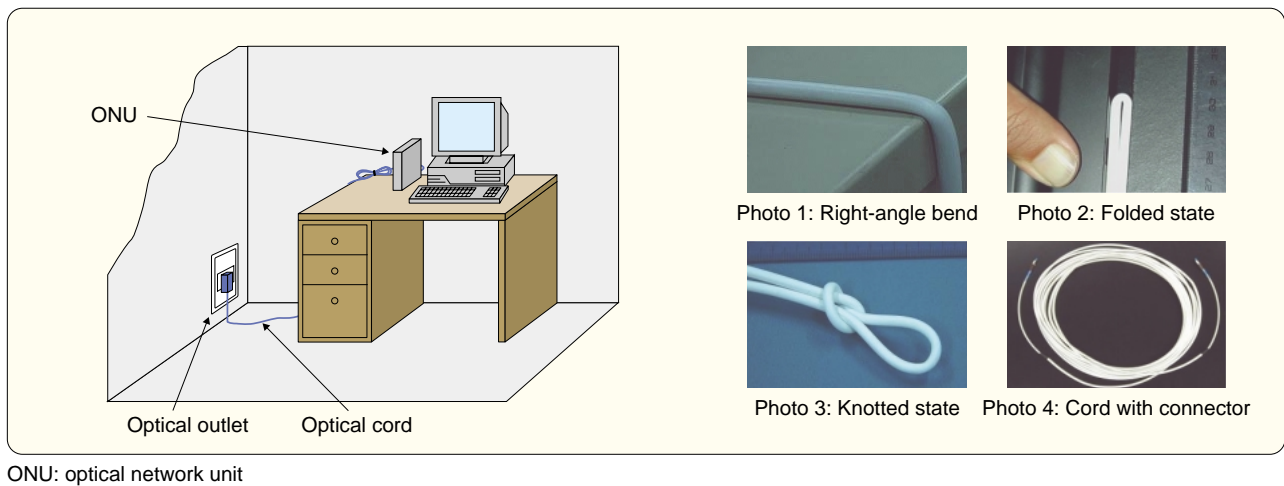


Fig. 6. Free-bending optical fiber cord.

#### 4.2 Path selection by optical wavelength

Next, in relation to the core network, NTT has developed a system in which transmission paths are selected using optical wavelengths [2]. With conventional switches, packet information must be converted from an optical signal to an electrical signal in order to be read, which creates delays and other problems. However, switches based on a path selection controlled by optical wavelengths eliminate the need for this conversion, which prevents delays and facilitates the construction of large-capacity systems. NTT Laboratories is now developing this system and is already providing prototype equipment to academic research institutions and the like.

### 5. Application examples

Now, I would like to mention two applications that I think are especially promising in terms of helping to solve various social and economic problems.

#### 5.1 Remote pathological diagnosis system

I'll start with an application that makes use of ICT in the field of medical treatment. In Japan, pathologists who diagnose the presence of cancer cells are concentrated in large metropolitan areas. Consequently, when patients living in regional areas want an expert opinion on suspect tissue samples, the samples are usually sent by mail to a pathologist in a big city, so the results are delayed even longer. The NTT Group has been conducting trials of a remote pathological diagnosis system in collaboration with a regional medical university, and the use of this system has actually begun at a medical-treatment site

[2]. This is a high-quality, low-cost video communication system that combines a general optical access line, commercial personal computers, and microscopes. With this system, regional areas can receive quick and low-cost pathological diagnosis equivalent to that in large metropolitan areas.

#### 5.2 Digital map virtual factory

Next, I would like to introduce an application using such a bidirectional video communication service that provides a new employment opportunity for people that for various reasons cannot commute to a job. **Figure 7** illustrates the concept behind the "digital map virtual factory," which uses a broadband network to enable digital maps managed by the NTT Group to be created and edited at home [3]. In this system, a supervisor in a digital map center interacts with people working at home over an online connection. A videoconferencing system with a shared-screen function enables both parties to see the other person's face and to work closely as a team. At present, a staff of 220 people including individuals caring for children and those who are physically challenged are employed in this virtual factory. From a corporate point of view, a virtual factory like this one can create new business opportunities and even revolutionize the business process. A huge potential work force can be tapped by creating employment opportunities in a telecommuting style not only for the physically challenged and senior citizens but also for child-rearing and care-giving individuals and other people who cannot commute to work.

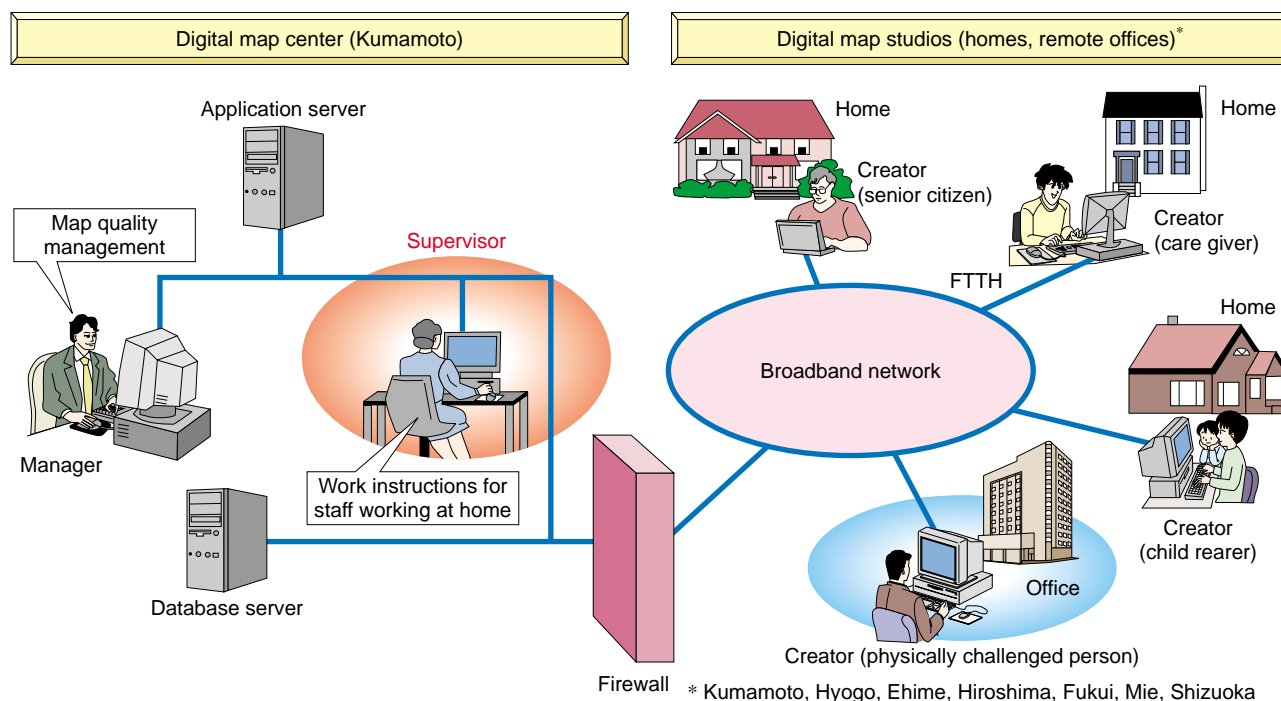


Fig. 7. Digital map virtual factory.

## 6. Technological developments supporting new applications

Having presented some application services, I would now like to mention some technological developments that provide a foundation for new applications.

### 6.1 Digital cinema

As I mentioned last year, there is a trend in the movie industry to replace the traditional movie presentation system based on analog film with a “digital cinema” scheme that will deliver high-quality digital video using advanced compression technology [2], [4] (Fig. 8). In October, NTT digital-cinema technology was used in a trial that delivered digital-video content from the Hollywood studios of Warner Bros. to theaters in Roppongi, Odaiba, and Osaka over an optical fiber network. This was the first attempt in the world at delivering ultrahigh-definition 4K\* (8-megapixel) video to commercial theaters. This feat was repeated in November with the delivery of a Harry Potter film in this format. These efforts at digital cinema will no doubt bring major changes to the

way that movies are transported, delivered, and presented in the movie industry. There is much anticipation that digital cinema will create new business opportunities.

### 6.2 Cralinet

Next, I’d like to mention a technology that deals with speech, the basis of human communication. The NTT Group has developed software for adjusting the speed of speech without altering its pitch as well as technology for creating synthesized speech with a level of quality equivalent to that of natural voices. Compared with existing speech synthesis technology, this technology—called Cralinet—makes use of a large-scale speech database to achieve not only high-quality speech but also highly accurate readings and accents even for Japanese surnames (which are renowned for their diverse and sometimes unintuitive readings) and imported words written in Roman letters (Fig. 9). Systems based on Cralinet have already been deployed at a number of call centers in Japan. We expect the combination of automatic speech with operator-based customer support to improve work processes and customer service at call centers and lead to all sorts of business processes being revolutionized.

\* 4K: Denotes the number of horizontal pixels in the 8-megapixel video standard consisting of 4000 horizontal  $\times$  2000 vertical pixels; this is about 4 times the definition of ordinary HDTV.

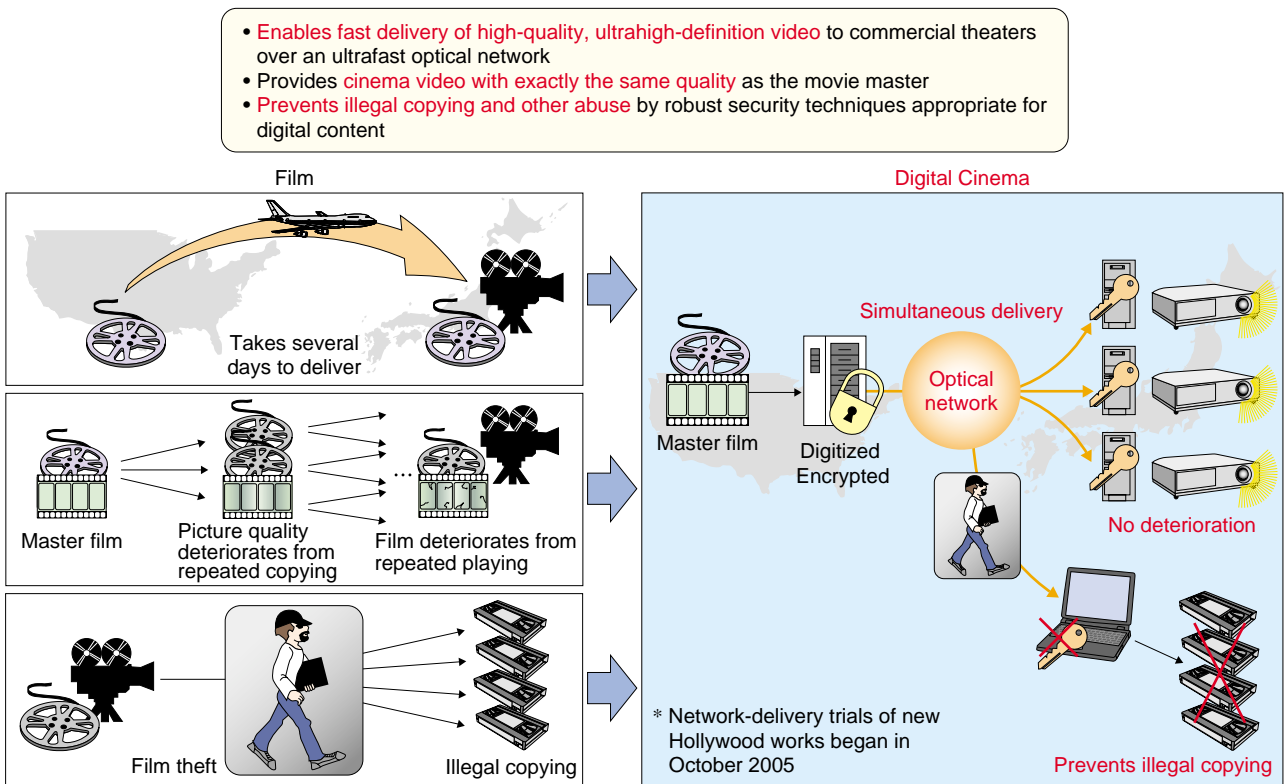


Fig. 8. Hollywood-approved high-quality/ultrahigh-definition 4K digital cinema.

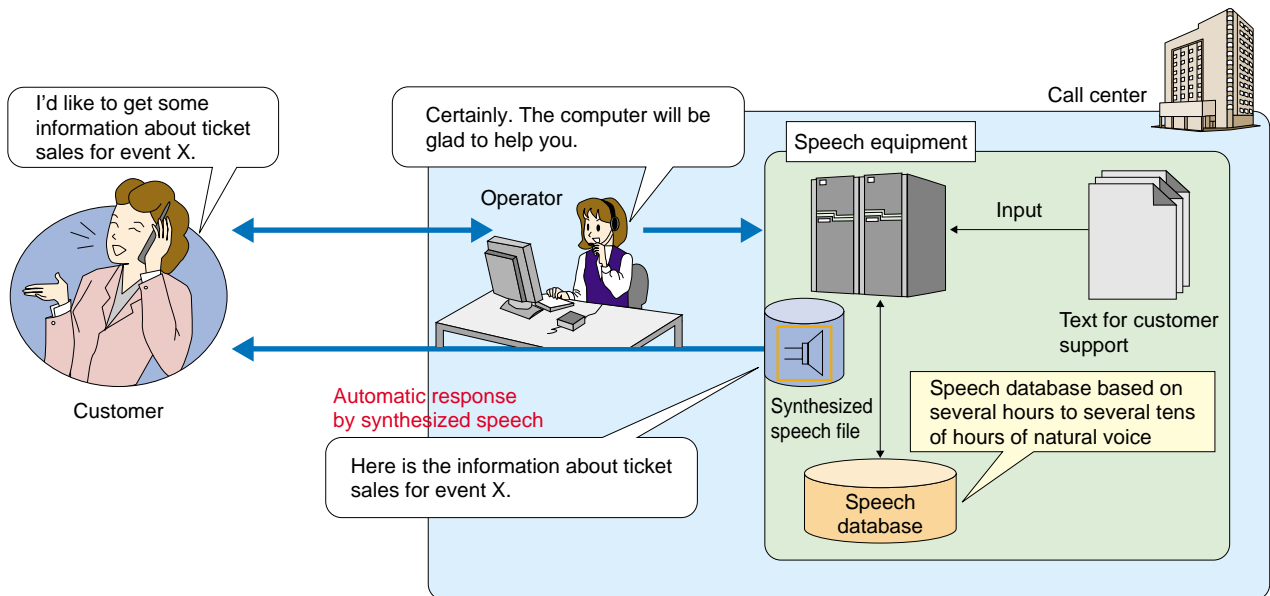


Fig. 9. Cralinet: Speech synthesis technology achieving the same quality as natural voices.

### 6.3 RedTacton

Finally, I would like to mention a promising communication technology called RedTacton that treats the surface of the human body as a data transmission

path (Fig. 10). Instead of using radio or light waves or electric current to communicate, it generates a region on the surface of a human body in which a very weak electrical effect (i.e., an electric field) occurs that can

- Communication technology using **electric fields generated on the surface of the human body**
- If part of the human body touches a RedTacton transceiver, a transmission path forms between the terminals enabling communication to be performed.
- Natural actions like touching, holding, sitting, walking, and stepping become a trigger for opening doors, starting up devices, accessing information, etc.

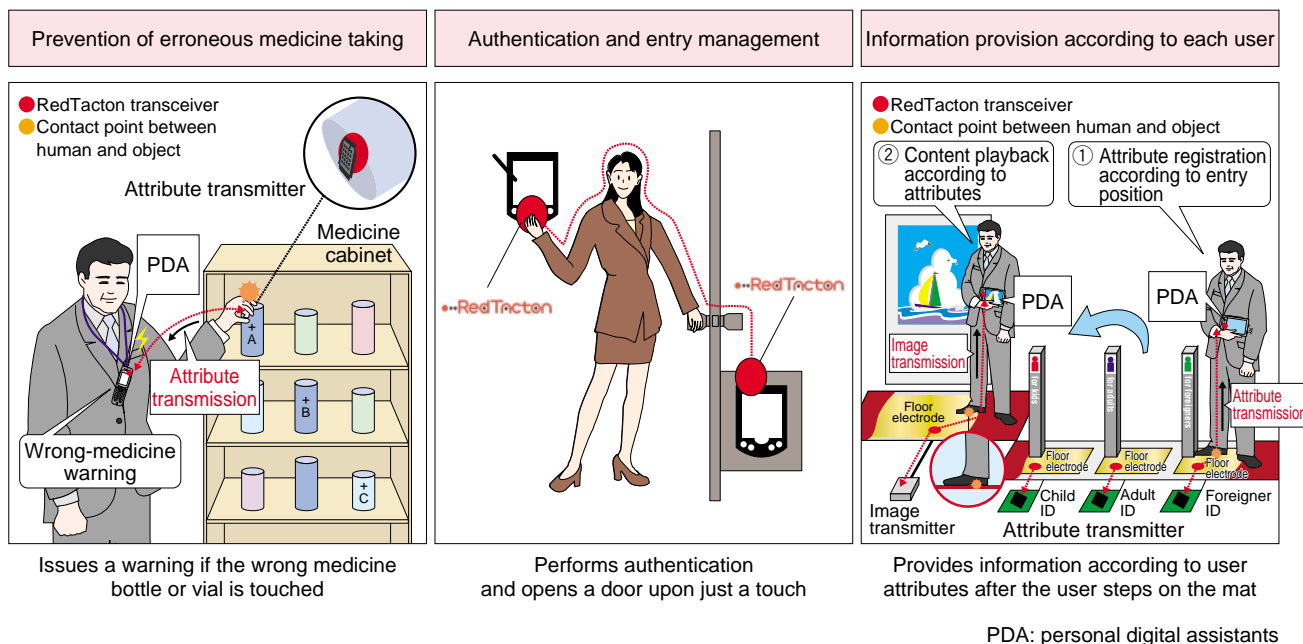


Fig. 10. RedTacton: New communication technology using the surface of the human body as a data transmission path.

be used as a communication path. A person having a RedTacton transceiver on his body need only touch something else with a transceiver installed to have a signal pass through his body and be read by a sensor, that is, to establish communication. This is seen as a promising technology for the upcoming era of ubiquitous services. RedTacton will benefit the aging society by preventing persons under medication from taking the wrong medicine. It can also be used for personal authentication and entry management as well as crime prevention.

### Toward effective solutions

Various problems must be solved and barriers overcome to achieve a true ubiquitous broadband society. NTT will capitalize on its group abilities to meet these issues head on, but we also realize that success in this endeavor is only possible by working together

with all concerned. The NTT Group will continue in its efforts to provide safe and secure services to fulfill its role of an innovative enterprise that everyone can rely on at all times.

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