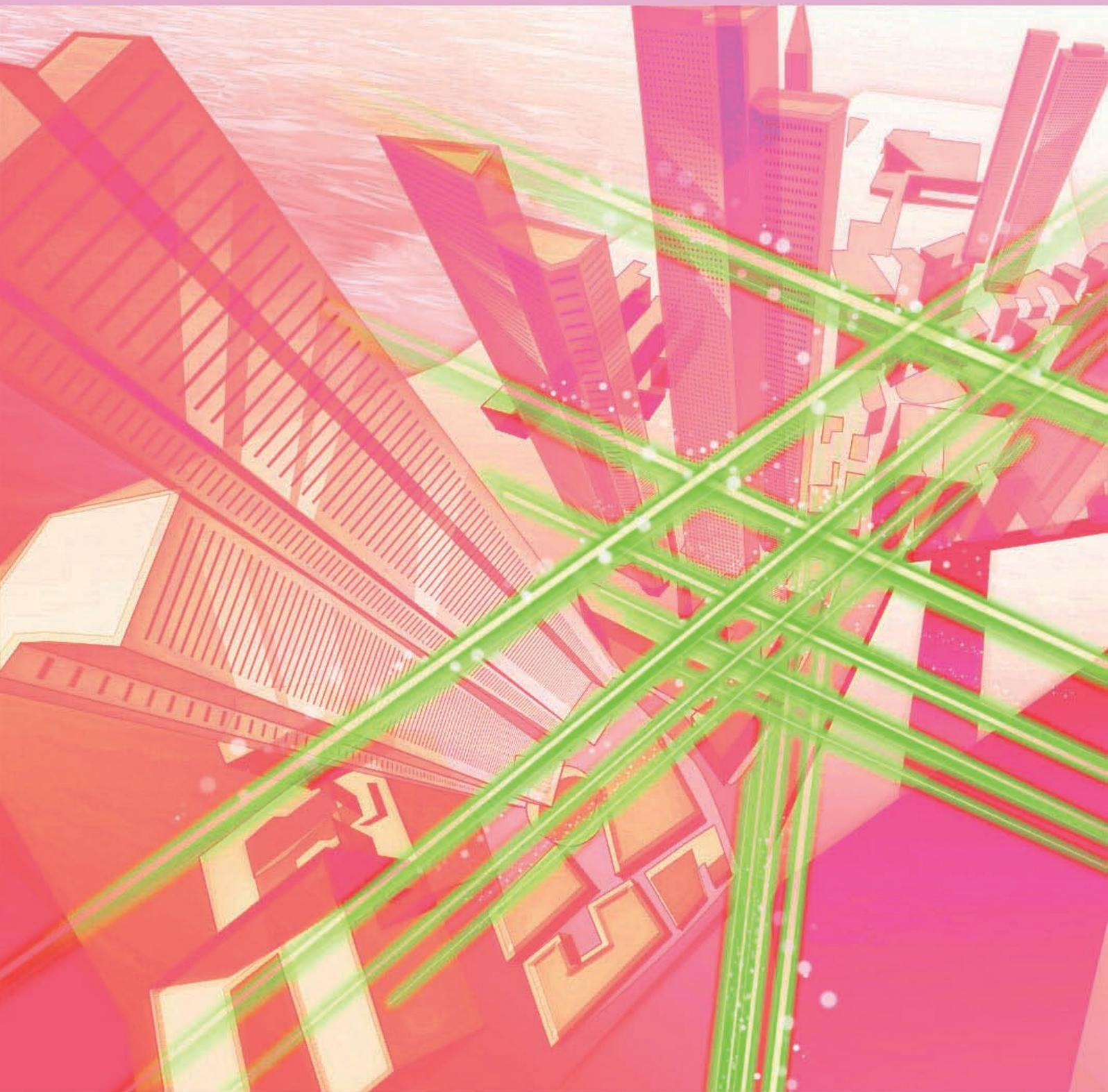


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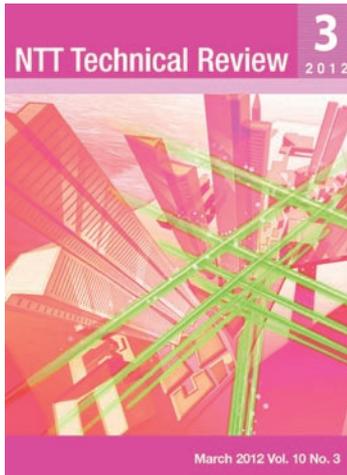
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Becoming a Leading Player through Globally Seamless Services

Jun Sawada
Executive Vice President,
NTT Communications



Overview

In 2011, NTT Communications announced its Vision 2015 growth strategy and reorganized its corporate structure by function. NTT Communications has set a goal of becoming a leading player in a market dominated by globalization, the cloud, and smartphones. We asked Executive Vice President Jun Sawada how the company can increase market share in such a dynamic, worldwide market.

Leveraging group power on the basis of a common principle of connecting

—Mr. Sawada, please tell us about the Vision 2015 growth strategy.

When this vision was drawn up in 2011, global markets, the cloud, and smartphone services were already at the center of the business environment. And after three consecutive years of decreasing sales and profit and with competitors who were actually growing, we felt the need for a strategy that could address these circumstances. The Vision 2015 slogan is “Global ICT Partner—Innovative. Reliable. Seamless.” (ICT: information and communications technology). Our goals here are to strengthen further our existing competencies in Asia, become an optimal partner for our customers throughout the world who wish to expand into fast-growing markets in Asia and emerging nations, and become highly regarded by all our customers as a *bona fide leading global player* on the same level as the four current major players (AT&T, Verizon, BT, and Orange) by 2015.

Awareness of the NTT brand was surveyed about a year ago, but unfortunately, the results indicated a level that could hardly be called high. NTT Communications does business in 30 countries from

78 base offices, and my aim is to raise awareness of the company and to become a leading player in both name and reality. I also want the company to expand its business on the basis of our shared value of *bridging* networks.

To give you some specific targets, I would like to raise the group’s consolidated revenue to at least 1.5 trillion yen by doubling the sales of our global businesses. Furthermore, with an eye to increasing the percentage of our business in new fields to 80% and beyond, I want the whole NTT Communications group to move forward with great speed, develop best practices, and increase group power overall.

Overhauling the organization with success in mind

—What is your specific strategy for achieving these objectives?

To achieve these objectives, we need to improve our competitive power. This also holds true for our objective of raising worldwide awareness of NTT Communications: if we are losing out to our competitors, we can’t expect to make much progress in establishing awareness.

This is the era in which customer needs and wants move seamlessly from one location to another. It

simply doesn't work to have, say, one service structure for Japan and another for the USA. Although some customization may be needed for each region, a company must be able to provide the same quality of service based on the same standards throughout the world.

Most people would agree that success, for a company, means profit and name recognition. But these factors depend on being selected by a customer. To maintain growth, we would like to be selected by companies desiring to expand overseas and even by our overseas customers seeking growth under these severe global economic conditions. By pursuing such business, I would like to see NTT Communications grow together with our customers. But there's more. To get our customers to select us for their business plans, we must take the initiative and face our problems directly with a determined attitude.

To this end, we undertook a major restructuring—the first since the founding of NTT Communications—based on three main pillars: a service-oriented approach, globally seamless operations, and a function-based structure. As part of this restructuring, we transformed our approach to services. In the past, we focused on individual user needs and developed new services from the viewpoint of the service-receiving side. From here on, there will be a greater emphasis on presenting services from the service-provisioning side.

Specifically, we began by restructuring the corporate organization according to three core functions—sales, services, and operations—and staff. That is, we established a system that would give us a competitive edge by consolidating and optimizing by function all of the resources and know-how distributed throughout the organization so that they could be used in the most effective way possible.

Although it will take time for substantial results from this approach to be seen, some effects have already begun to appear as a wide array of similar services come to be consolidated into larger services through organizational restructuring.

As these objectives become established and we work to achieve them, it is important that all those concerned throughout the world understand the essentials of this effort and move together with one mind. We are making progress in establishing a common vision, but I want to make sure that we involve our more than twenty overseas subsidiaries in moving forward.

Company rules have also been changed to a considerable extent, but not to the point of causing major



confusion. At the same time, a situation with no confusion at all would seem to mean that no reform has actually taken place, which is something that I would worry about!

Actually, out of 100 problems that we extracted from opinions gathered at all NTT Communications sites, 34 of them concerned organization. We are working to solve those problems in a step-by-step manner. The other problems involved requests and issues concerning processes and methodologies. All of these problems should be solvable as long as we face them head on by disseminating the right information and promoting understanding.

It is difficult to create a perfect organization first time around. The role of business is to respond to ongoing changes in society, and as a result, the situation surrounding us at NTT Communications is always changing. We will keep a close watch on this changing situation and respond appropriately to it without destroying our three business pillars of a service-oriented approach, globally seamless operations, and a function-based structure. A failure to change with the times can only lead to confusion in the workplace.

Rejecting a niche role for growth as a global player

—NTT Communications has formulated a Global Cloud Vision as one example of globally seamless operations—one of the company's three main pillars. Could you tell us a bit about it?

Our Global Cloud Vision aims to provide a wide range of services reflecting our company's strengths—from networks and datacenters to servers and applications—in an end-to-end, one-stop manner. In short,

we are rolling out a cloud service that we would be expected to provide as a communications operator but in a globally seamless manner. The key technology here is open source software such as OpenFlow, which enables centralized path control on the network, and OpenStack, a cloud controller. The Global Cloud Vision aims to provide multivendor support to gain a competitive edge, that is, to support equipment and operating systems from multiple vendors that customers are introducing into their systems, and it is moving quickly to establish an open-source base in virtualization technology. By the way, this cloud service deploys research achievements of the NTT Information Sharing Platform Laboratories. I believe that NTT Communications was the first in the world to announce the commercialization of a virtualized network connecting datacenters using OpenFlow technology in the form of a cloud service. We also plan to incorporate extensive security measures in this service in response to the growing worldwide demand for more secure remote access.

Unfortunately, though, NTT Communications currently lacks the might to take on local services in regions throughout the world. This is exactly why we would end up being just a quick niche player if we didn't make tight connections. If we truly desire to take our place next to entrenched operators in other countries as a global player by 2015, we must increase our presence.



We are also making steady progress in terms of infrastructure. One example is an undersea cable called the Asia Submarine-cable Express (ASE). This cable planned by NTT Communications is scheduled to interconnect Japan, the Philippines, Hong Kong, Singapore, and Malaysia. Since the seabed of the Bashi Channel south of Taiwan is unstable owing to frequent earthquakes, we are routing this cable as close to the Philippines as possible, but it will still be able to connect Japan with these countries in the shortest, fastest way. The cable will be linked with the Pacific Crossing cable that we purchased two years ago. And we will provide a highly reliable international network service via the world's fastest cable connecting the west coast of the USA with Japan, Hong Kong, and Singapore.

Moving forward with speed and a zeal for reform

—After undergoing such a large-scale restructuring, what does NTT Communications resolve to do this year?

Our business standards for Japan have already been set, and from here on, we will be creating standards that will work for us on the global scene. What is important for each and every one of us at NTT Communications is reform and speed. With a sense of resolve that seeks to throw out the old, we must face the future head-on.

If we were to bring Japanese standards with us into the world, they would not necessarily be considered useful or appropriate by our global colleagues. Instead, on the basis of a global, *common* perspective, we should treat Japan as a local market that needs our support.

Of course, I myself have to change! Just putting my

thoughts on paper does not bring about any changes. And even if I attempt to instigate reform together with my Japanese colleagues and international ones as well, that doesn't mean that we will automatically be on the same wavelength. Executive management—myself included—and middle managers must develop a good understanding of the situation that we are in and make constructive comments and hold discussions. The technology and services that can now be provided already exceed my imagination. The fact is, obsolescence is rampant in our industry. I'm sure that all of us sense just how transient technology, services, and customer attitudes and range of experience can be. The essence of our business, however, must not be blurred. There is nothing to worry about as long as we have a clear understanding of what is essential in our endeavors. What we must be *faithful* to here is what our worldwide customers, including our Japanese customers, want. Looking forward, we will strive to provide services in a highly motivated, faithful manner. We may be suffering now, but I firmly believe that tomorrow will be a better day. Let's run together into the future!

Interviewee profile

■ Career highlights

Jun Sawada entered Nippon Telegraph and Telephone Public Corporation (now NTT) in 1978. After serving as manager of various network facilities, he moved to the business planning section in the Corporate Planning Department in 1988. He was involved in the reorganization of NTT in 1996 as a member of the restructuring office. Then, after working in international services and serving in the USA, he was instrumental in developing and launching new businesses from the NTT Communications Corporate Planning Department in 2000. He became general manager of the Kansai branch office in 2003, vice president of the Corporate Planning Department in 2006, and senior vice-president in 2008. He took up his present position in 2011.

NTT Activities Toward Expanded Telework

Yukie Tachi[†] and Yoshiaki Noda

Abstract

NTT has implemented teleworking for its own employees and aims to expand the use of telework in Japan. It has investigated why, despite the availability of various products for making effective use of telecommunications, telework has still not made sufficient inroads into society.

1. Introduction

Teleworking is a theme that has long been pursued by telecommunications companies, but so far it has been unable to produce spectacular results in society. Even in the NTT Group, which has already established a telework system, employees that are actually working from home (telecommuting) on a daily basis are in the minority. One reason for the small scale of telework is poor data security: there have been several high-profile information leaks in recent years.

The R&D Produce Group in the NTT Research and Development Planning Department has been promoting *incubation produce* activities since April 2010 with the aim of identifying technology trends and social changes early and discovering and cultivating new service and business seeds. Telework is one of the themes targeted by these activities. Of course, the use of telework is still a work in progress, but looking back at 2011, when many people actually did telework after the Great East Japan Earthquake of March 2011, which led to the implementation of power-saving measures, NTT is aiming to further expand telework in 2012 on the basis of valuable experience gained during that time. In this feature article, we first introduce a survey of telework tools. Then, after touching upon the summertime power-saving measures in 2011 and a vision for telework, we present an in-house use case of a business continuity plan at NTT Communications. We then introduce solutions

that exploit the technical expertise of the NTT Group, discuss telework trends in Japan, and describe a satellite-office social experiment.

2. Telework tools

What types of tools are needed for telework? Here, we summarize some key tools from the viewpoint of employee-oriented telework.

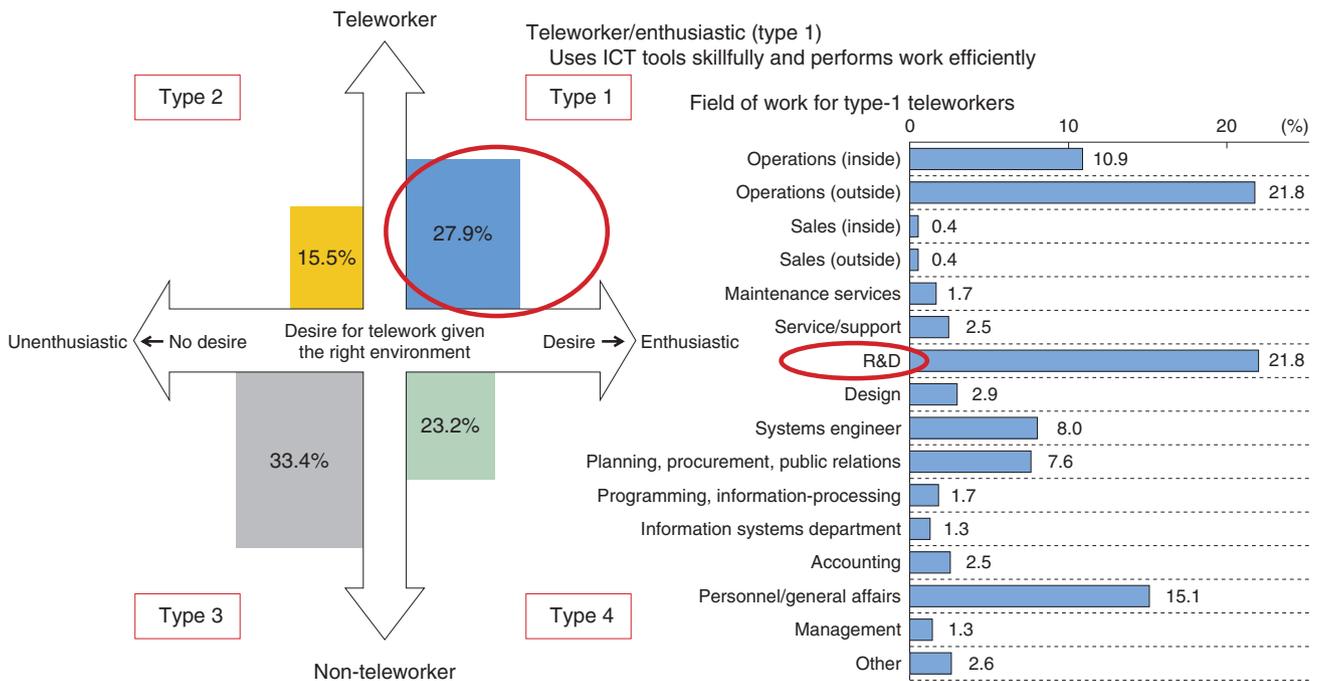
(1) Work tools

A teleworker typically needs tools such as a personal computer (PC) and file server for tasks such as gathering information and preparing documents. In telework, a remote access system and thin-client system are provided as products for accessing the work environment from a location other than one's office and for performing work. Terminals for gaining access from the outside are not limited to a notebook computer or dedicated thin-client terminal—they may also be a mobile phone, tablet computer, or smartphone.

(2) Communication tools

The telephone, email, groupware, conferencing systems, and an in-house social networking service (SNS) are tools that are needed for managing people, sharing information, and holding casual conversations. In telework, services such as call forwarding and teleconferencing, web-based conferencing, and videoconferencing to facilitate remote meetings are provided. While email is a convenient tool for performing one's duties, it is not ideal for casual conversation. For this purpose, tools such as instant messaging and an in-house SNS are used.

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Source: Prepared from NTT "Survey of User Needs for Telework Tools" 2011.

Fig. 1. Employee distribution by telework usage and attitude.

(3) Awareness and presence tools

These are tools for determining the status of other employees, such as whether they are available to talk. It is said that telecommuting can generate a sense of alienation compared with working in an office. For this reason, a manager is responsible not only for managing telework but also for maintaining morale and order. When many people are teleworking at the same time, as in long-term telework or home-based call centers, employee needs can be extensive.

3. Market survey

3.1 Overview

At NTT, the telework tools described above are already being provided to some extent, but it has become apparent that they are not being actively used. With the aim of clarifying obstacles to telework penetration, we conducted a user-needs survey on telework tools in fiscal year 2010.

3.2 Survey results

(1) No expansion in current state

Regardless of the presence or absence of telework systems, the number of employed people currently

involved in telework has reached a saturation point with respect to the total working population. In its current state, telework is incapable of reaching the level targeted by the Japanese government (7 million telecommuters). Why is telework not expanding? It has become clear from group interviews and web surveys that employees have misgivings about telework, which they feel reduces their opportunities for communication and degrades the way that they work and their sense of worth (value) within the company. Furthermore, when we talked to enterprises that had introduced telework, we often heard the opinion that "It is still unclear whether telework can raise productivity in an organization." In short, both managers and employees expressed doubt about telework. To overcome this barrier to telework, it is important to present good telework methods to employees and prepare case studies of successful telework in terms of productivity.

(2) Creative employees

In the survey, employees were divided into four types in terms of using or not using telework and being enthusiastic or unenthusiastic about teleworking, as shown in Fig. 1. We focused on the combination of teleworker & enthusiastic (type 1). Employees

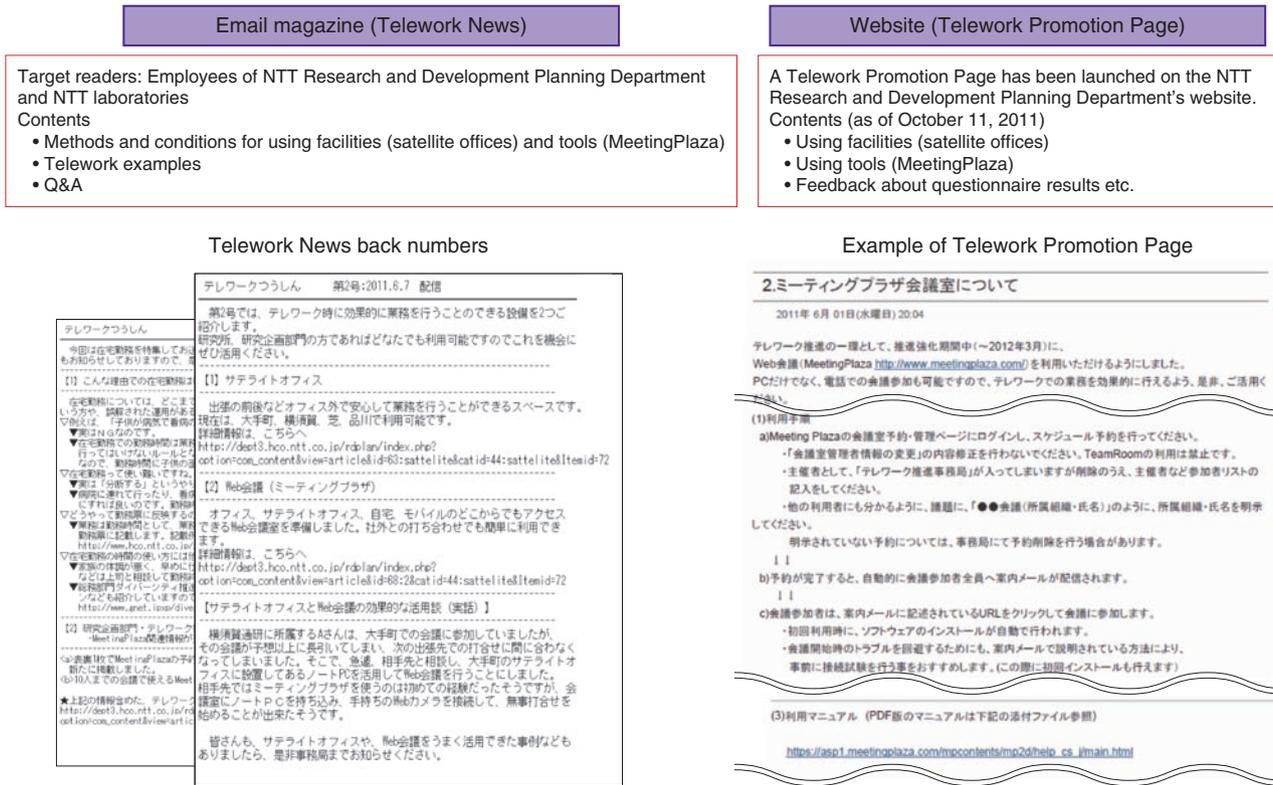


Fig. 2. In-house promotion of telework in NTT laboratories.

of this type skillfully use the information and communications technology (ICT) environment provided by the company and efficiently perform their work. We therefore considered that the policies and measures associated with this type of user would be effective in preparing successful case studies. Furthermore, in examining the field of work or job position of type-1 users, we found that many worked in research and development (R&D), so we decided to make a connection between the approach to telework inside NTT laboratories and expanding the telework market.

4. Telework promotion at NTT laboratories

On the basis of the results of the abovementioned survey, telework promotion activities were launched at NTT laboratories in FY2011. A number of suggestions for improving the telework environment were obtained through questionnaires and other means. These included establishing satellite offices, providing communication tools, and raising the efficiency of mobile working. As a result, several satellite offices have been set up at various locations including

the NTT Research and Development Planning Department (in Otemachi, Tokyo) and four online conference rooms in NTT IT's MeetingPlaza^{*1} [1] service have been made available for use by teleworkers. Information promoting telework is also being provided through an electronic magazine emailed to users and via the Research and Development Planning Department's website (Fig. 2).

5. Telecommuting during power-saving measures

After the Great East Japan Earthquake, power-saving measures were imposed from July to September 2011. NTT as well as NTT Communications, NTT DATA, NTT DOCOMO, NTT Software, and other NTT Group companies saw an increase in the number of employees working from home in some way and in the number of days when telework systems were used. As a result, a large number of people had the opportunity to experience telework firsthand.

Below, we review the work patterns that evolved

*1 MeetingPlaza is a trademark of NTT IT.

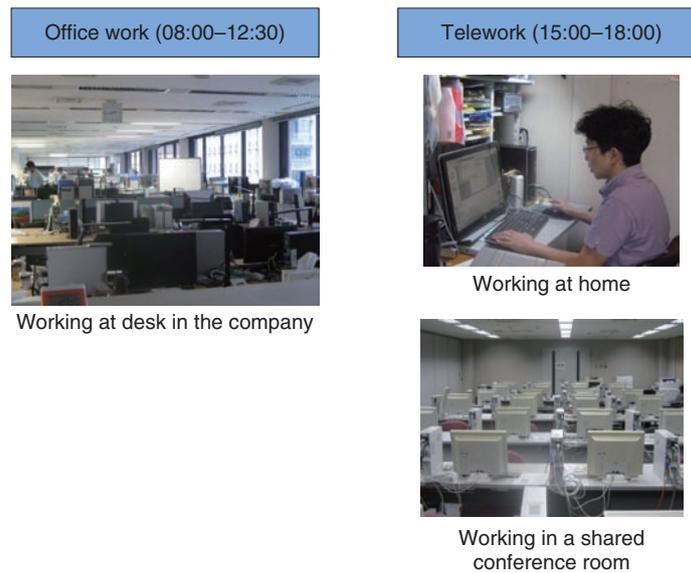


Fig. 3. Example of work format at NTT Research and Development Planning Department during the summer power-saving period.

during this period at NTT's Otemachi offices in relation to the different types of telework tools described earlier. The teleworking took place in either the morning or afternoon on a floor-by-floor basis (**Fig. 3**).

5.1 In relation to work tools

In the past, a telework environment was achieved by having users remotely access their desk PCs at the office from company-supplied PCs or approved home PCs. During the power-saving period, however, power was expected to be turned off across entire floors of the Otemachi building, which necessitated a migration of the desk PC environment to a cloud environment (Biz desktop); this led to a change in work style, which let teleworkers access their own PC environments from any PC, which could be located on their desks, in their homes, or even in shared conference rooms. As a result, work that could not be completed during normal working hours could be placed on the PC desktop in the cloud and be completed later during telework periods. It was also possible for teleworkers to access their organization's file server from the cloud environment, which meant that it was no longer necessary to physically carry essential materials out of the office as long as they were in digital form.

5.2 In relation to communication tools

More attention than expected was paid to commu-

nication tools during this period. For example, someone calling an office extension number that had been set up by a teleworker to be switched to his or her mobile phone would not know that the call was being transferred. For this reason, teleworkers placed their mobile phones nearby when teleworking so that they could answer quickly in line with normal office practice. Moreover, it was difficult to secure meeting space owing to the shortage of conference rooms in Otemachi at this time, so microphone/speaker equipment for voice conferencing (such as RealTalk^{*2}) was used to hold meetings among employees in the office, employees out of the office, and teleworking employees. Web conferencing (such as MeetingPlaza) was also used to hold meetings among teleworking employees, but as many employees had no experience of using such a system outside the company, some guidance was necessary such as connection trials. These measures undoubtedly reduced the number of unnecessary, non-urgent meetings, but it also reaffirmed the importance of communication in the work process. The feeling was that there is room for further improvement with regard to communication tools.

5.3 In relation to awareness and presence tools

The status of one's superiors and colleagues was determined through existing schedulers and by

*2 RealTalk is a trademark of NTT Advanced Technology Corporation.

	Life	Work	Society
Vigor	<p>Develop a zest for living through an autonomous way of working</p> <ul style="list-style-type: none"> • Enable the sharing of individual expertise throughout society by enhancing individual presence. • Make <i>flat</i> connections between human resources independent of time and place and assemble an optimal task force composed of individuals with abundant social experience and advanced knowledge. 	<p>Become more competitive through new management methods</p> <ul style="list-style-type: none"> • Revolutionize organizational structure and work processes by using next-generation ICT and make telework mainstream. • Develop new management methods independent of organizational scale, time/place, and personnel flow and become increasingly more competitive. 	<p>Achieve a society full of possibilities</p> <ul style="list-style-type: none"> • Achieve drastic integration across the entire country including urban and regional areas • Instead of society being run through regulations and guidance from above, let people themselves create space in their cities and regions to make best use of their resources and create a society that is best for them.
Wisdom	<p>Enhance knowledge and sensitivity through diverse exchanges</p> <ul style="list-style-type: none"> • Use the time gained from less commuting and more efficient work practices to generate diverse exchanges and learning opportunities over the network. • Increase awareness of the community and sense of citizenship and help promote cultural and artistic activities toward a more comfortable and prosperous society. 	<p>Create new sense of value through network knowledge</p> <ul style="list-style-type: none"> • Facilitate decision-making through visualization and standardization of work processes and accelerated communication. • Create a foundation for greater productivity in the service industry and white-collar fields to trigger a fusion of knowledge and increase added value. 	<p>Revitalize regional communities through ICT and business creation</p> <ul style="list-style-type: none"> • Treat problem solving in regional communities as a business process operated by individuals with a strong sense of community and citizenship. • Link individuals with a corporate organization having work visualization and standardization know-how to create business and expand national restoration to regional areas.
Peace of mind	<p>Enable people to lead fulfilling lives meeting childcare and care-giving needs</p> <ul style="list-style-type: none"> • Provide ample care for families without career disruption and financial risks. • Balance work and time spent with children, parents, and spouses for greater peace of mind and more stable lives. 	<p>Ensure business continuity</p> <ul style="list-style-type: none"> • Introduce telework to establish a work environment outside the office and ensure business continuity by simultaneously maintaining the ICT infrastructure and human resources. • Make telework a habit to consolidate resources and knowledge and shorten the lead time for work restoration during times of emergency due to natural disasters, pandemics, etc. 	<p>Address disaster, depopulation, and environmental problems</p> <ul style="list-style-type: none"> • Use the communication lines deployed to homes for daily work and enhance the information environment and degree of literacy in the home as effective countermeasures to natural disasters and environmental problems. • Connect the network to depopulated areas to improve inhabitants' degree of self-sufficiency through the development of new service industries and revitalization of primary industries.

Source: Prepared from Japan Telework Society, Telework 2.0 Study Group 2009.

Fig. 4. Telework possibilities: Telework 2.0.

exchanging information about the starting and ending times of telework: no new presence indication tools were introduced during the power-saving period. Since employees usually went into the office every day, there were no real obstacles to business operations, but since those with busy schedules were not always in front of their PC, the need was felt for some kind of linkage with a mobile tool to check on another employee's schedule or presence.

6. Home-based call center

One example of telework that NTT has come to provide is the home-based call center. It has recently become possible to transfer enquiries made to a call center to home operators by using a cloud-based platform and distributing USB flash drives (universal serial bus memory devices) that have a fingerprint-based authentication function to those home opera-

tors. All the terminal software required for call center operations can be provided on the USB flash drive, so the home operator only needs to have a home PC and broadband connection. Such services are already being provided, as in NTT AT's MatchPhone ASP Home product (ASP: application service provider). Staff at NTT Com CHEO who use its CAVA^{*3} (.com advisor & valuable agent) are also attracting attention as participants in a next-generation work style that is expected to expand.

7. Telework 2.0

In 2009, the Telework 2.0 proposal was announced as a vision of telework in the future. This proposal

*3 CAVA: A system from NTT Com CHEO that consigns ICT-related work to home-based call center operators who have obtained Internet certification through a program operated by NTT Communications.

was drafted by the Telework 2.0 Study Group of the Japan Telework Society [2]. Based on a vision of individuals, organizations, and society with 20% of the working population consisting of teleworkers by 2010, as described in the government's e-Japan Strategy II, Telework 2.0 was a study on future telework. Its objective was to define a new approach to telework and create proposals and measures for achieving it from diverse viewpoints including management and organization, business processes, human resource management, technology, the workplace, and cities and regional areas [3].

In the matrix shown in **Fig. 4**, the life, work, and society columns represent things that must be undertaken on the basis of the state of society, while the vigor, wisdom, and peace-of-mind rows represent a proactive search for new possibilities in the way people work. In relation to this vision, the *cloud* has come to be viewed as a major paradigm shift since 2009, and looking forward, it is thought that Japan should recreate itself as a more flexible and powerful society by revolutionizing work styles by using cloud services [4]–[6].

8. Concluding remarks

The tools mentioned in this article can be used for work on a routine basis and can facilitate the work process even outside the office during a time of crisis,

and they can be used for raising an organization's productivity. The telework promotion in NTT laboratories and the expanded use of telework during last summer's power-saving period have shown that the provision of tools in itself is not a solution and that a problem-solving approach is best, as in searching for the most effective way of using available tools in accordance with an organization's environment. With this in mind, we aim to accelerate our activities toward expanding the telework market.

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Yukie Tachi

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Since joining NTT DATA in 1987, she has been working on system development for the retail and consumer goods industry. She moved to NTT Research and Development Planning Department in 2010 and is currently working on incubation themes such as telework.



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He received the B.E. and M.E. degrees in electrical engineering from Ritsumeikan University, Kyoto, in 1989 and 1991, respectively. Since joining NTT in 1991, he has been working on R&D of automatic speech recognition technologies. He is currently engaged in improving NTT customers' in-house equipment and planning telework business.

Developing Secure and Ubiquitous Telework Environments at NTT Communications

Mika Sugiyama[†]

Abstract

NTT Communications has had a telework system for some time enabling more than 1000 employees to work from home. This system enabled most business to continue as usual after the Great East Japan Earthquake of 2011 despite disruptions in public transportation. NTT Communications is promoting telework to its customers with an extensive lineup of products and comprehensive support based on its own in-house experiences in introducing telework practices.

1. Introduction

For many companies in Japan, the Great East Japan Earthquake of 2011 underscored the importance of work-style innovation in supporting power-saving measures, a business continuity plan (BCP), and further improvements in productivity. As a result, these companies are now taking a hard look at telework systems that enable employees to access the company's office environment in a secure and ubiquitous manner from their homes or outside locations. At the same time, setting up an appropriate information and communications technology (ICT) environment is essential for introducing and promoting worry-free teleworking, but only a small percentage of companies are in the process of constructing a telework environment (**Fig. 1(a)**). The reasons given for not introducing telework are often system-related, as in concerns about information leaks and the high cost of implementation (**Fig. 1(b)**). Against this background, NTT Communications has been operating a cloud-based virtual desktop service called Biz Desktop Pro (**Fig. 2**) since June 2010 to provide safe, secure, and convenient access from anywhere at any time over the Internet and to support corporate telework efforts. After the earthquake, cloud features that enabled the

creation of a telework environment in a relatively inexpensive and quick manner garnered high praise and the number of inquiries received at NTT Communications about Biz Desktop Pro increased by five times. The service also attracted much attention in the media, such as the Yomiuri Shimbun (article on April 4, 2011), Nikkei Shimbun (article on April 17, 2011), NHK News Watch 9, (broadcast on April 7, 2011), and Nippon Television NEWSZERO (broadcast on April 20, 2011). In this way, companies that had been reluctant to introduce telework for reasons of security or lack of in-house telework rules underwent a major change in telework awareness, which provided sudden opportunities for telework market expansion.

2. Telework issues solved by Biz Desktop Pro

Biz Desktop Pro constructs a virtual personal computer (PC) environment within NTT Communications' robust datacenter through the use of virtualization technology. The following features support the introduction of a corporate telework system.

(1) Use only as needed with low monthly fees

A virtual desktop environment has traditionally required system-engineering work for its construction, but its conversion to a cloud-based format lowers startup costs and enables it to be launched in a relatively short time. Furthermore, integrating the

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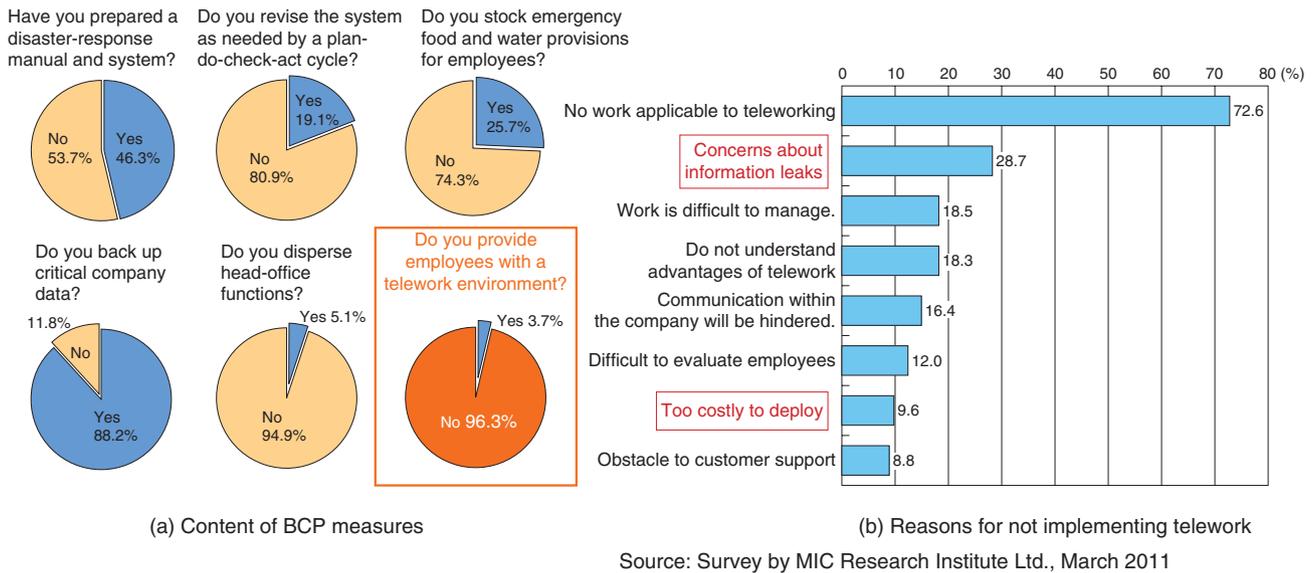


Fig. 1. Survey of corporate BCP measures.

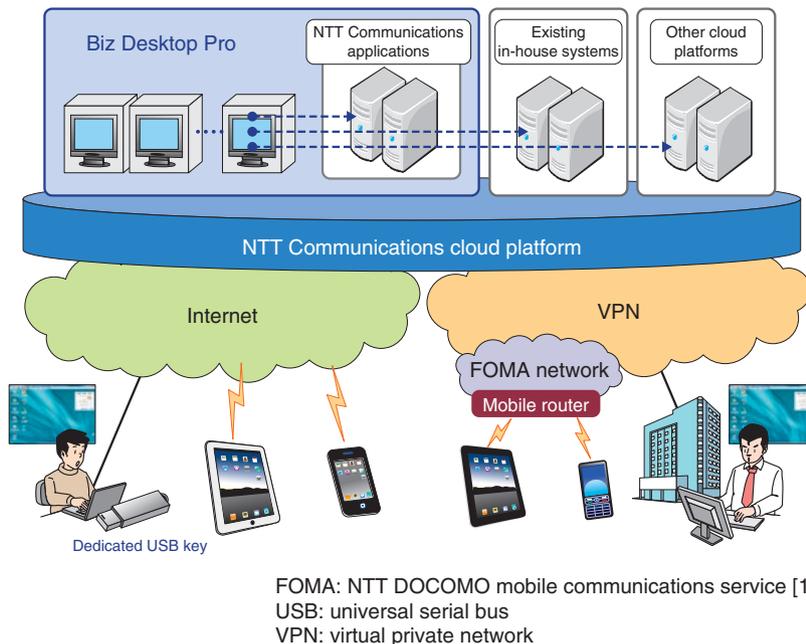
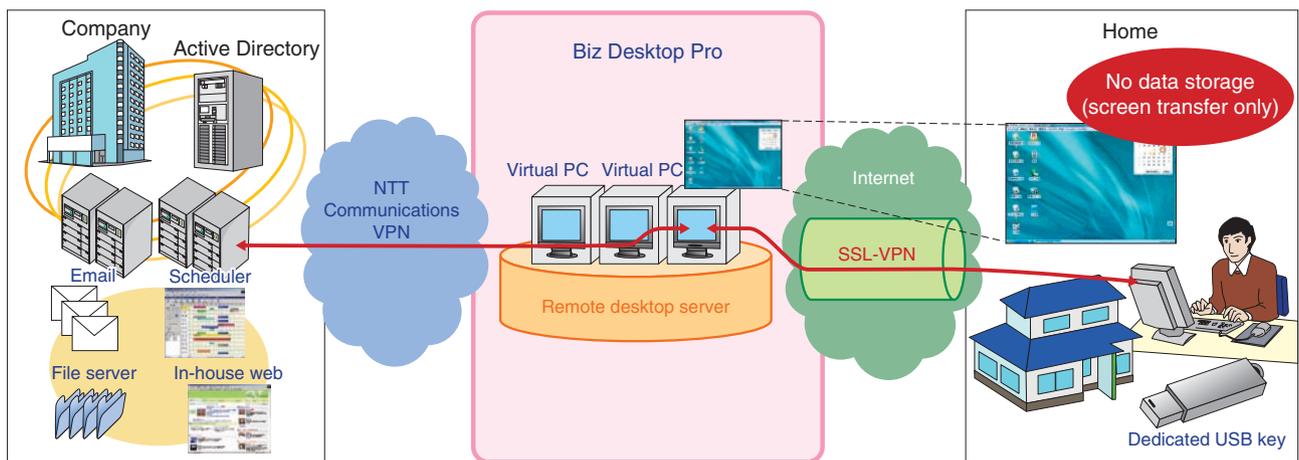


Fig. 2. Overview of Biz Desktop Pro service.

virtual desktop environment with the network eliminates the need to design, deploy, and operate center circuits as in the past, which facilitates implementation.

(2) Secure remote access

The use of a screen-transfer system means that absolutely no data is left on a terminal used at home or at an outside location. There is consequently no need to worry about information leaks even if the



SSL: Secure Sockets Layer

Fig. 3. Implementation of Biz Desktop Pro at NTT Communications.

terminal should go missing. Moreover, double encryption and multifactor authentication prevent unauthorized access by eavesdropping, spoofing, etc., and the prevention of document printing, downloading, screenshot printing, etc. provides an effective countermeasure to security threats.

(3) Unified management of PC environment

In contrast to the past thin-client service, Biz Desktop Pro provides a number of important benefits. It simplifies and accelerates the deployment of PCs and the increase (decrease) of resources as the number of employees increases (decreases), prevents the unnecessary installation of applications, and enables uniform management of virus protection and data backup. It also enables home PCs and existing company PCs to be used as they are: there is no need for dedicated PCs.

3. Telework efforts at NTT Communications

NTT Communications had envisioned the need for BCP measures even during normal times before the crisis of 2011 and had established a remote work environment using Biz Desktop Pro (Fig. 3). In this environment, the user only has to insert a dedicated USB (universal serial bus) key into a home PC to log into his or her virtual PC environment and activate in-house security policies through a link established using Active Directory (a Microsoft service).

Since NTT Communications had already implemented and promoted a system that enabled more

than 1000 employees to work from home (telecommute) under a telework manager, it was able to use Biz Desktop Pro to continue most business as usual after the earthquake despite disruptions in public transportation. Moreover, during the power-saving period from July to September 2011, it was able to make a major contribution to reduced usage of electrical power by expanding target users to all 8000 or so company employees and getting more than 1000 employees per month to engage in telework (Fig. 4).

NTT Communications' Tohoku branch office in the city of Sendai was directly affected by the Great East Japan Earthquake. Amidst the break in lifelines, disruptions in public transportation, and insufficient supply of consumer goods and other commodities, personnel at this location were able to get a bare-bones, provisional office up and running within one week of the disaster and to reopen for business using Biz Desktop Pro. However, as transportation services had not yet been completely restored even after the office had genuinely reopened, continuing with a telework format made it possible to sustain business operations without any major disruptions.

NTT Communications has promoted flexible application of telework on a variety of occasions, such as for telework trials envisioning the outbreak of new types of infectious diseases (starting in February 2011), as a countermeasure to commuting difficulties following the Great East Japan Earthquake (starting in March 2011), and to support power-saving measures (July to September 2011). Although telework adoption is still a work in progress, these instances of

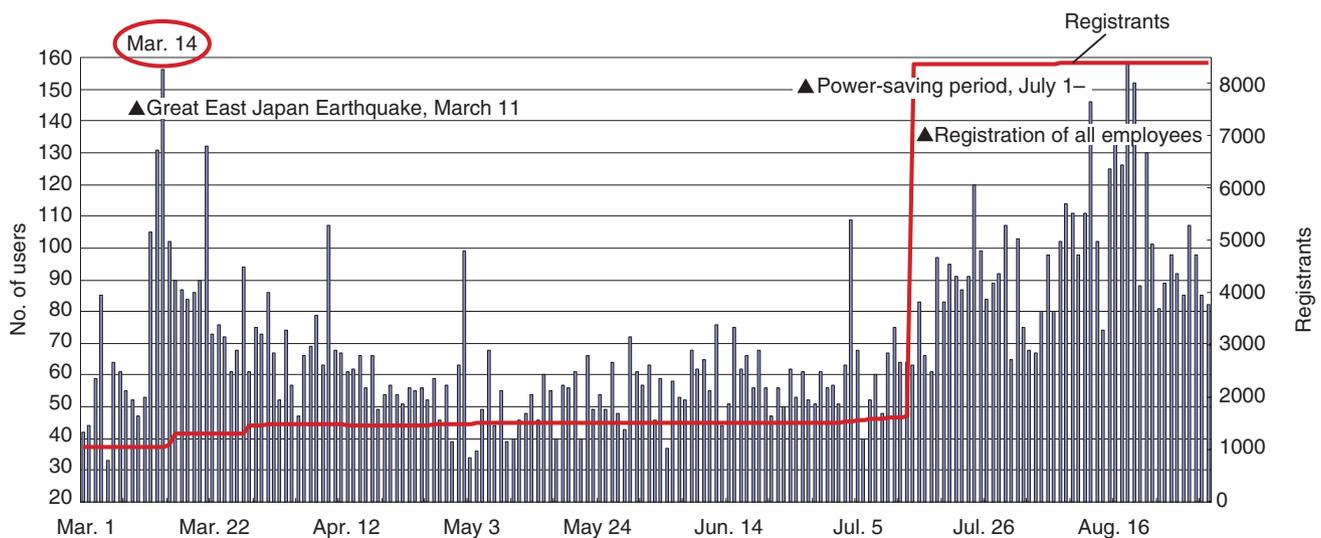


Fig. 4. Telework usage at NTT Communications (by day).

practical teleworking have helped raise awareness of its benefits on a company-wide level and enable telework to take root. Looking to the future, NTT Communications plans to further promote the advantages of telework beyond any particular locations or sites and to proactively expand and apply work-style innovation toward a work/life balance in addition to BCP support.

Since the introduction of a telework system in 2007 at NTT Communications, employees having childcare and care-giving responsibilities have been telecommuting on a two-days-per-week basis. In other words, NTT Communications itself puts telework into practice, and in addition to providing an environment in which employees can fulfill both work and family responsibilities, the company sees telework as a way of making more effective use of commuting time, raising employee motivation, and raising the efficiency of business operations. Based on these experiences, NTT Communications wishes to support the diverse work styles of its partners and customers from an ICT perspective.

4. Security technologies for telework environments

Security is the main concern in the implementation of a telework environment. Biz Desktop Pro specifies security policies from the four viewpoints of authentication, terminal, communication path, and server to achieve the level of security needed in the cloud era

(Fig. 5).

(1) Authentication security

This policy strengthens security by combining multiple authentication factors in addition to ID (identification) and password. For example, USB key authentication and MAC (media access control) address authentication can be used for identifying the terminal, authentication of the originating IP (Internet protocol) address for identifying the communication path, and matrix pattern authentication and fingerprint authentication for identifying the individual. Appropriately selecting and combining such authentication factors maximizes the security level. Other practices or recommendations also help to enhance security. For example, common names for accounts are generally not allowed and measures for preventing password cracking such as requiring complex passwords (of at least eight alphanumeric characters) are provided.

(2) Terminal security

To prevent information leaks, this policy prescribes a mechanism that prevents document saving or data downloading from the in-house system to local home or outside terminals or to external storage media such as USB memory connected to a terminal. It also disables printing or use of the print-screen function from home or an outside location to prevent the outflow of actual data to points outside the company. At NTT Communications, home PC terminals used for

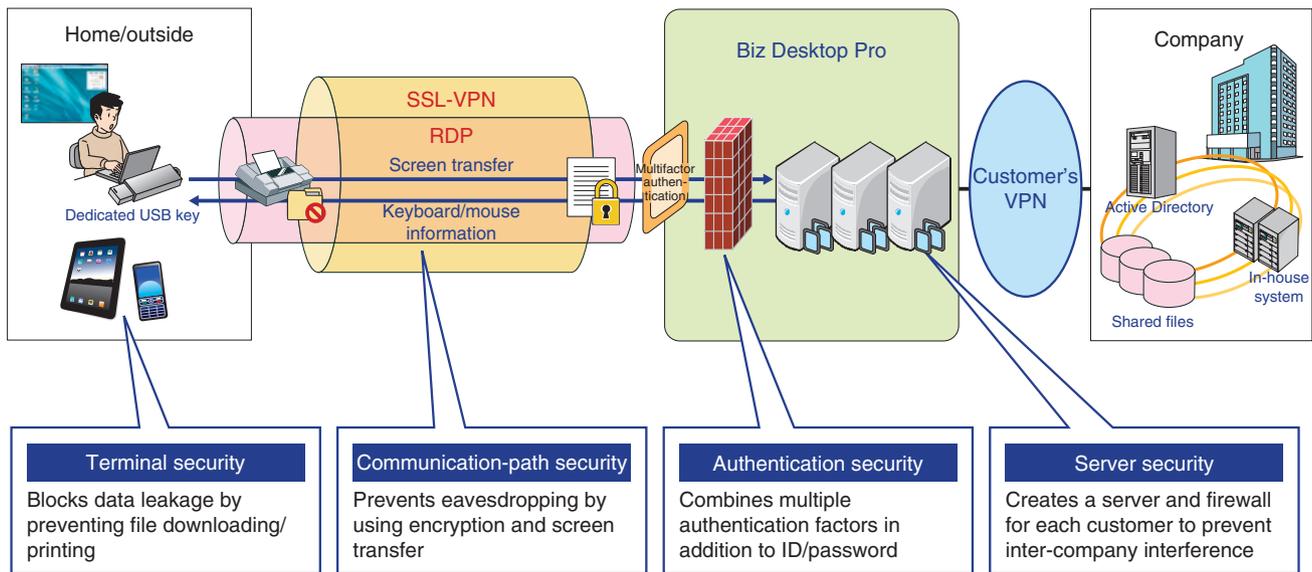


Fig. 5. Security policies in Biz Desktop Pro.

company purposes are prevented from connecting if the definition file of their anti-virus software is not the latest version. This quarantine function serves to further enhance security.

(3) Communication-path security

This policy dictates the use of Remote Desktop Protocol (RDP) for performing secure transfer of only screen information on virtual PCs and ensuring that absolutely no data is left on home or outside terminals. Moreover, when an Internet connection is made, double encryption through SSL-VPN (Secure Sockets Layer virtual private network) and RDP makes for even stronger security.

(4) Server security

This policy calls for the creation of a firewall and server for each company and the division of the network into segments so that a security problem that by chance occurs for a particular company does not affect the operations of another company in any way. Anti-virus software is also installed as an additional measure to prevent virus infections, and network traffic and resources are constantly monitored 24 hours a day every day to watch out for unauthorized access, abnormal jumps in CPU (central processing unit) resource usage, etc.

5. Work-style innovation supporting the use of multiple devices

The dramatic spread of smartphones and tablets and the diversification of work styles in recent years have led many companies to proactively adopt a business style that uses mobile tools and a business environment that can make effective use of idle time when moving from one place to another.

Biz Desktop Pro supports multiple devices such as Android terminals and the iPhone/iPad to enable employees to access the same office environment using a PC inside the company and a smartphone or tablet outside. The end result is a work style independent of place or time that takes full advantage of the benefits of placing applications and data in the cloud and that enables the most suitable device to be used according to current conditions.

NTT Communications offers a telework environment using smartphones through the provision of Remote Office Solution (Fig. 6). This service packages the elements needed for a company’s remote office environment, such as mobile data communications (3G (third generation)), public wireless LAN (Wi-Fi local area network), smartphone terminals, 050IP phone applications, mobile device management tools, and a virtual desktop service (Biz Desktop). By using smartphones and tablets in this way to establish a new work style independent of place and time and to spread the positive effects of telework,

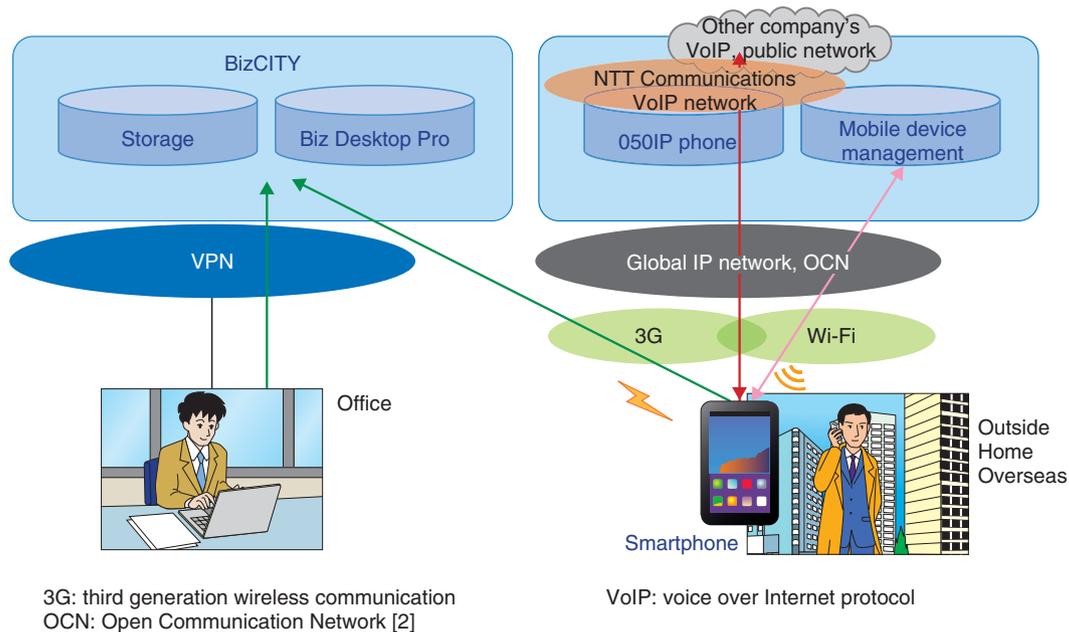


Fig. 6. Overview of Remote Office Solution.

NTT Communications seeks to improve the productivity of its sales force, speed up the management process, develop highly competent personnel, and raise moral, and by extension, improve company results.

6. Concluding remarks

Telework is not a new word. Its benefits have been discussed for some time. Nevertheless, many companies are still reluctant to introduce a telework environment because of security concerns or the lack of in-house rules governing telework.

In addition to Biz Desktop Pro and Remote Office Solution introduced in this article, NTT Communications provides an extensive lineup of cloud services for achieving a safe and convenient telework environment. These include Biz Storage, Biz Mail (email), Work Box (scheduler), and services for checking on the well-being of others and for broadcasting information. With these services, NTT Communications naturally seeks to spread telework from an ICT perspective, but it also wants to apply its in-house experience and know-how in implementing a telework environment to providing its partners and customers with comprehensive support that includes methods for establishing telework rules and workplace environments.

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NTT IT's Telework Solutions

Junichi Sawase[†] and Masafumi Kishino

Abstract

NTT IT has been supporting the deployment of corporate telework systems by providing its MagicConnect remote-access virtual private network service and MeetingPlaza web conferencing service. This article describes the features of these two services and introduces NTT IT's new SmartTelework service, which combines these services to resolve key telework issues.

1. Introduction

Telework has traditionally been promoted as a means of providing employee benefits, as in working from home to (1) enable child care and care giving and (2) achieve a work-life balance. As a consequence, telework experiments have been limited in range. However, the appearance of new influenza strains at the end of 2009 and the Great East Japan Earthquake of March 2011 and subsequent power-saving measures in the summer of 2011 highlighted the main benefit of teleworking—working from anywhere at anytime—as an effective means of ensuring business continuity.

For telework purposes, NTT IT provides MagicConnectTM*1, a remote-access virtual private network (VPN) service, and MeetingPlazaTM*2, a web conferencing service. Through these two services, it has been supporting companies creating telework environments. Demand for MagicConnect and MeetingPlaza jumped immediately after the flu outbreak and the earthquake/tsunami disaster, but these days, many companies are still expressing their desire to use these services to ensure business continuity.

2. Issues and solutions

According to the survey described in the “2010 White Paper on Information and Communications in Japan” from the Ministry of Internal Affairs and Communications (MIC), companies in Japan consider the following issues to be the main obstacles to

the spread of teleworking:

- No work applicable to teleworking
- Cost
- Information security
- Management of employee work and results
- Communication

Resolving these issues should therefore boost the use of telework systems. Among these issues, we think that information security, management of employee work and results, and communication can be solved by technical means (**Table 1**). For this purpose, NTT IT provides the MagicConnect and MeetingPlaza services as well as its new SmartTelework*3 service, which combines these two services. These three services are described below.

3. Services

3.1 MagicConnect: remote access VPN service

MagicConnect is a remote access VPN service that enables the screen contents displayed on an office personal computer (PC) normally used for everyday in-house work to be displayed and manipulated on the user's remote terminal (home PC, tablet computer, etc.) without any data files being downloaded to that terminal. It solves the problem of information security usually raised as a telework issue and enables everyday work to be performed safely and easily from outside the company (**Fig. 1**).

When an employee is performing work outside the company as in teleworking, his or her environment

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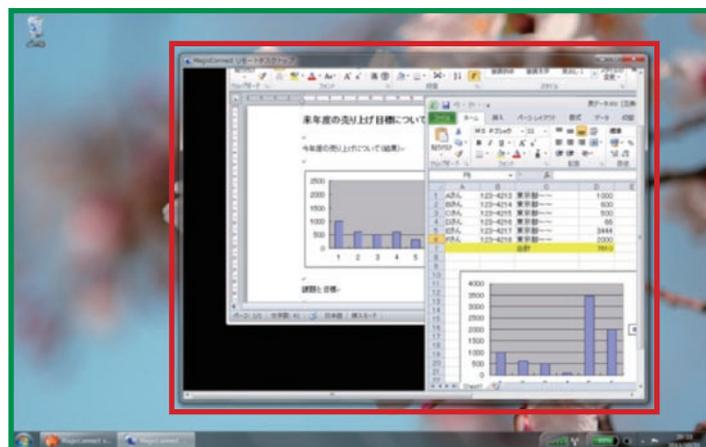
*1 MagicConnectTM is a registered trademark of NTT IT.

*2 MeetingPlazaTM is a registered trademark of NTT IT.

*3 SmartTelework is a trademark of NTT IT.

Table 1. Main issues hindering the spread of teleworking.

Issue	Details	Potential for technical solution
No work applicable to teleworking	• Work involving the telephone and face-to-face interaction is difficult by teleworking.	Fair
Cost	• Implementation incurs expenses. • Actual expenses are unknown. • Cost-benefit analysis is difficult.	Fair
Information security	• Telework environment could be unsecure. • There a risk of information leaking. • Viruses could be introduced into the company's system.	Good
Management of employee work and results	• Actual working time of employees cannot be determined. • Work results cannot be evaluated appropriately.	Good
Communication	• Teleworking hinders teamwork. • Employees feel alienated. • Sense of belonging to the organization is reduced.	Good



- The green frame indicates the desktop screen of the user's remote PC.
- The red frame indicates the desktop screen of the office PC. Excel, Word, and other files are processed on the office PC.

Fig. 1. MagicConnect screenshot.

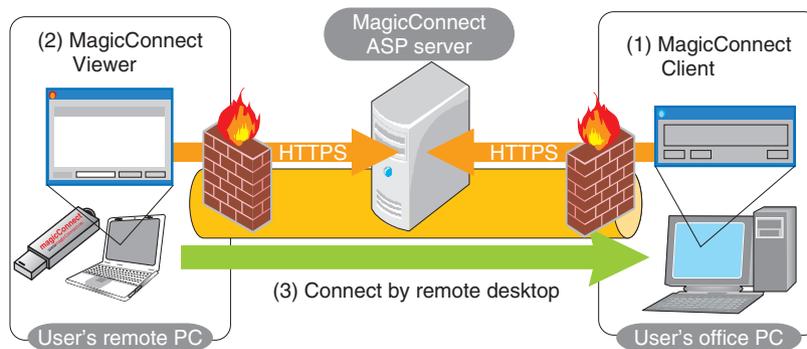
consists of various elements such as the workplace itself and the terminal and network being used. Not all of these elements provide an adequate level of security, so security must be ensured from the telework-service side. MagicConnect has been highly evaluated by companies that have introduced it because of its superb performance in countering information leaks, virus infections, and spoofing (Table 2). Although security and convenience are often conflicting features, MagicConnect excels in both ease of deployment and convenience of use.

Implementing MagicConnect does not require a company to make network-related changes, such as releasing firewall ports or changing router settings,

nor does it require the use of an expensive gateway. To get started with MagicConnect, the user first checks whether the office PC targeted for remote operation can connect to and browse the web. If it can, the user only has to install standby software called MagicConnect Client on that PC to set up an environment that enables access to it from the outside. The fact that no settings of existing network equipment need to be changed has the effect of not only simplifying implementation but also maintaining security policies ((1) in Fig. 2). The ASP (application service provider) server is a service server operated by NTT IT. It relays sessions performed in the personal computers as shown in (1) and (2) in Fig. 2.

Table 2. Comparison of security of existing services and MagicConnect.

Function	Existing services	MagicConnect
Preventing information leaks	Existing services such as IPsec VPN and Remote Access Service Server (RAS) allow email and files to be downloaded and processed on the user's remote terminal, which creates a risk of information leakage.	Eliminates the risk of information leakage by using a screen-transfer-type thin-client system (remote desktop) and by not transferring files to the user's remote terminal.
Preventing virus infections	Existing services such as IPsec VPN and RAS extend the in-house local area network to the outside, which leaves open the possibility of a virus infection via the communication path. They also allow the transmission of files into the company from the outside, which presents a risk of virus infection via files.	Prevents the company being infected by viruses by launching a preregistered remote-operation application from MagicConnect Viewer and disabling all other types of communication. It also disallows the transfer of files into the company.
Preventing spoofing	Authentication by only user ID and password may not prevent connections by other users (spoofing).	A hard-to-duplicate personal USB key, terminal information, and multifactor authentication combined with a certificate prevent spoofing.



- (1) Install MagicConnect Client on user's office PC and connect to ASP server.
- (2) Connect to ASP server from user's remote PC using MagicConnect Viewer.
- (3) Operate the user's office PC by a remote desktop.

Fig. 2. Getting started with MagicConnect.

To remotely access that office PC from the user's remote PC, the user inserts a personal USB (universal serial bus) key into the remote PC to start up MagicConnect Viewer. No pre-installation is required, and a borrowed or shared PC can be safely used instead of one's own PC. HTTPS (hypertext transfer protocol secure) is used to establish communications, which makes it easy to make connections from hotel lines and other circuits that have traditionally restricted connections to VPNs ((2) in Fig. 2). Once a VPN connection has been established with MagicConnect, the user can operate the office-PC desktop as usual and perform work ((3) in Fig. 2).

In the above way, MagicConnect provides both a high level of security and an exceptional degree of convenience. Far from being limited to working from home (telecommuting), it can also be used in a vari-

ety of fields including mobile telework and remote maintenance.

3.2 MeetingPlaza: web conferencing service

MeetingPlaza is a web conferencing service that has come to be used by more than 3000 companies since its launch about ten years ago.

As discussed above, management of employee work and results and communication have been raised as key telework issues. To resolve these issues, there is a need for functions that enable remotely located employees to determine each other's status and collaborate just as if they were working in an office. MeetingPlaza features a video-based status checking function and application-sharing function that enables users to hold meetings from remote locations and to engage in joint projects.

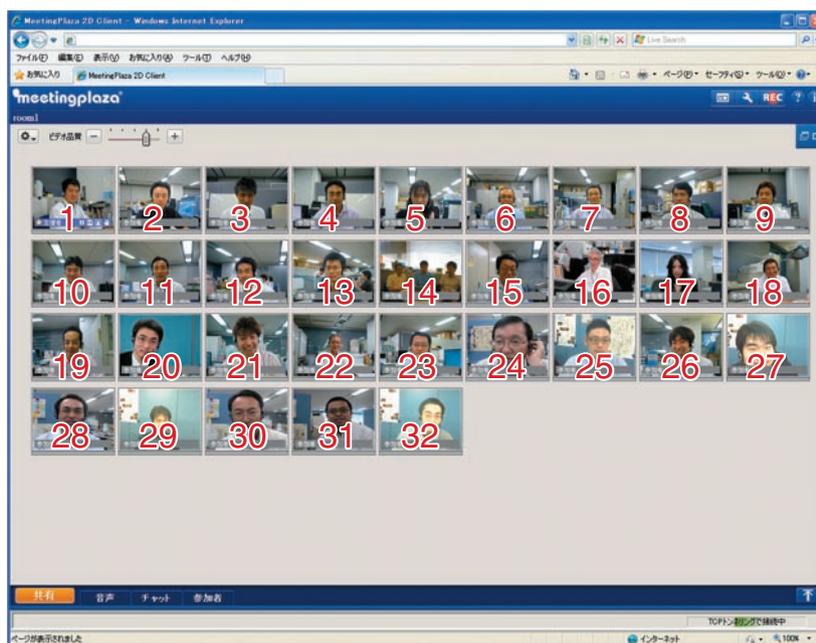


Fig. 3. Multi-user display screen.

Ordinary communication tools are intended for a small number of simultaneous users, so they cannot simultaneously display a large number of video images. By contrast, MeetingPlaza uses a proprietary protocol called Virtual Community Communication Protocol (VCCP), which controls the number of conference participants according to the available bandwidth and can simultaneously display and continuously deliver up to 32 portrait-type video streams, the largest number supported by any existing videoconferencing service, at home and abroad (Fig. 3).

This protocol can cope with a mixture of high-speed and low-speed terminals when making connections. Under VCCP, terminals capable of high-speed connections communicate with each other via high-quality audio and video, while all other combinations of terminals communicate by audio and video at a level appropriate to current network conditions. This automatic bandwidth adjustment function handles fluctuations in bandwidth and prevents problems like audio cutoffs and unintentional departures from the conference room. It lets teleworkers check the status of their colleagues just as they would in an office environment and perform their work with a sense of being in a workplace. Managers can check the work status of employees under their supervision by means of video, which lets them manage work effectively.

Ordinary communication tools can be adversely

affected by the telework environment and local connections that can generate noise, making conversations difficult. To counter such noise, MeetingPlaza uses noise echo reduction (NOER) technology developed by NTT Cyber Space Laboratories. This technology features three-stage processing consisting of echo suppression, noise suppression, and processed-speech distortion suppression that counteracts the effects of the surrounding environment and produces high-quality speech.

MeetingPlaza also provides an application sharing function that enables conference participants to collaborate on projects just like in an office. This function provides the same sense of looking over the shoulder of a colleague working on his or her PC at the office and observing how that colleague is executing a certain application. It also enables a participant to obtain operation rights as the need arises and to remotely operate that application and edit materials (Fig. 4).

MeetingPlaza enables the type of collaborative work traditionally done in an office to be pursued in a telework environment by providing the above functions of simultaneous multi-screen video delivery, automatic bandwidth control, and application sharing.

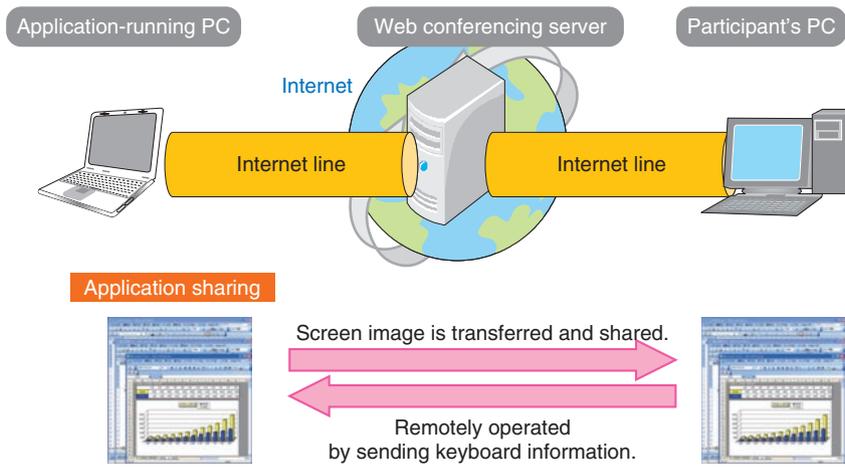


Fig. 4. Concept of application sharing.

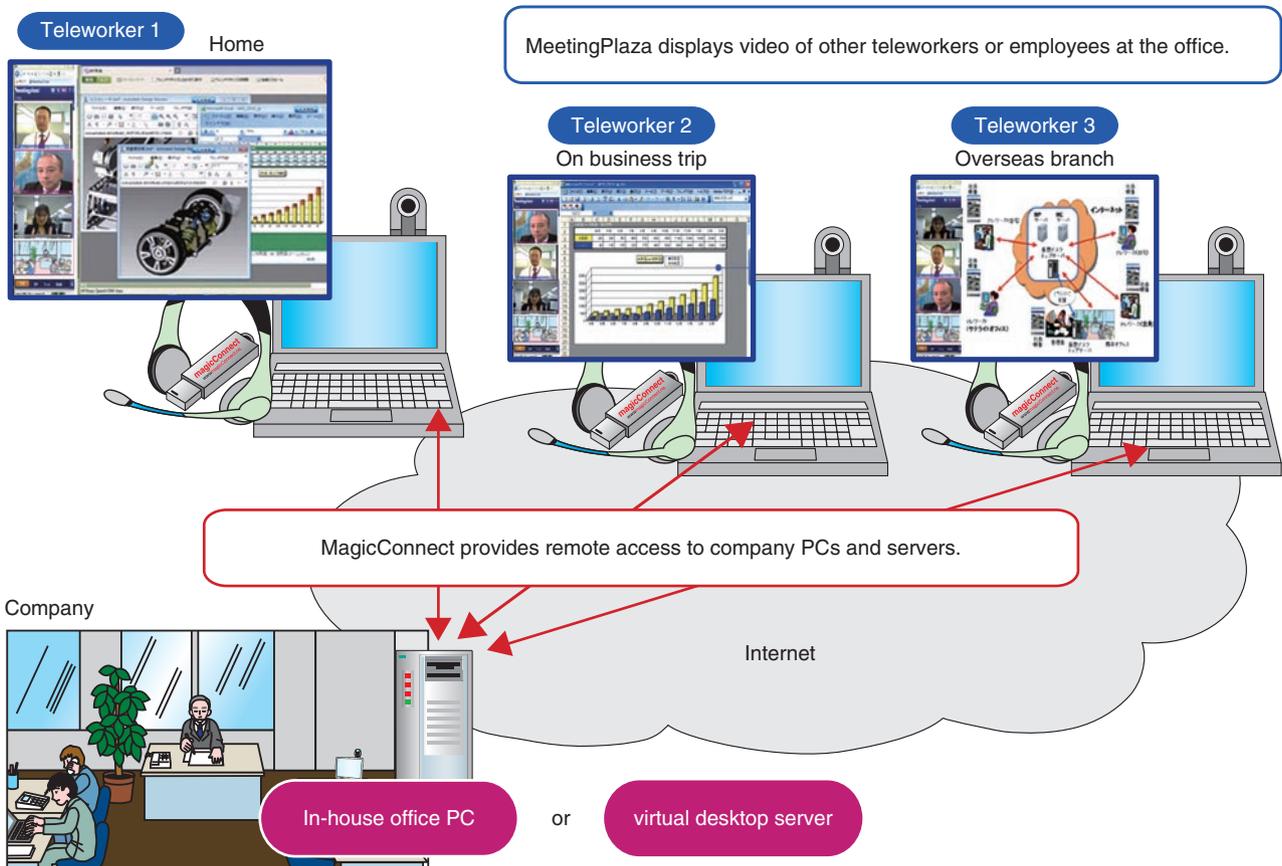


Fig. 5. Overview of SmartTelework.

3.3 SmartTelework: a telework solution

SmartTelework combines MagicConnect and MeetingPlaza to simultaneously resolve the three key telework issues (information security, management of employee work and results, and communication) and achieve an advanced telework environment (Fig. 5). With SmartTelework, a teleworker at home or on a business trip can use MagicConnect to perform the same PC-based work as normally done on an office PC. The same teleworker can also use MeetingPlaza to participate in web conferences and collaborative work with other teleworkers and/or employees at the office with the aim of solving work-related problems. A teleworker can also obtain a sense of office participation without feeling alienated through the display of continuous video streaming of other members in the organization. On the other hand, a manager can check the status of those members through video and can even determine the progress being made by teleworkers in their work.

Files used for telework are absolutely prevented from being moved outside the company, so there is no need to worry about information leaks. At the same time, a mechanism for managing centralized information on a file server, for example, enables a manager to check on the work being performed by teleworkers.

The combination of a remote-access VPN function that enables work to be done safely outside the office

and a video-based communication function that enables employees to keep in touch with each other creates a synergetic effect that turns teleworking into a viable work format.

4. Concluding remarks

Ironically, it took the experience of an unprecedented disaster to make many people pay attention to the benefits of teleworking, which had until then made few inroads into society. Telework could potentially have an even greater impact in making work more efficient and improving the lives of working people, as has been suggested since the 1980s. There is considerable latent demand for teleworking across a wide range of applications beyond its use at the time of a national disaster. It is envisioned as a countermeasure to a dwindling labor force as the aging society advances, as a solution to demands for a new working style compatible with child-care and care-giving responsibilities, and as a means of recruiting highly capable personnel from all over the world.

Looking forward, we plan to further develop the SmartTelework concept and its supporting technologies. The telework field shows signs of genuine expansion in the years to come, and NTT IT aims to support its growth by providing easy-to-use telework technologies and services.



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Telework Solutions by NTT-AT

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Abstract

NTT Advanced Technology Corporation (NTT-AT) provides solutions and services with products based on cutting-edge technologies. This article introduces a multipoint-conferencing telework solution using WarpDeskPlus (remote-access thin client), MeetingPerfe (paperless-conferencing support system), and RealTalk (speakerphone for conferencing) designed to meet the demands to perform telework anytime and anywhere and be prepared with business contingency plans.

1. Introduction

To ensure that business operations continue during sudden emergencies and to promote teleworking, which can create a good balance between an employee's work and private life, a business enterprise should provide an environment that lets an employee access company systems not only while at work but also at home or on a business trip. For such an environment, there are four key issues.

- How can secure access be achieved?
- What security measures should be taken?
- What tasks should be targeted for telework?
- How can working hours be managed?

These issues need to be taken into consideration in selecting appropriate elements of a solution and designing and constructing required systems. As a telework-conferencing solution, this article overviews a multipoint paperless conferencing system, which enables safe and secure participation from home as well as from work, and focuses on the technical features of the individual elements comprising this solution.

2. Paperless-conferencing system with multipoint audioconferencing

An example configuration of the paperless-conferencing system for teleworking provided by NTT

Advanced Technology Corporation (NTT-AT) is shown in **Fig. 1**.

A server for paperless-conferencing support systems (MeetingPerfe^{*1} series 1 and 2) set up on the head office's in-house local area network (LAN) connects the head office with multiple branch offices via the Internet (or via in-house LANs), and electronic documents sent from this server can be shared on client terminals such as personal computers (PCs). Consequently, the head office and branch offices can operate as a single, paperless conference room. A company employee who is working at home (teleworking) or on a business trip can connect his or her remote-access thin-client device (called WarpDeskPlus^{*2}) to one of the company's conferencing PCs and remotely participate in a conference in a secure manner.

Moreover, audio conferences between locations (namely, the head office and branch offices) are connected through an audioconferencing server (SIP (session initiation protocol) server installed in head office), and realistic audio conferences with clear voices are created through audioconferencing speakerphones (called RealTalk^{*3}) and one or more PCs with telephony software (softphones) installed at each location.

Employees working out of the office can participate in audio conferences via softphone modules installed

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*1 MeetingPerfe is a trademark of NTT AT.

*2 WarpDeskPlus is a trademark of NTT AT.

*3 RealTalk is a trademark of NTT AT.

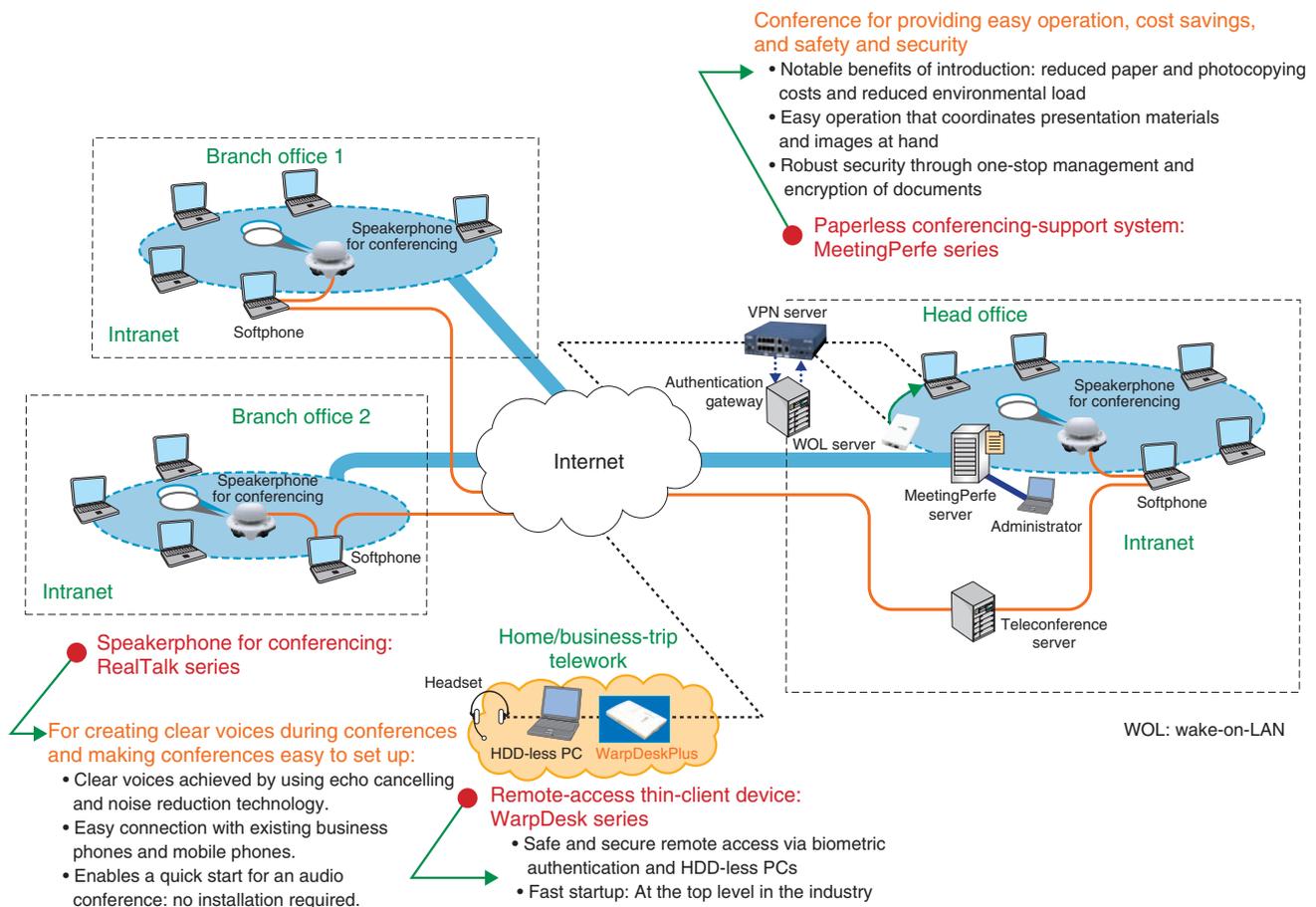


Fig. 1. Paperless-conferencing system that enables teleworking.

in their WarpDeskPlus. They can use headsets to participate in conferences with minimum inconvenience to others around them even when they are at home or on business trips.

Telework can be managed by setting up a WarpDeskPlus authentication gateway under the control of virtual-private-network (VPN) routers, and access-log management is possible at the same time as attendance management of connections outside the company (such as setting connection time slots and days off for individuals).

3. WarpDesk series

WarpDeskPlus is a USB (universal serial bus) device that includes configuration data and client software. It has a proprietary operating system (OS) based on Linux, which is required by the thin-client terminals. To enable remote access to in-house systems from outside the company in a secure manner, it

uses biometric authentication based on fingerprints. The basic configuration of a thin client using WarpDeskPlus is shown in Fig. 2, and the key features of WarpDeskPlus are listed in Table 1.

The client PC is started up from the OS installed in WarpDeskPlus itself and connected to a VPN router set up on the company side (i.e., server side). During this startup, WarpDeskPlus identifies the user through its biometric authentication function. At the company-side VPN router, multifactor (i.e., ID and password) authentication is used. Together, these authentication measures ensure a high level of security. After the VPN router has been connected, a connection using Microsoft's Remote Desktop Protocol (RDP) is made to the user's PC at his or her company desk or to a cloud server. This configuration lets the user perform tasks as if operating his or her own PC at work while at home or on a business trip.

Since a thin-client system such as WarpDeskPlus can be started up from the system device

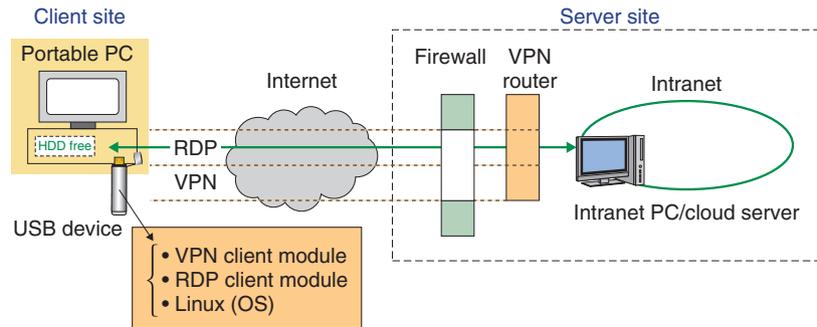


Fig. 2. Basic configuration of thin-client system.

Table 1. Main features of WarpDeskPlus.

Server side	Intranet PC	VPN-connection software not needed
	VPN router	Necessary
Client side	Portable PC	HDD free, OS free
	USB device	Linux (OS) RDP client and VPN client software modules (compatibility with four types of support VPN)
Security	Multifactor authentication	Biometric authentication by fingerprint Intrusion by third parties through firewalls eliminated through the use of passwords and IDs for VPN servers
	Intranet communication encryption between PCs	RDP: encryption by RSA RC4 (stream cipher also used in SSLv3) Maximum encryption level of RDP: equivalent to encryption level of VPN at 128 bits
Action required if a portable PC is lost		Notification unnecessary

RSA: public-key cryptography algorithm named after Rivest, Shamir, and Adleman
SSLv3: Secure Sockets Layer version 3

independently, PCs that do not contain hard disk drives (HDDs), i.e., HDD-less PCs, can be lent by the company to people working off the premises. This eliminates the risk of information leakage due to PCs being lost or stolen. Alternatively, a home PC that does contain a hard disk can be used because when WarpDeskPlus starts up, it overrides and bypasses the PC’s local HDD, which completely eliminates concerns over infection from viruses concealed in the Windows OS of a PC.

4. MeetingPerfe series

Many companies are steadily promoting paperless meetings. Telework is also going paperless, which makes it possible to reduce information leakage from distributed paper documents and electronic files and reduce document printing costs.

MeetingPerfe Series 2 is a server-client-type paperless meeting-support system that registers electronic

files in a server and supports an unlimited number of client terminals. It has two operating modes: sharing mode (in which high-speed screen interlocking is possible) and independent mode (in which articles and papers that the user wants to see can be viewed in the same manner as paper documents).

MeetingPerfeIII, which is compatible with Windows 7 and has a function for automatically converting documents to PDF (portable document format) files upon registration, was released in June 2011. An example of MeetingPerfeIII in operation is schematically shown in Fig. 3, and its key features are listed in Table 2.

Previously registered documents are automatically downloaded to the conference terminals at the start of the meeting. Moreover, before the meeting, notes needed for the meeting can be included, and they can be viewed during the meeting with usability equivalent to that of paper materials (namely, notes can be checked before and after the meeting).

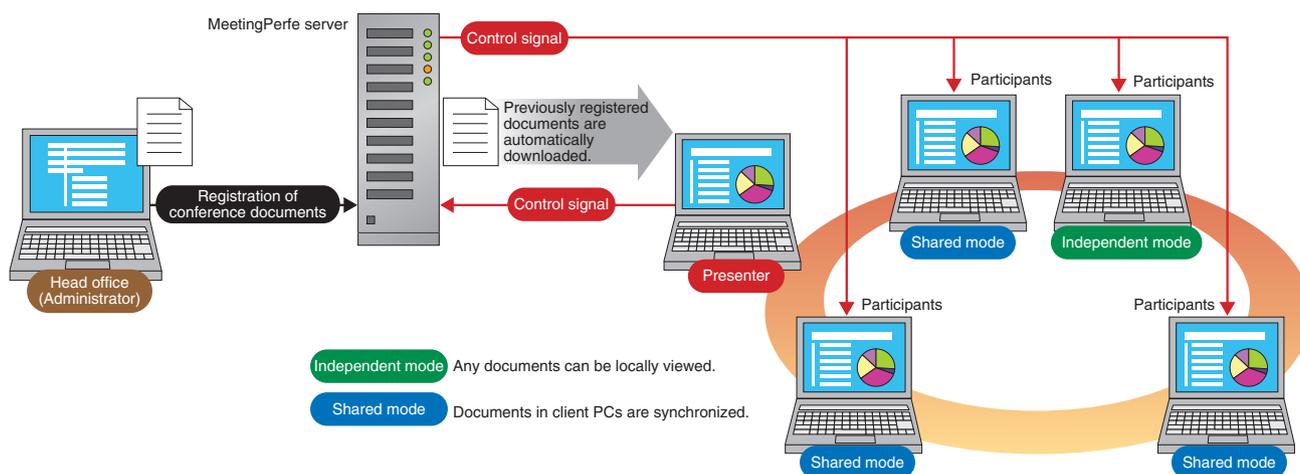


Fig. 3. System configuration of MeetingPerfe.

Table 2. Main features of MeetingPerfe.

<p>Server (conference-controller side)</p>	<ul style="list-style-type: none"> • Information control: Only authorized users can participate and view documents. • Server registered documents are automatically converted to PDF files. • Documents can be replaced (re-registration of documents) even during a conference. • Registered documents are automatically downloaded to all conference terminals when participants join the conference. • Documents to be recovered are deleted from client terminals after the conference. • Previously registered documents can be searched and viewed. • Multiple conferences can be simultaneously held via one MeetingPerfe server.
<p>Client (participants' side)</p>	<ul style="list-style-type: none"> • Switching between sharing mode and independent mode <ul style="list-style-type: none"> →Sharing mode: High-speed page coordination enables conference documents to be presented to and shared among participants. →Independent mode: Unrestricted viewing of other documents is available during a presentation. • Note function <ul style="list-style-type: none"> →Notes can be created and read before, during, and after a conference. • Documents can be shown enlarged or reduced. • Documents supported: <ul style="list-style-type: none"> →PowerPoint, Excel, Word, DocuWorks, PDF *PowerPoint animations are supported. *Files configured with security (i.e., password protected) are out of the scope of operation.

5. RealTalk series

To implement remote meetings, it is necessary to construct an audioconferencing system that creates a strong sense of presence with high-quality sound that does not irritate users. NTT-AT's latest model, which has been provided since September 2009, is a simple audioconferencing environment that is independent of the type of communication line. Moreover, a hands-free device (with a speakerphone-type body) called RealTalk R7 has been released [2], [3]. Up to six of these hands-free devices can be daisy-chained together. RealTalk R7 is based on three technologies: (1) segmental sound detection technology, which can

switch the partitioning space segment on and off with respect to all directions; (2) echo-cancelling technology, which can also accommodate multiple devices connected in a daisy chain; and (3) noise-reduction technology, which eliminates noise from sources like air-conditioners. Its key features are listed below.

- Sound detection covering 360° is provided by using four microphones per RealTalk unit.
- Sound-detection direction is controlled by monitoring the partitioning space segment.
- Daisy-chaining enables up to six RealTalk devices per location to be connected, so large meetings can be accommodated.
- Speech conferencing can be recorded through a

recording interface.

Besides these features, the easy setup automatically handles any line and phone types, so a comfortable audioconference with a large number of people is made possible by simply connecting cables. RealTalk R7 can thus be applied as a flexible and easy-to-use device in various application scenarios in business.

6. Other solution elements

6.1 Authentication gateway

One issue with teleworking via remote access is participant management. The system provides participant management by means of an authentication gateway controlled by the VPN router connected to WarpDeskPlus (Fig. 1). As well as having a function for authenticating the connection with the in-house LAN, the authentication gateway enables the reservation of connection time slots and days off and management of access logs with user IDs and release times. Since these functions can also be used via in-house terminals on a LAN connection, finely tuned operations (such as management of daily out-of-office hours) are possible. Up to 100 combinations of PCs and users can be registered.

6.2 Wake-on-LAN server

If a wake-on-LAN (WOL) server is included in the

system, an in-house PC or server can be switched on remotely. As a result, it is not necessary to leave the power on all the time to enable remote connections with the in-house PCs and server from thin clients (such as WarpDeskPlus) (Fig. 1). Moreover, as an essential element of energy-saving management at a company, the server has a function for showing the operational status of the PCs and servers connected to the network at a glance. PCs and servers are automatically registered when they are connected to the LAN, which makes it possible for services to be started right away. NTT-AT has released two types of WOL server: one for controlling 250 devices on one sub-network and one for controlling 500 devices on two sub-networks.

7. Concluding remarks

This article introduced a paperless conferencing system featuring multipoint conference calls and remote access by thin clients. It is applicable to BCPs for disasters and to telework. It can also be used in combination with electronic whiteboards and videoconferencing systems. In future, this system will be expanded to solution services that can be used seamlessly in various application scenarios (such as disaster-prevention planning conferences and paperless education/training systems).



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Work Style Transformation by Live-Link Design Office and Telework

Yuki Tatsumi†

Abstract

To derive new ways of working—through telework—to the utmost extent, NTT Facilities is providing an office-building solution called Live-Link Design Office. This is intended to provide more comfortable and more efficient offices than those that have been available up until now.

1. Introduction

NTT Facilities is providing a *facility-integration service* for integrating three core technologies: information technology (IT), energy technology, and architectural technology. This service brings four key benefits to customers: it maximizes property value, minimizes facility costs, improves intellectual productivity, and responds to concerns about the global environment and safety and security. This article introduces a transformation in work style through telework and office design to suit that transformation, which will make it even easier to pass on these benefits to customers.

Customers who expect improvements in intellectual productivity through office transformation strongly desire not only the provision of offices as space for simple work but also the creation of an indoor environment that should improve the intellectual productivity of company workers while assuring a comfortable and healthy environment. However, the relationship between indoor environmental performance and intellectual productivity is influenced by various factors; accordingly, there are various viewpoints concerning what kind of analysis axes to use for quantitative evaluation.

Applying our past achievements and experience gained to date [1], NTT Facilities has developed a *work-style diagnosis system**1 that features quantitative evaluation of intellectual performance on two

axes: 1) Live for individual motivation and 2) Link for team communication (**Fig. 1**).

Quantification of an office environment lets one compare data before and after an office has been transformed and objectively evaluate the office design (a process that has tended to be done by gut feeling until now). Moreover, by implementing the work-style diagnosis system and promoting office design utilizing the system, it becomes possible to visualize the problems afflicting an office environment and to prepare efficient and effective office-design plans. In this manner, providing office consulting and office design in an integrated fashion is the key feature of Live-Link Design Office [2] (**Fig. 2**), an office-design software program developed and used by NTT Facilities.

2. Basic design of an office by Live-Link Design Office

To remedy the problems afflicting an office environment visualized by the work-style diagnosis, Live-Link Design Office*2 drafts office-reformation plans that will change peoples' ways of working. It separates the functions of an office into seven *scenes*,

*1 Work-style diagnosis is a simple method in which ten questions concerning a previously set-up office environment are posed to all office tenants in a web-questionnaire format, the obtained answers are collected, and the collected data is analyzed using NTT Facilities' proprietary conversion logic.

*2 Live-Link Design Office is a concept developed by NTT Facilities. It provides an ideal office environment in which office workers can play their roles with good motivation and improve their intellectual productivity.

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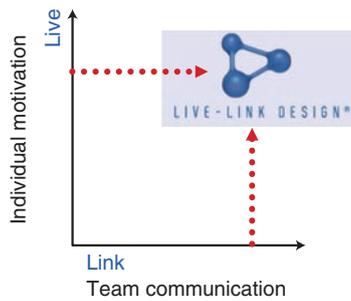


Fig. 1. Evaluation axes for intellectual productivity.

The questions are all in the form of: “Do you agree or disagree with the following statements?”

- 1) The environment enables necessary information to be obtained easily.
- 2) It lets workers concentrate on their work.
- 3) It is comfortable and easy to use.
- 4) It is one that you would choose to work in.
- 5) It enables workers to choose where to work.
- 6) It makes you feel secure mentally and physically.
- 7) It enables workers to communicate with each other frankly.
- 8) It lets workers easily feel refreshed.
- 9) It enables workers to create and cooperate together.
- 10) It is an environment that workers are proud of.

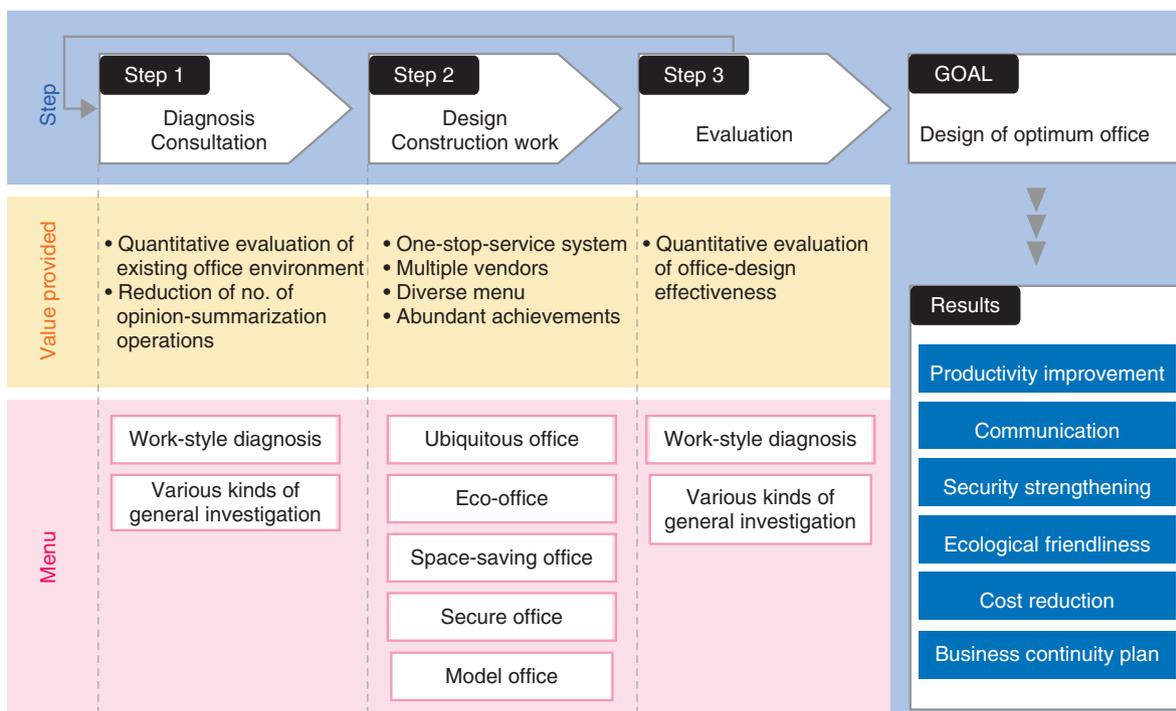


Fig. 2. Format of Live-Link Design Office.

which are locations (spaces) where job functions are performed (Fig. 3). According to the way in which scenes are connected and allocated, it is possible to create spaces in which individual motivation is improved and communication is enriched. As an example of scene connection, a space accommodating computer printers and servers (scene name: *academy*) and a space where workers refresh themselves (scene name: *break*) could be placed adjacent to each other so that conversation between someone taking a short break and someone waiting for a printout becomes natural and spontaneous. The transforma-

tion of office-space allocation in a model office constructed at NTT Facilities in 2010 is shown in Fig. 4.

In the pre-transformation layout, exclusive spaces for individuals (scene name: *station*) take up most (78%) of the office space; on the other hand, in the post-transformation (new) layout, the figure was suppressed to 45%, and there is more shared space (lack of which was a major complaint). Despite the fact that no changes were made to the physical location of the office, floor area, and tenants, the implementation of work-style diagnosis had two main effects: the

 <p>シンク (Think)</p>	 <p>ステーション (Station)</p>	 <p>コミュニティ (Community)</p>	 <p>レビュー (Review)</p>
<ul style="list-style-type: none"> • Work requiring concentration (such as drawing up proposals) • Confidential work (such as writing personnel evaluations) 	<ul style="list-style-type: none"> • Materials preparation • Email/phone communication • Back-office work 	<ul style="list-style-type: none"> • Preparatory-meeting procedures (mainly discussions) 	<ul style="list-style-type: none"> • Meetings and preparations (mainly sharing reports and information) • Seminar implementation (such as study groups)
 <p>レセプション (Reception)</p>	 <p>アカデミー (Academy)</p>		 <p>ブレイク (Break)</p>
<ul style="list-style-type: none"> • Handling reception duties • Dressing for work • Personal receipts • Entry to and exit from the company 	<ul style="list-style-type: none"> • Choosing locations for printers, stationary, etc. • Research work by sharing publications 		<ul style="list-style-type: none"> • Breaks (lunch, change of pace, etc.) • Frank conversations about non-business topics

Fig. 3. Seven scenes.

Live-Link value after transformation was dramatically improved and intellectual productivity was raised to an extremely high level.

After the way of connecting and allocating scenes has been determined, to maximize the functional capability of the seven scenes, five schemes are incorporated into the scenes (**Fig. 5**). For example, some of the schemes related to *break* (the scene in which workers can refresh themselves) facilitate a relaxing effect by using natural colors for carpets (responding to the concern about the type of space), installing vending machines dispensing snacks (providing good tools), establishing a personnel-evaluation system that places emphasis on planning proposals thought up by stimulating informal communication and on original ideas resulting from the aforementioned refreshing effect (creating suitable systems), abolishing reservation systems so that everybody can use tables easily (improving rules), and holding monthly networking events across departments (improving mood).

3. Telework and ubiquitous offices

To embody a customer's management philosophy and corporate culture in an office, it is important to investigate office design on a conceptual basis. Recently, there has been an increase in the number of customers actively promoting a balance between work and free time (work-life balance) while trying to make work more efficient. For such customers, we are proposing the *ubiquitous office*—namely, a work environment that allows a worker to flexibly choose where and when to work.

As an *office* (anywhere inside or outside the company) that can create an environment providing the same working performance as the base office, the ubiquitous office is created by adopting a way of working that puts telework to maximum use, for example, supporting working from home, introducing thin-client systems into the company, and creating a remote-access environment (which can be accessed from personal computers (PCs) carried out and about and from rental offices in membership-system Internet cafes).

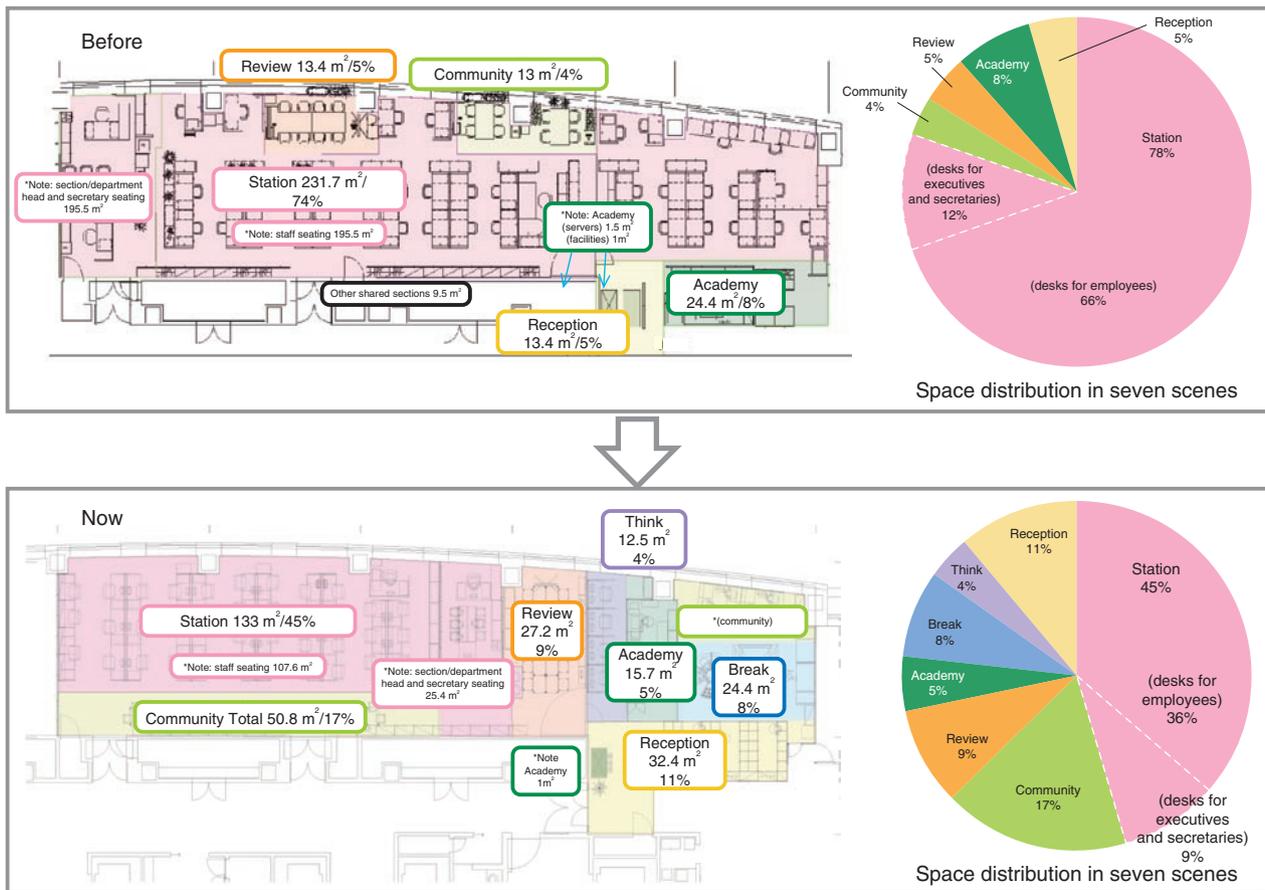


Fig. 4. Plans for transforming a model office.

Space		Tools	
<ul style="list-style-type: none"> • Construction work (floor, walls, ceiling, etc.) • Building utilities (lighting, air-conditioners, etc.) • Furniture and fixtures (desks, chairs, etc.) • Examination of number of established rooms (number of meeting rooms, etc.) 		<ul style="list-style-type: none"> • IT equipment (such as telephones, PCs, secure printers (i.e., printouts cannot be seen by unauthorized people), and remote-access tools) • Software and applications • Vending machines and coffee servers 	
Systems	Rules	Mood	
<ul style="list-style-type: none"> • Personnel-evaluation system • Labor-welfare system • Attendance management • Security policy 	<ul style="list-style-type: none"> • File-management rules • Facility-utilization rules • Coolbiz and Warmbiz 	<ul style="list-style-type: none"> • Abolishing conventional tiers of office hierarchy • Holding networking events • Dropping job titles (e.g., saying Mr. Smith instead of Department Chief Smith) 	

Fig. 5. Five schemes.

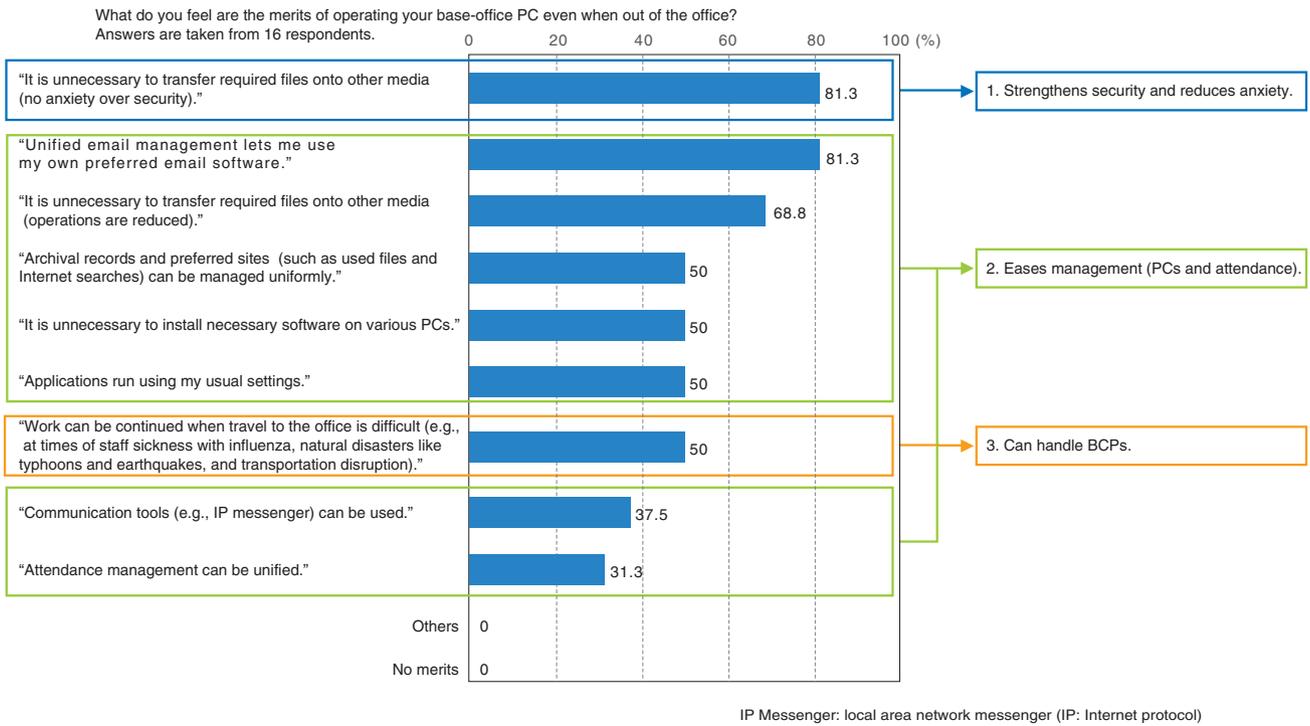


Fig. 6. Merits of remote access.

At what times do you use Desk@ (no. of respondents: 12)

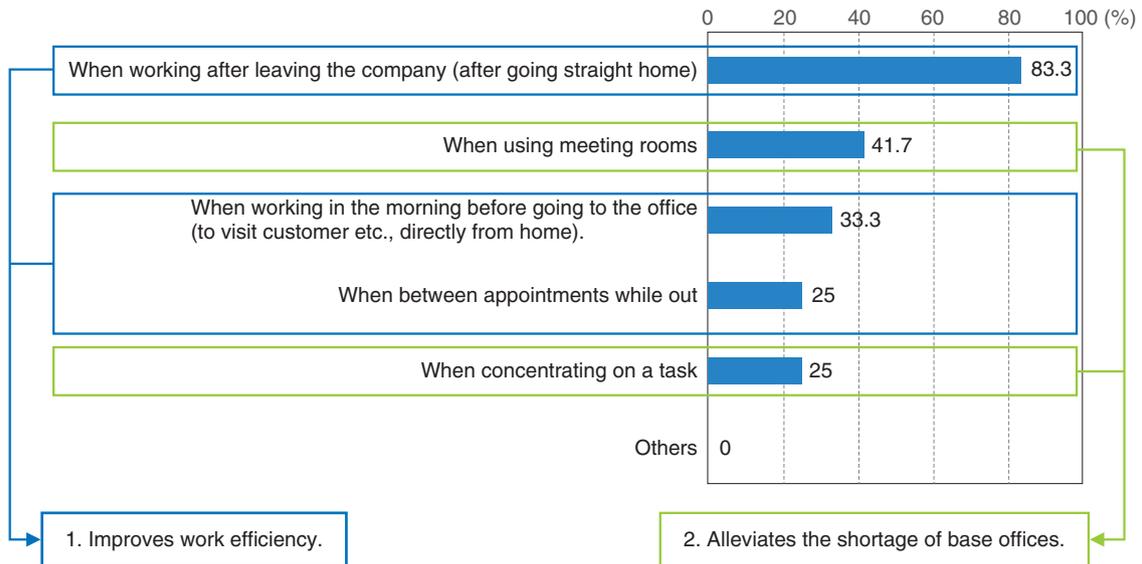


Fig. 7. Types of usage and effect of remote access.

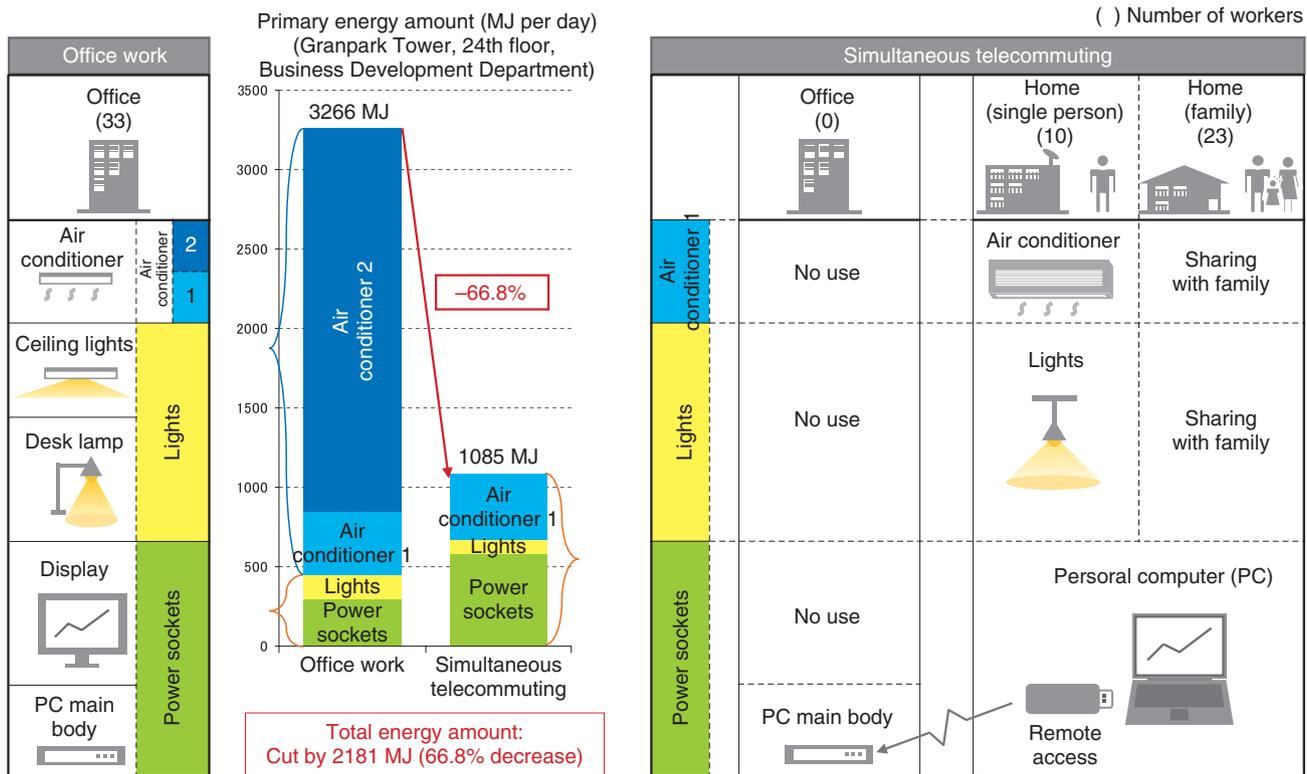


Fig. 8. Energy-saving effect of teleworking en masse.

At NTT Facilities, a ubiquitous office was set up, and a ubiquitous-office trial was performed to assess its effectiveness and gain experience (accumulate know-how). The effect of implementing the trial ubiquitous office (for the year 2010) was determined. In particular, the cost benefit of working outside the office (using the ubiquitous office) was calculated from the unit cost for labor. This calculation showed that the cost of travelling time was reduced by about 10,000 yen per business trip; travelling was made more efficient by about 20,000 yen per trip; and travelling expenses were cut by 500 yen per trip.

On top of these cost benefits, other benefits—such as reduced anxiety over security (by eliminating the need to carry data), unification of PC data, and correspondence with business continuity plans (BCPs) covering times of difficulty in getting to work—were mentioned by trial participants as merits of the ubiquitous office (Fig. 6). In addition, the results of analyzing the purposes for which a rented office (called Desk@) was used (usage scenes) not only showed the effects of making work more efficient (including use while out of the office), but also confirmed the effect of alleviating the shortage of base offices (such as

using Desk@ as a meeting room or place for work requiring concentration) (Fig. 7).

4. Telework and eco-offices

In recent years, businesses have been focusing their attention on environmental measures in the office; however, in response to power shortages resulting from the Great East Japan Earthquake (March 2011), they are once again focusing their attention on the importance of energy-saving measures. At NTT Facilities as well, we have been actively developing technologies and services for saving energy. The essential ingredients concerning these energy-saving efforts are thoroughness of energy management and establishment of an *eco-work style* by transforming our way of working. Eco-work style, defined as a style of working that is ecologically or environmentally friendly, is achieved through actively promoting telework and trying to make work more efficient through measures such as Japan’s Coolbiz and Warmbiz campaigns [3], paperless meetings, videoconferences, universal layouts, working from home, and mobile work.

5. Energy-saving effect of teleworking en masse

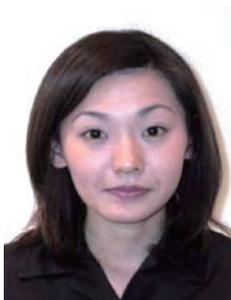
Implementing working from home (as one form of telework) en masse was calculated to be very effective in terms of energy savings in an office building. The calculated effect of such an implementation, assuming that one department (33 people) occupying the NTT Facilities head office (in Tokyo's Minato ward) implements teleworking in unison on one day in summer, is plotted in **Fig. 8**. If none of the staff of one department come to the office, it is possible to not turn on the air-conditioning, lighting, and some power sockets (for printers, vending machines, etc.) for an occupied space of 300 m². Although the workers use lights and air-conditioners in their homes and communication devices (including PCs) for accessing PCs in the base office, which are still turned on, the implementation would achieve a 66.8% decrease in the amount of primary energy [4] used. Moreover, implementing mass teleworking on a regular basis in this manner also helps BCPs by acting as practice for continuing business during times of crisis.

6. Future developments

From now on, to diversify specific support services for solving problems concerning offices through work-style diagnosis, we will continue actively implementing IT services (like telework) in offices. Moreover, by verifying the precise effect of this implementation while giving even more thought to office environments, we will continue to expand our integrated facility services which combine IT, energy, and architectural technologies by, for example, developing automatic control programs for building utilities and ensuring the consistency of IT-based visualization of energy savings.

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Telework Trends

Hiroshi Suzuki[†], *Chiaki Imaizumi*, and *Yukie Tachi*

Abstract

This article describes the benefits of telework as determined through trials and the challenges facing telework expansion efforts.

1. Introduction

Telework is a broad term, but it can be divided into several categories: telecommuting (i.e., working from home), mobile telework (i.e., work done while in transit to or at one's destination), and satellite-office work (i.e., work done in facilities other than one's home base). Alongside advances in information technology (IT), telework gained in popularity throughout the 2000s. In particular, since 2005, telecommuting has been getting more popular.

Under a commission from the Ministry of Health, Labour and Welfare, the Japan Telework Association has been operating telework consultation centers—where telework implementation plans are discussed—since 1999. The number of companies participating in consultations at these centers has increased rapidly since 2000.

In this article, we describe some telework implementations, the effects of these implementations, and the challenges faced in these examples (along with their respective solutions).

2. Telework popularization

The results of a survey on the number of people teleworking carried out by the Japanese Ministry of Land, Infrastructure, Transport and Tourism are shown in **Fig. 1** [1]. It is clear from this graph that the proportion of teleworkers has increased since 2000. In particular, the number in 2010 was over ten million, which corresponds to 16.5% of the Japanese employed workforce. That figure is much higher than expected. It includes people who spend more than

eight hours per week continuing their work on personal computers (PCs) at home after returning from work and people who send and receive emails from smartphones while out of the office. With many people working in this manner, it seems that, to a certain extent, telework has become acceptable.

The change in the number of companies in discussion with the telework consultation centers is plotted in **Fig. 2** [2]. The number that consulted in 2010 was ten times that in 2002. In particular, since the publications of the “Guidelines for Teleworking” by the Ministry of Health, Labour and Welfare and the “Telework Security Guidelines” by the Ministry of Internal Affairs and Communications in 2005, the rate of yearly increase has risen. It is clear from these survey results that telework is rapidly becoming popular in Japan.

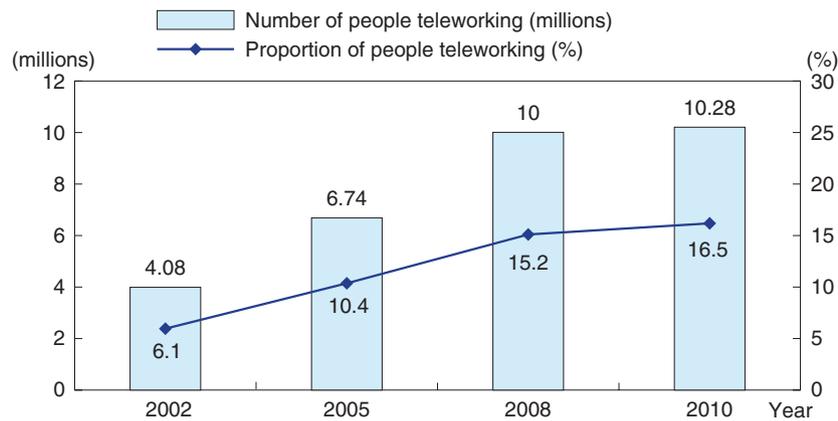
3. Telework implementation goals in companies

The goals of implementing telework in companies can be classified as follows.

(1) Improving work productivity

If telework were implemented in the sales field, then its effects would include dealing with enquires from customers more swiftly and increasing the time spent with customers by reducing time spent traveling. Moreover, if telework were implemented at a staff recruitment agency, work productivity would be improved because it would no longer be necessary to receive telephone calls and visitors or be interrupted by colleagues wanting to talk, so workers would be able to concentrate on their work.

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Source: "Field Survey of the Number of People Teleworking" by the Ministry of Land, Infrastructure, Transport and Tourism, Japan

Fig. 1. Trend in the number of people teleworking.

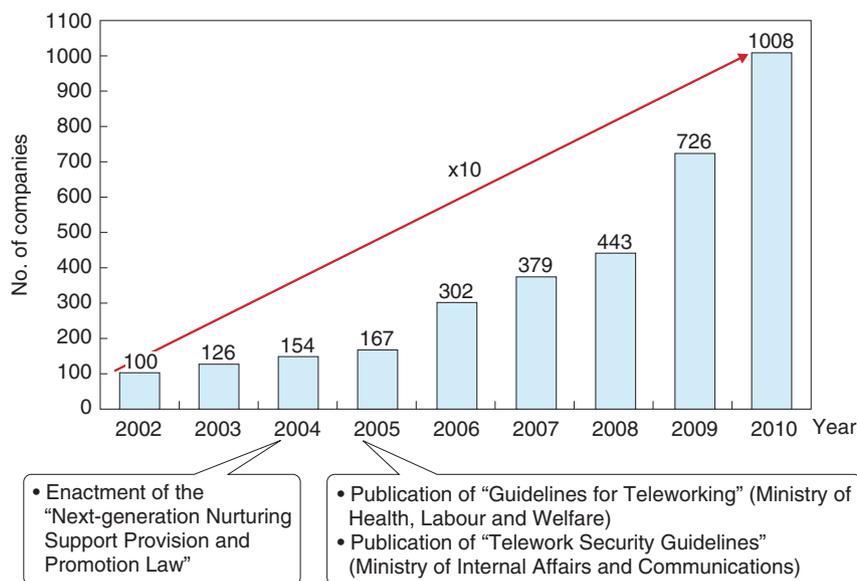


Fig. 2. Change of the number of companies in discussion with telework consultation centers.

(2) Transforming the consciousness of company employees

Transforming the way of working to one of being able to work anytime, anywhere is expected to, for example, *lighten the footwork of employees*, promote cooperation with other branches and other companies, and make it easier to get accurate information from frontline branches.

(3) Improving the work-life balance of company employees

By implementing telecommuting, a company can avoid valuable employees leaving to raise children or provide nursing care for elderly parents and it can employ people who have difficulty commuting by letting them work from home. From the viewpoint of ordinary company employees, telecommuting assures them of harmonious time with the family. Moreover, the creation of an environment in which it is easy to

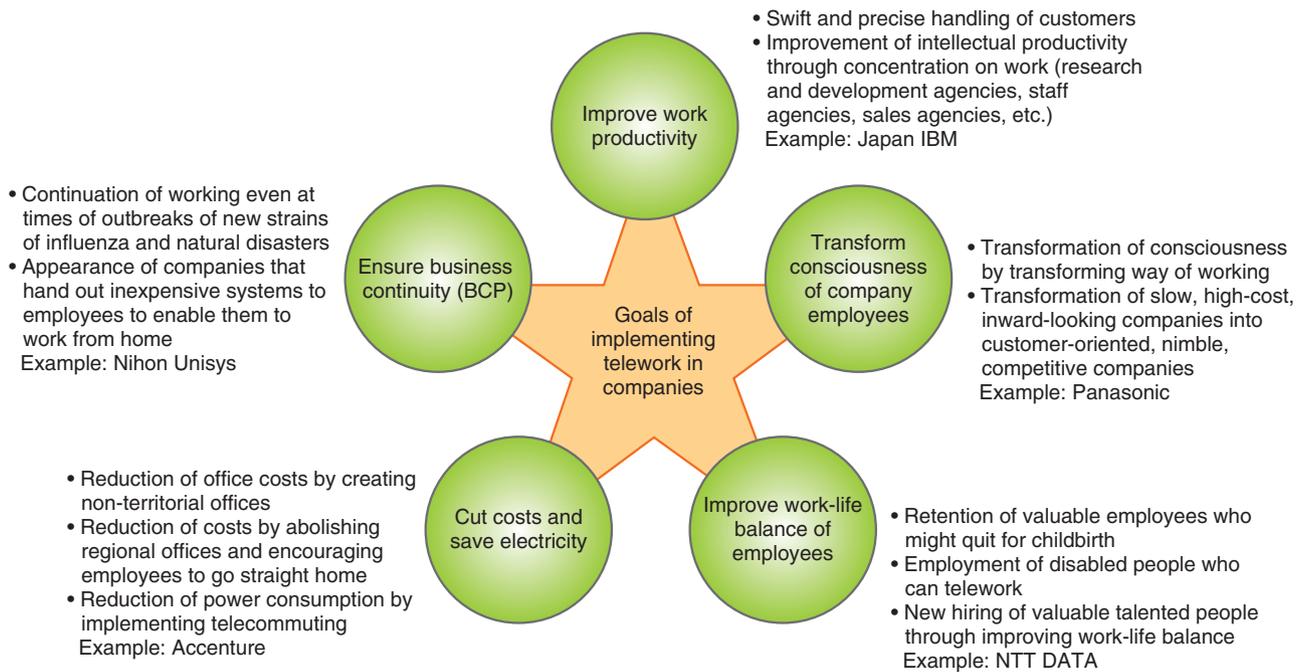


Fig. 3. Goals for implementing telework in companies.

work makes it easy to utilize valuable talented people.

(4) Saving electricity and reducing costs

In conjunction with telework implementations, reductions in office-related costs such as office rental fees and electricity bills become possible if offices are turned into non-territorial offices* and, in turn, electricity can be saved. Moreover, at times of power-supply shortages, working from home enables significant power savings to be achieved by telecommuting implemented on the basis of entire building floors or company departments. According to a calculation by the Japan Telework Society, a power saving of 1 kW per person can be achieved by implementing telecommuting. In other words, the power-saving effect of one million people becoming telecommuters is equivalent to one whole nuclear power station.

(5) Ensuring business continuity

In the event of a natural disaster or pandemic outbreak (such as new strains of influenza), telecommuting is also effective. If people work from home on a

* A non-territorial office (also known as a non-territorial workspace) is one in which workers do not have their own particular desk or office space but share all the workspaces with their co-workers.

regular basis, it becomes possible to comply with business continuity plans (BCPs), which ensure that business continues even at times of emergencies, through telecommuting. Thanks to many companies implementing teleworking, business continued without major difficulties even after the Great East Japan Earthquake in 2011.

4. Telework implementation examples

Every year, the Japan Telework Association publicly recognizes leading companies involved in telework with their Telework Promotion Award. Telework implementations at five of the companies that have received this award are described below as examples (Fig. 3).

(1) Implementation aimed at improving work productivity: Japan IBM

Aiming to increase the amount of time available for interviews with customers, Japan IBM has been introducing mobile offices—targeting salespersons and systems engineers—since 1997 and increasing the movement efficiency of sales departments. Furthermore, since 2005, a system called on-demand work style has been expanded to cover 5000 people. A base office is an organization that sets up a non-

territorial office while creating an environment in which telework is possible anytime anywhere by means of implementing satellite offices and telecommuting. As for the effects of these implementations, the following results have been reported: (i) customer-consultation time increased by 30% (by decreasing transit time and the time taken to get to the office to do paperwork), (ii) the time needed for information processing decreased by 50% (through timely information sharing), and (iii) office space costs decreased by 30%.

(2) Implementation aimed at transforming consciousness of company employees: Panasonic

Panasonic implemented a system called e-Work on a test basis in 2006 and has been expanding this system (which now covers 30,000 employees) on a full-time basis since 2007. This telework implementation was aimed at transforming the company from an inward-looking, sluggish, and high-cost one into a customer-oriented, nimble, and competitive one. The system features telecommuting, mobile work, *spot offices*, and non-territorial offices.

At Panasonic, to get this system up and running, a body called the e-Work Promotion Office, which played the role of coordinating e-Work throughout the whole company, was set up, and an e-Work Promotion Committee was established. Moreover, the company's senior management fully supported telework through e-Work, and under direct control of the chief executive, the e-Work Promotion Office assigned a director in charge of e-Work. At present, e-Work is widely utilized (i.e., 5500 people per month use it for telecommuting and 9000 people per month use the spot-office function), and it is successfully meeting the desired aim.

(3) Implementation aimed at improving work-life balance of company employees: NTT DATA

At NTT DATA, as one of a number of working groups established to transform the behavior of employees, a working group focused on improving the work-life balance of female employees with young children was set up in 2005. The group's activities, which were approved by senior management, led to telework being implemented from the bottom up. Teleworking for female employees was introduced as an experiment in 2005, telework trials started in 2006, and full implementation officially started in 2008. The target of this telework, which covered almost all of the company's staff (both male and female workers), was to eliminate one section.

Among the achievements attributed to telework, it was reported that the sense of burden concerning childcare for women was reduced by 82% and that their autonomous, self-managed way of working was improved by 77%. Moreover, earnest voices saying that "Without this system, I would have had to quit the company" were heard from female employees with childcare responsibilities. After the Great East Japan Earthquake, the number of people teleworking from home increased threefold.

(4) Implementation aimed at cutting costs: Accenture Japan, Ltd.

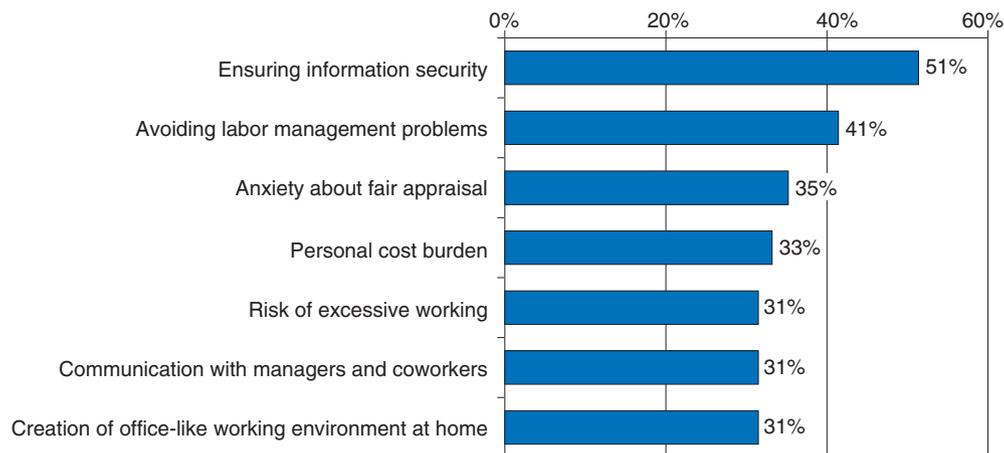
Accenture Japan Ltd. developed a telework program aimed at cutting costs and creating a new way of working for the next generation. The program's target was about 400 members of the administration staff working at the head office. The trigger for the program was relocation from the Aoyama office in Tokyo to the Minato-Mirai office in Yokohama. Employees living in the Tokyo, Chiba prefecture, and Saitama prefecture faced longer commuting times, so in response, it was decided to let those employees telework from home on one or two days per week. As a result, the core office space taken up by those employees was reduced, and non-territorial offices were set up.

The results of this telework program are summarized as follows. Space was saved in anticipation that the users telecommuting from home would be 50% of the targeted employees; this led to annual savings of about 1.5 million yen. Furthermore, a comparison of overtime before and after the implementation of the telework system showed that overtime was cut by 8.5 hours per person per week (on average). One factor resulting in this cut in overtime is thought to be teleworkers being able to work without distraction.

(5) Implementation with secondary aim of ensuring business continuity: Nihon Unisys, Ltd.

In 2007, Nihon Unisys, Ltd. implemented a telecommuting system aimed at improving work productivity and giving workers a good work-life balance. In 2008, as part of the company's BCP measures, a system (called SASTIK) for creating a thin-client environment for transferring screen images was distributed to all company employees. As a BCP measure implemented by Nihon Unisys, Ltd. after the Great East Japan Earthquake, telecommuting brought the following three benefits.

- 1) Company employees working at home on the day the earthquake struck were greatly relieved



Source: "Report on Survey about Trial Implementation of Sharing System" by the Ministry of Health Labour and Welfare, Japan

Fig. 4. Challenges facing telework implementation.

because they could pick up their children from kindergartens and schools.

- 2) After confirming the safety of their homes after the earthquake, these employees were able to continue working.
- 3) In the week following the earthquake, many employees were able to work at their regular time via SASTIK.

In addition to the above benefits, utilizing SASTIK served as an energy-saving measure: in the non-territorial offices, although alternate rows of ceiling lights were switched off, workers moved nearer to windows or under switched-on lights.

5. Challenges facing telework implementation

Although telework has brought the broad range of benefits described above, telework implementation faces seven remaining challenges. The results of a questionnaire concerning trials of a collaborative-use telework system given by the Ministry of Internal Affairs and Communications and the Ministry of Health, Labour and Welfare are shown graphically in Fig. 4 [3].

The first challenge is to ensure information security. Since enforcement of the Personal Information Protection Law in 2005, many companies have experienced losing PCs, and as a result, taking PCs outside the company has become prohibited. At present, however, cloud systems as well as inexpensive systems enabling work in a virtual thin-client environment have become widespread. Consequently, the chal-

lenges facing information-security measures have constantly evolved, so new ones have had to be overcome.

The second challenge is labor management. In 2005, "Guidelines for Teleworking" by the Ministry of Health, Labour and Welfare were published, and several points to keep in mind regarding labor management of teleworkers became explicit. These guidelines clearly state ways of handling labor management issues. In the case of mobile work, it is considered that labor management can be applied to employees working away from the office.

The third challenge concerns appraisal systems. Although circumstances are different if a worker is working at home every day, telecommuting systems in Japan are mostly designed for telework on one or two days a week. In that case, existing appraisal systems can be applied without any problems. Since mobile work is the main work style in the sales and systems engineering fields, there is no need to change their systems.

The fourth challenge is the personal cost burden. Although each company handles the matter differently, the cost of heating and lighting the home while a teleworker is working there can be something of a burden. However, workers perform their telework knowing that they can file a claim for business expenses to cover those costs. Although it is not really a merit for such teleworkers, people who telework for only one or two days a week should find that the burden is not too much to bear.

The fifth challenge is the possibility of being caught

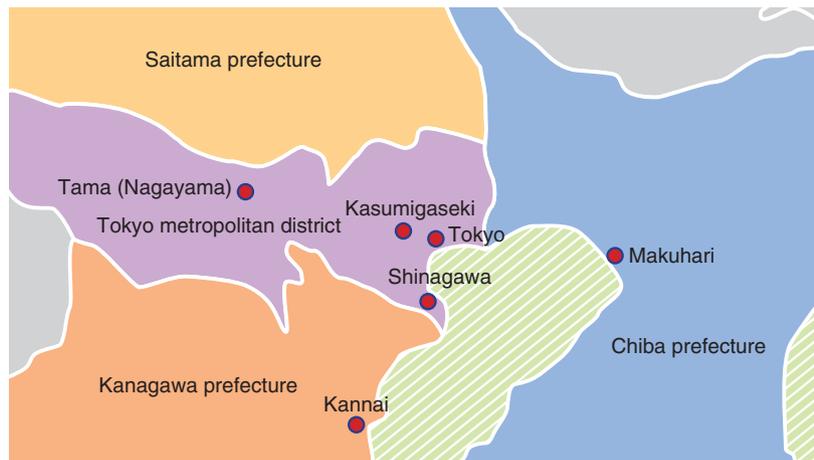


Fig. 5. Locations of telework centers.

up in working excessively. However, a number of past business cases demonstrate that working without interruption makes it possible to complete work in a shorter time and that the trend in working hours is downward. If starting and finishing times for telework are set in advance, prolonged working will probably not become a major problem.

The sixth challenge is communication with the manager and co-workers. This challenge will probably not become a significant problem in the case of telework on one or two days a week. However, it is hoped that burdens such as a teleworker having to take calls from people at the office can be alleviated by means such as automatic call transfer.

The seventh challenge is to create an office-like environment in the home. Although it is hoped that telework can be done, as much as possible, in a private room, there are likely to be many problems because of the cramped housing in the Tokyo metropolitan area. It is thus necessary to get the rest of the family to understand that they should do their best to refrain from interrupting the teleworker.

As described above, most of the challenges associated with telework have been addressed. As for the seventh challenge (concerning an office-like environment in the home), however, there are cases in which solutions are difficult despite all efforts. Some of the successful solutions are described below.

6. Public trials at telework centers

As part of a project from the Ministry of Land, Infrastructure, Transport and Tourism, the Japan Telework Association has established telework centers at six locations in the Tokyo metropolitan area and is presently conducting telework trials. The aim of these trials is to understand the necessary conditions for expanding the telework centers across Japan. As shown in **Fig. 5**, functioning as facilities for mobile work in the city, telework centers have been set up in three locations in the city (Tokyo, Kasumigaseki, and Shinagawa), and functioning as facilities for supplementing telecommuting in the suburbs, telework centers have been set up in three locations in the suburbs of Tokyo (Tama (Nagayama), Kannai, and Makuhari). These telework centers were opened between October 2011 and the end of January 2012. The targets of these telework centers—which do not charge any usage fees—are SOHO (small office, home office) workers and employees of companies that have already implemented teleworking or are conducting telework trials. It is hoped that everyone will make good use of the telework centers and evaluate them in terms of convenience.

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Spectrum Suppressed Transmission Scheme for Higher Frequency Utilization Efficiency

Jun Mashino[†] and Takatoshi Sugiyama

Abstract

In this article, we introduce a spectrum suppressed transmission scheme as one of the most promising technologies for increasing frequency utilization efficiency in order to overcome the shortage of frequency resources experienced by various wireless systems. It should provide simultaneous frequency sharing among multiple wireless communication systems.

1. Introduction

Higher transmission speeds are needed for wireless communication systems to support rich communication applications. However, the popularity of various wireless systems has led to a shortage of frequency resources, which is becoming a severe problem and affecting the introduction of new wireless systems and the spread of wireless equipment. An example of conventional frequency allocation is shown in **Fig. 1**. This method assigns dedicated frequency bandwidth for each wireless system and also provides a frequency guard band between the systems to prevent mutual interference. However, demand for wireless communication systems will exceed their capacity because of the high demand for wireless data traffic and the lack of frequency resources. Therefore, NTT Access Network Service Systems Laboratories is considering the need for simultaneous frequency sharing among various wireless communication systems in the near future.

Trials of frequency sharing among wireless communication systems have already been started. For example, the 2.4-GHz frequency band, designated as the industrial, scientific, and medical (ISM) band, which is license-free, is used by lots of electronic hardware including Wi-Fi devices and microwave

ovens. But existing frequency sharing methods are based on collision avoidance as typified by CSMA/CA (carrier sense multiple access/collision avoidance), so a system must wait to transmit signals while other systems are transmitting. They just use a form of separation in time for wireless systems using the same frequency band. Frequency-band sharing at the same time and same location is what is required in order to solve the frequency shortage problem fundamentally.

2. Spectrum suppressed transmission scheme

NTT Access Network Service Systems Laboratories is developing a spectrum suppressed transmission scheme as one of the key technologies for achieving frequency sharing among various wireless communication systems [1]. The scheme's frequency allocation for two wireless communication systems is shown in **Fig. 2**. It allows spectra to overlap in the frequency domain so that the total occupied bandwidth (f'_{all}) is narrower than that in the conventional frequency allocation method (f_{all}). The transmission bit rate is maintained because the wireless interfaces, including the symbol rate and modulation type, are not changed at all. Thus, the frequency utilization efficiency is increased because the total occupied bandwidth is narrower for the same transmission bit rate.

However, the communication quality could be

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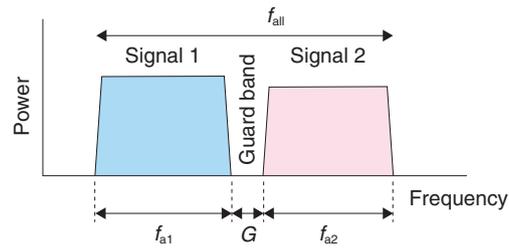


Fig. 1. Conventional frequency allocation.

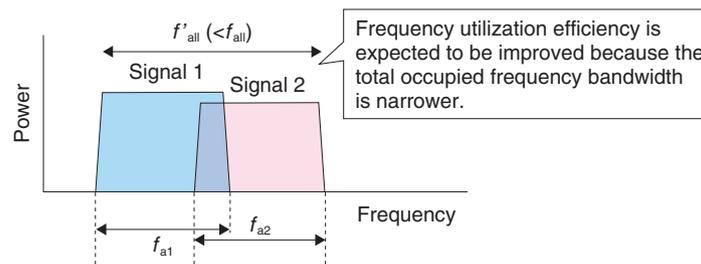


Fig. 2. New frequency allocation.

degraded by mutual radio interference in the overlapped frequency bandwidth. To address this problem, we have devised an interference suppression technique suitable for wireless transmitters and receivers [2]. The following sections describe the processing in detail and present results for an evaluation of the increase in frequency utilization efficiency.

3. Spectrum suppression technology

In this section, we introduce our spectrum suppression technique for multicarrier signaling. Here, we assume that orthogonal frequency division multiplexing (OFDM) is used for the multicarrier signaling. OFDM, which transmits data in parallel on multiple subcarriers, has recently begun to be used in various high-speed mobile communication systems including Wi-Fi, WiMAX (Worldwide Interoperability for Microwave Access), and LTE (Long Term Evolution), owing to its high frequency utilization efficiency and tolerance to multipath fading. These OFDM systems normally use forward error correction (FEC) coding/decoding to improve communication quality in wireless environments that have a high error rate, as shown in **Fig. 3**. This is called COFDM (coded OFDM).

3.1 Spectrum suppression at the transmitter

Our scheme suppresses the overlap frequency bandwidth before transmission to achieve simultaneous frequency sharing without radio interference (**Fig. 4**). Although it is achieved by passing the signal through a filter, it could also be easily achieved by setting the transmission power of particular subcarriers to zero when OFDM is used. Note that suppression rate α is defined as the ratio of the suppressed bandwidth to the bandwidth originally used by the signal. The transmission bit rate can be kept at that of the non-suppressed signal while some of the subcarriers are suppressed.

3.2 Spectrum suppression at the receiver

In the FEC decoder, some information called likelihood, which reflects whether a transmitted binary digit (bit) is more likely to be 0 or 1, is used for error correction processing. The likelihood is calculated in the subcarrier demodulation process. When the log-likelihood ratio (LLR) is used as the likelihood metric, a larger absolute value is assigned to received bits on subcarriers whose reception power is higher. Similarly, a smaller absolute value is assigned to bits on lower-power subcarriers. Positive and negative values correspond to whether the bit is more likely to be 0 or 1. The proper likelihood for the suppressed

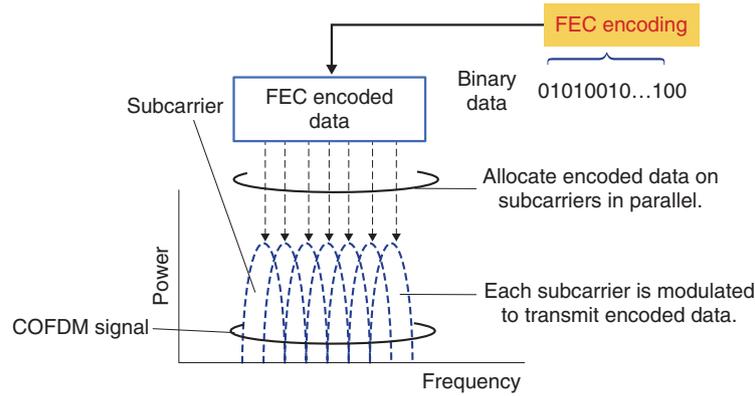


Fig. 3. COFDM signal.

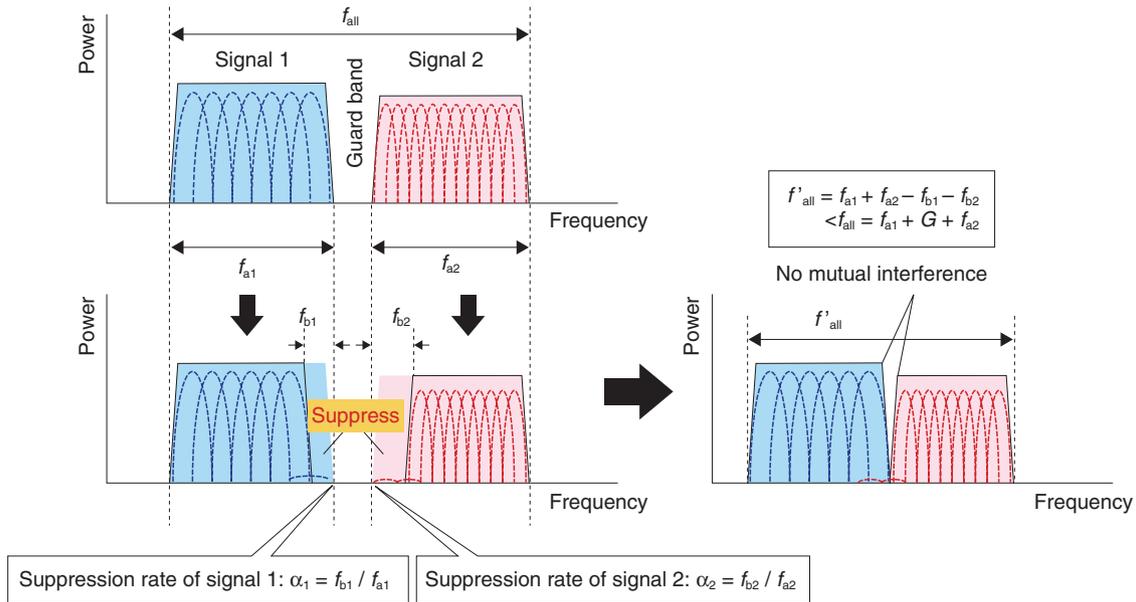


Fig. 4. Narrowing of the occupied bandwidth by spectrum suppression at the transmitter.

subcarriers has an extremely low absolute value because no information is transmitted on suppressed subcarriers. Unfortunately, when the reception power of an interference signal is relatively high, the likelihood for suppressed subcarriers is calculated as a large absolute value, as shown in **Fig. 5**. This results in wrong error correction and causes degradation in the reception performance.

To overcome this problem, we implement FEC metric masking in the receiver. This technique simply replaces the likelihood for suppressed subcarriers by a neutral value. If LLR is used, the replacement is

equivalent to setting the likelihood to zero. This simple technique can assist in achieving appropriate FEC decoding that suppresses arbitrary adjacently received signals. Since all functions other than the FEC metric masking are the same as in a conventional OFDM receiver, implementation is easy. Note that similar processing could be done by passing the signals through a filter that suppresses interference signals.

4. Evaluation

We evaluated the reception performance and

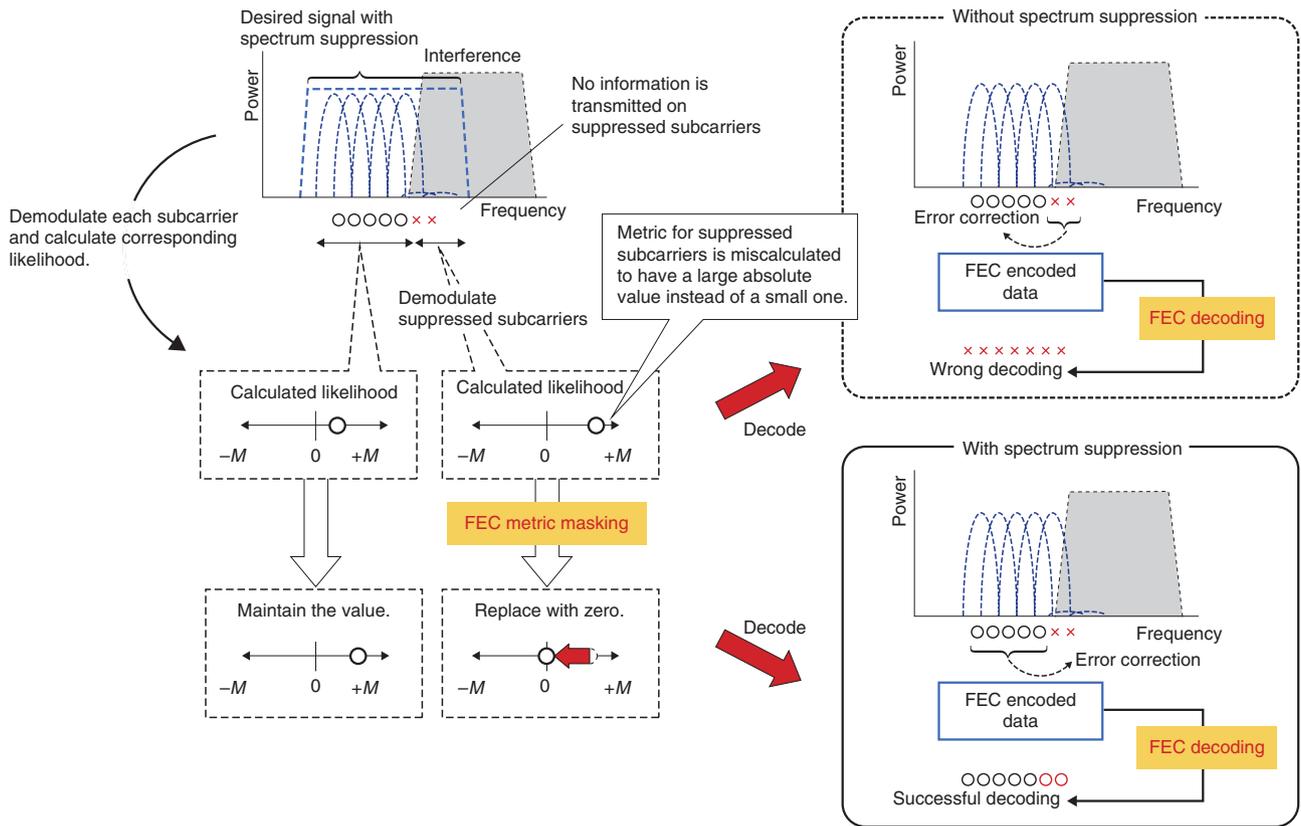


Fig. 5. Appropriate error correction performed by spectrum suppression at the receiver.

Table 1. Simulation parameters.

1st modulation	QPSK, 16QAM, 64QAM (adaptive)
2nd modulation	OFDM (851 subcarriers)
Subcarrier spacing	10.94 kHz
FEC coding	Convolutional turbo coding
FEC rate	1/2, 3/4 (adaptive)

frequency utilization efficiency by computer simulation. Major simulation parameters are listed in **Table 1**. They all conform to Mobile WiMAX [3].

The block error rate (BLER) versus suppression rate α is shown in **Fig. 6**. FEC metric masking on the suppressed subcarriers greatly improved the performance during spectrum suppression adaptation. For an assumed target BLER of 10^{-1} , our scheme achieved a maximum tolerable suppression rate of 38% for QPSK 1/2 and 15% for 64QAM 3/4 compared with 27% for QPSK and 0% for 64QAM 3/4 without this

scheme (QPSK: quadrature phase shift keying; 64QAM: 64-state quadrature amplitude modulation; 1/2, 3/4: coding rates, i.e., the number of bits per symbol). This is a remarkable increase in simultaneous frequency sharing.

The frequency utilization efficiency versus suppression rate α is shown in **Fig. 7**. The frequency utilization efficiency is defined as the transmission bit rate that can be achieved within the total bandwidth (f_{all}) occupied by two signals. Note that the suppression rates of the two signals are the same for simplicity ($\alpha = \alpha_1 = \alpha_2$). Without spectrum suppression, the frequency utilization efficiency is greatly degraded, especially when α is more than 15%. This is because the likelihood for suppressed subcarriers is miscalculated, as mentioned above. On the other hand, with our spectrum suppression technique, the frequency utilization efficiency increases as α increases. Note that the staircase pattern of the performance line is caused by changes in modulation order or FEC coding rate for adaptive modulation and coding. When α is less than 15%, our scheme with

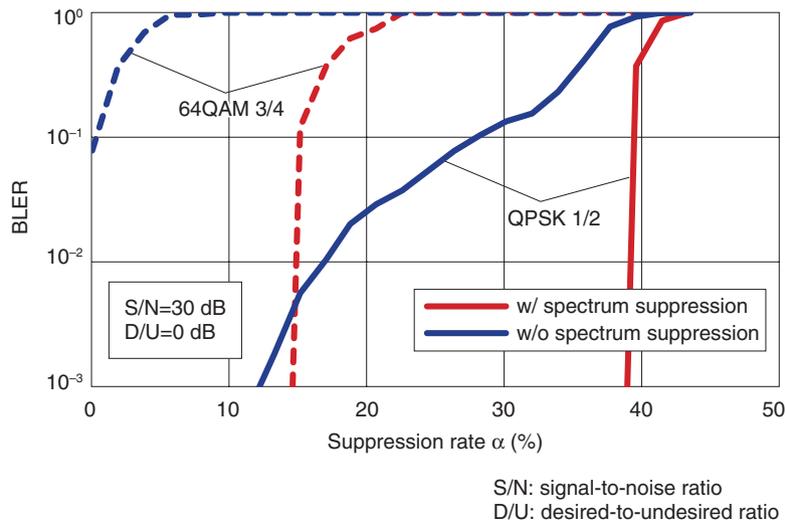


Fig. 6. BLER characteristics.

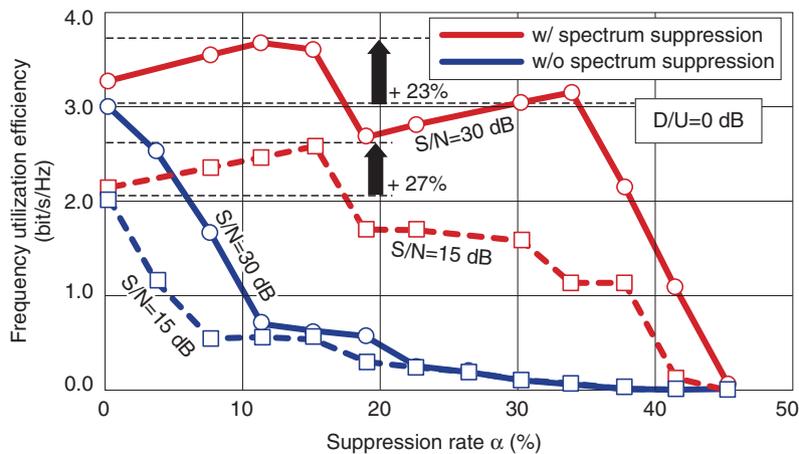


Fig. 7. Frequency utilization efficiency.

spectrum suppression can achieve higher frequency utilization efficiency than the conventional scheme, which does not share frequency resources at all ($\alpha=0\%$). The maximum improvement ratio is more than 20%. Note that the performance difference when $\alpha=0\%$ is also due to spectrum suppression, which can suppress the sidelobe of the adjacent signal.

5. Conclusion

This article explained our spectrum suppressed transmission scheme, which increases frequency utilization efficiency. It also introduced FEC metric masking, which can improve reception performance.

Computer simulation verified that using these two techniques can raise frequency utilization efficiency to about 20%.

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Content Delivery Networks Interconnection Standardization Activities in IETF

Takeshi Kuwahara[†]

Abstract

This article overviews the activities of CDNi-WG (Content Delivery Networks interconnection—Working Group), which was established in 2011 by the Internet Engineering Task Force (IETF) to provide the standard for CDN interconnection.

1. Introduction

To support the recent growing demand for streaming services on Internet protocol (IP) networks, various standards developing organizations are conducting standardization activities for content delivery network (CDN) technologies. The Internet Engineering Task Force (IETF), which is a large open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet, formed a Working Group (WG) on CDN interconnection called CDNi-WG [1]. This WG was officially established in 2011 at the 81st meeting of the IETF in Quebec City, Canada. Its purpose is to define protocol for CDN interconnection. The IETF is divided into eight functional areas: CDNi-WG is in the Transport Area, which covers protocol standards related to the transmission of streams of data over the Internet. The activities of CDNi-WG are overviewed below.

2. Demand for CDN interconnection

In the broad sense, a CDN represents a particularly optimized network coverage layer for delivering content. CDNs were originally designed to improve network and web server performance (or cost) as well to

eliminate network delays by placing web servers at distributed locations and redirecting a user's request to these distribution points according to the user's location. This enables a CDN to deliver content to a large number of users effectively.

Along with the recent widespread of digital content such as streaming video delivered over IP networks, CDN service providers are extending the scope of their business. In addition, Internet service providers, telecommunications carriers, and even enterprises are building their own CDNs. If these individual CDNs were interconnected, the scope of their services could be expanded without the CDNs themselves being extended.

An example of CDN interconnection between two CDN providers (CDN A and CDN B) located in two different countries is illustrated in **Fig. 1**. CDN interconnection enables CDN A to deliver content held within country A to end users in country B by forming a business alliance with CDN B.

Recently, telecommunications carriers providing various services in a particular geographic area have established their own CDNs in order to provide digital services such as IPTV (Internet protocol television). However, CDN interconnection of multiple carriers lets carriers expand their service areas without further investment in their own networks.

Meanwhile, content service providers obviously face huge demand for providing more people with their own contents. One of the advantages of CDN interconnection for content service providers is that it

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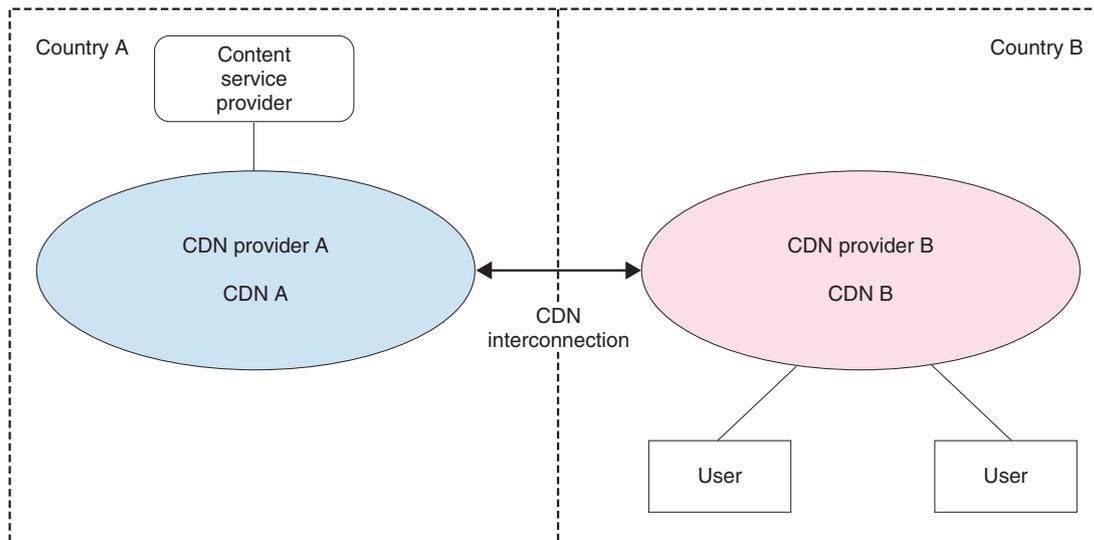


Fig. 1. CDN interconnection: Use case 1.

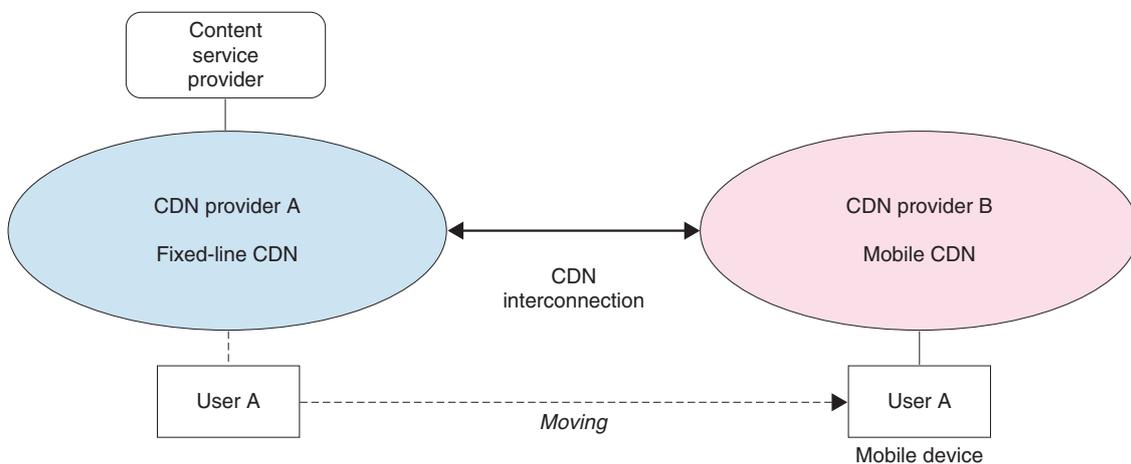


Fig. 2. CDN interconnection: Use case 2.

enables them to increase their number of users without forming business alliances with multiple CDN providers.

Another use case illustrating mobility support known as “TV Everywhere” is shown in **Fig. 2**. As is often the case with end users in a fixed network, subscribed users can access the same content seen at home when outside the home on their smartphones or tablets. In this case, CDN interconnection between the fixed-line CDN and the mobile CDN enables them to view the content as if they were at home. CDNi-WG is currently working on various use cases,

including temporary load distribution.

As described above, CDN interconnection provides benefits to CDN service providers as well as advantages to end users. However, since legacy CDNs were implemented using proprietary technology, there has not been any support for an open interface for connecting with other CDNs. Even though several CDNs could be interconnected, it was still difficult to achieve interconnection in the way that met operational requirements such as being able to exchange billing information. CDNi-WG is aggressively pursuing solutions to these problems.

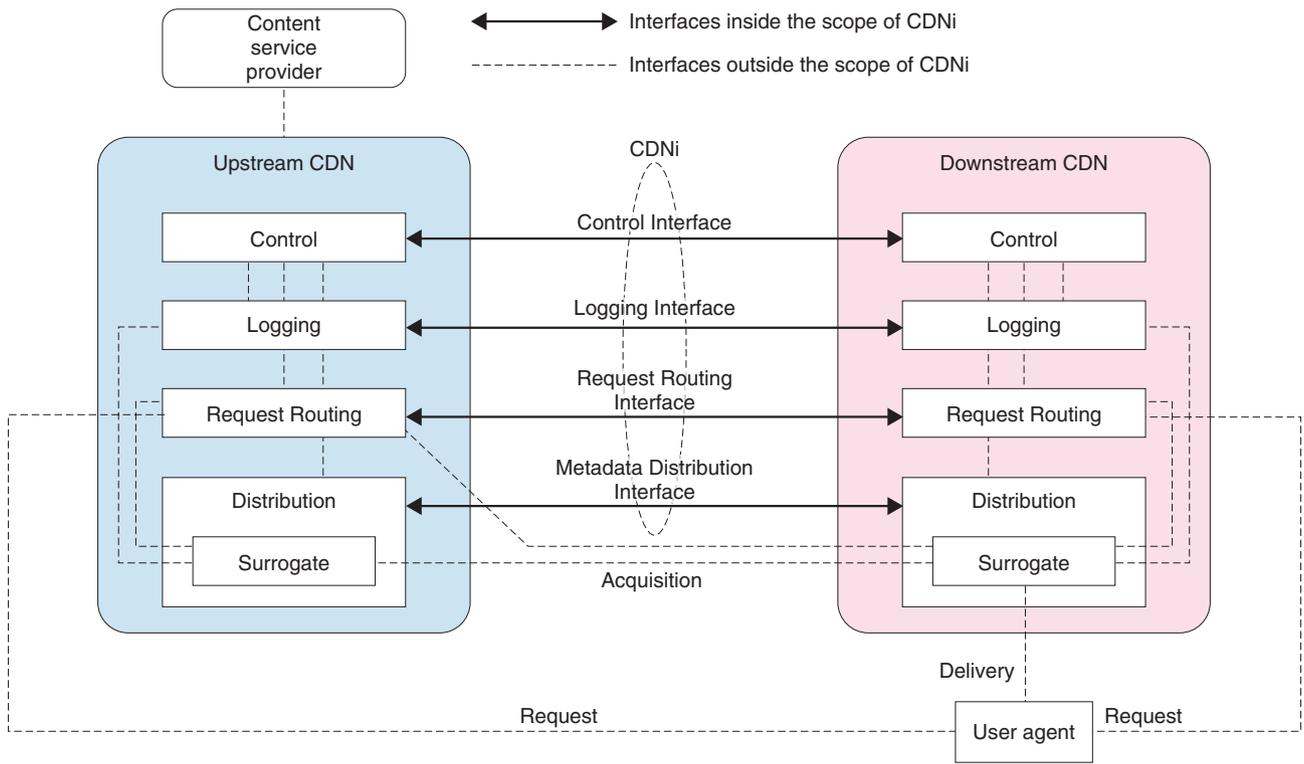


Fig. 3. Scope of CDNi.

3. Scope of CDNi-WG

The scope of current discussions in CDNi-WG is shown in Fig. 3 [2]. It models two CDN providers, interconnected between a content service provider and a user agent, providing CDN service. CDNi-WG is focusing mainly on the interfaces between CDNs, in particular, the interfaces between four fundamental functionalities:

- (1) **Control Interface:** This interface allows the basic CDN control systems in interconnected CDNs to communicate.
- (2) **Logging Interface:** This interface allows the logging systems in interconnected CDNs to communicate to exchange relevant activity logs in order to meet operational requirements such as billing.
- (3) **Request Routing Interface:** This interface allows the request routing systems in interconnected CDNs to communicate to ensure that an end user's request can be redirected from an upstream CDN to a surrogate in the downstream CDN.
- (4) **Metadata Distribution Interface:** This interface

allows the distribution system in interconnected CDNs to communicate to exchange information about content management.

Other interfaces including ones for content acquisition between interconnected CDNs are out of the scope of CDNi-WG. The reason of such a decision is that those interfaces in today's CDNs typically use standardized protocols: consequently CDNi-WG will focus on the control plane between interconnected CDNs.

4. Milestones of CDNi-WG

At the moment, CDN service providers, consisting of telecommunications carriers and cable operators, as well as CDN-related vendors are involved in discussions mainly via email lists. There is one upcoming milestone for CDNi-WG. By June 2012, this WG will finalize four informational documents: the problem statement, use cases, requirements, and framework. The WG will continue to work to define the specifications of three of the interfaces (Control, Logging, and Request Routing) by December 2012 and of the fourth (Metadata Distribution) by June 2013.

5. Conclusion

This article gave an overview of the activities of CDNI-WG, which has recently been established in the IETF. Standardization activities related to CDN interconnection will continue to be addressed in IETF with liaison among various standards developing organizations such as ETSI (European Telecommunication Standards Institute) in Europe and ATIS (Alli-

ance for Telecommunications Industry Solutions) in North America.

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NTT DATA (CHINA)

Presence and Service Offerings of NTT DATA in China

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NTT DATA (CHINA) Co. Ltd.*

Abstract

NTT DATA (CHINA) Co. Ltd., reorganized and headquartered in Beijing as the regional headquarters for China, provides consulting, system implementation, and maintenance services for local Chinese clients and global clients in China along with other companies in the NTT DATA Group throughout mainland China. In this article, we would like to give readers a comprehensive look at NTT DATA (CHINA)'s capabilities and services.



1. Overview of NTT DATA (CHINA)

1.1 Presence of NTT DATA in China

NTT DATA has had a presence in China since 1995. It has 15 entities (mainly shown as **Fig. 1**) with major capital that employ approximately 4000 people, or over 20 entities if minor-capital ones are included. It also has significant presence in 12 cities in mainland China covering Northeast China, North China, East China, South China, and Central China (**Fig. 2**).

1.2 Overview of NTT DATA (CHINA)

NTT DATA (CHINA) Co. Ltd., the regional headquarters (RHQ) for China, is located in Beijing (**Fig. 3**). It was formed in December 2011 through the reorganization of the RHQ with the former NTT

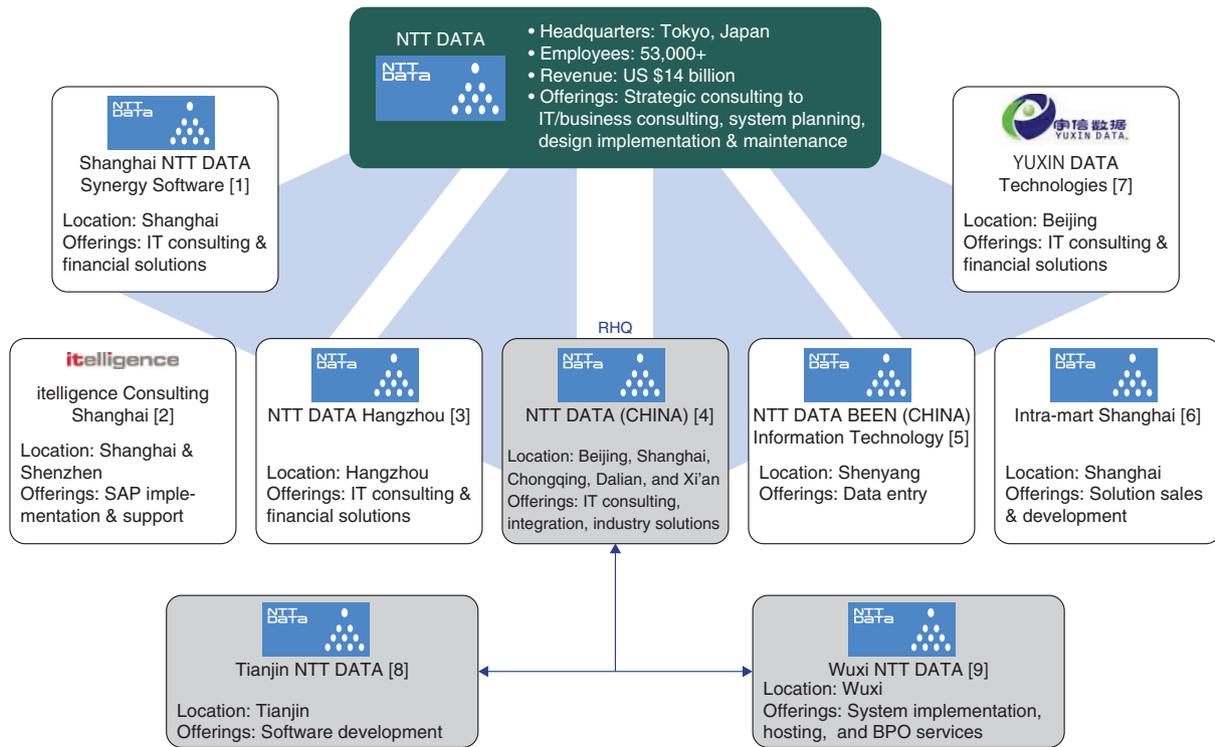
DATA (CHINA) and Beijing NTT DATA, and Fumio Kanda was appointed as its Chief executive officer (CEO). The company name is currently still Beijing NTT DATA Systems Integration Co. Ltd., but it will officially change to NTT DATA (CHINA) Co. Ltd. in March 2012.

The purpose of the reorganization was to enhance presence and capabilities for the local Chinese information technology (IT) market and consolidate the human resource pool for offshore development by enhancing the governance of all entities in China.

1.3 Corporate roadmap for NTT DATA (CHINA)

Since 1995, NTT DATA (CHINA) has been gaining experience by growing from serving local Chinese business individually to providing offshore software development for Japanese clients.

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BPO: business process outsourcing
SAP implementation: implementation of software provided by the company SAP

Fig. 1. Major capital entities of NTT DATA in mainland China.



Fig. 2. NTT DATA's presence in mainland China.



Fig. 3. NTT DATA (CHINA).

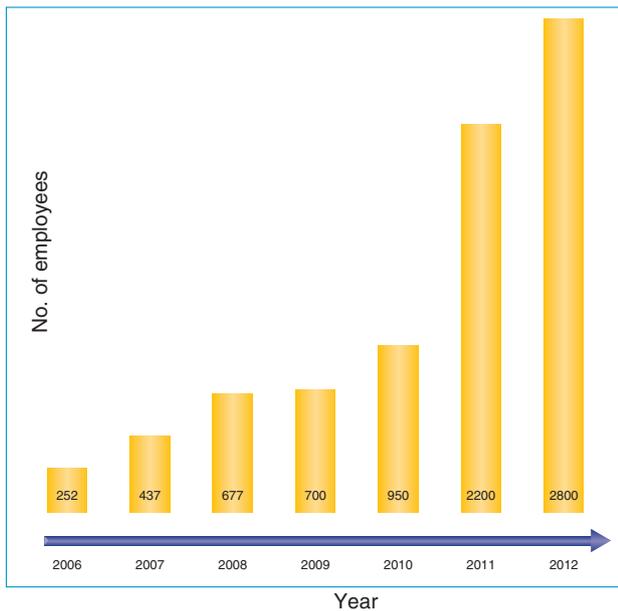
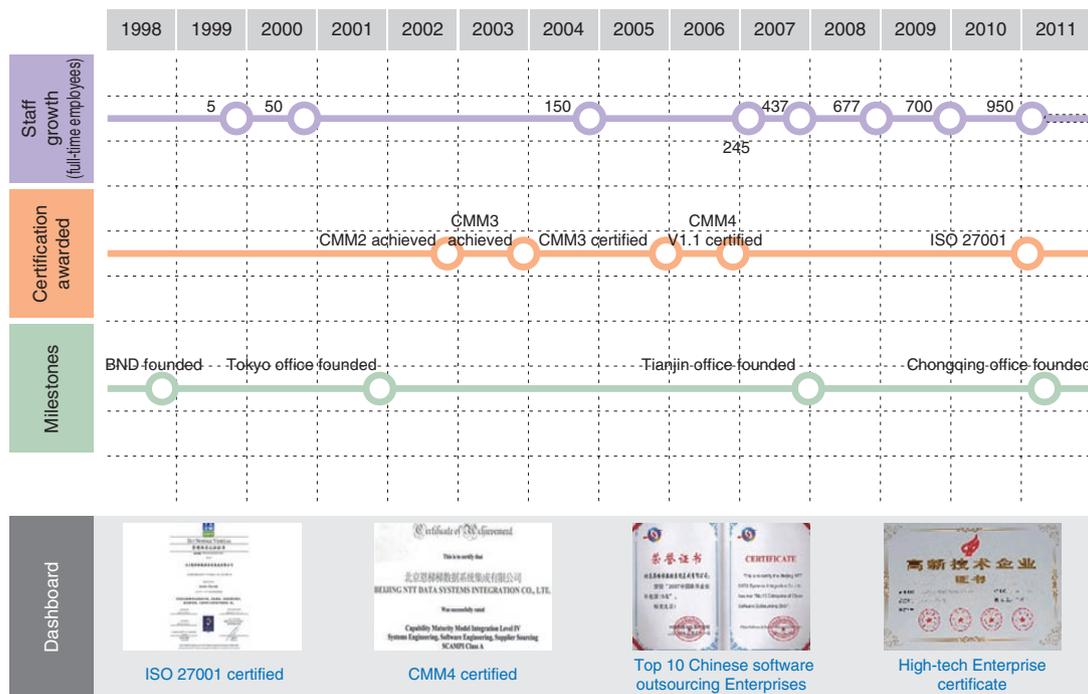


Fig. 4. Growth of NTT DATA (CHINA)'s resources.

To ensure adequate resources for ongoing projects while still keeping enough in reserve, it has been increasing its number of full-time employees by continuously recruiting (Fig. 4), establishing subsidiaries, conducting mergers and acquisitions, and maintaining tight relationships with strategic partners.

Training in technical knowledge and skills, foreign languages (Japanese and English), industry and domain knowledge, and project management is planned and implemented with high priority. CMM/CMMI (capability maturity model, capability maturity model integration) has been introduced and promoted in the organization, and the organization was certified with CMMI ver. 1.1 level 4 in 2006. Security policies and activities are implemented across the organization, and NTT DATA (CHINA) was certified with ISO 27001 in Oct. 2010 (Fig. 5).

As a result, NTT DATA (CHINA) can provide professional IT services to its clients with satisfactory quality, convincing process management, and the requested security level. It was ranked ninth among Chinese software export and outsourcing vendors, as measured by 2010 revenue. From now on, it will



BND: Beijing NTT DATA

Fig. 5. Corporate roadmap for NTT DATA (CHINA).

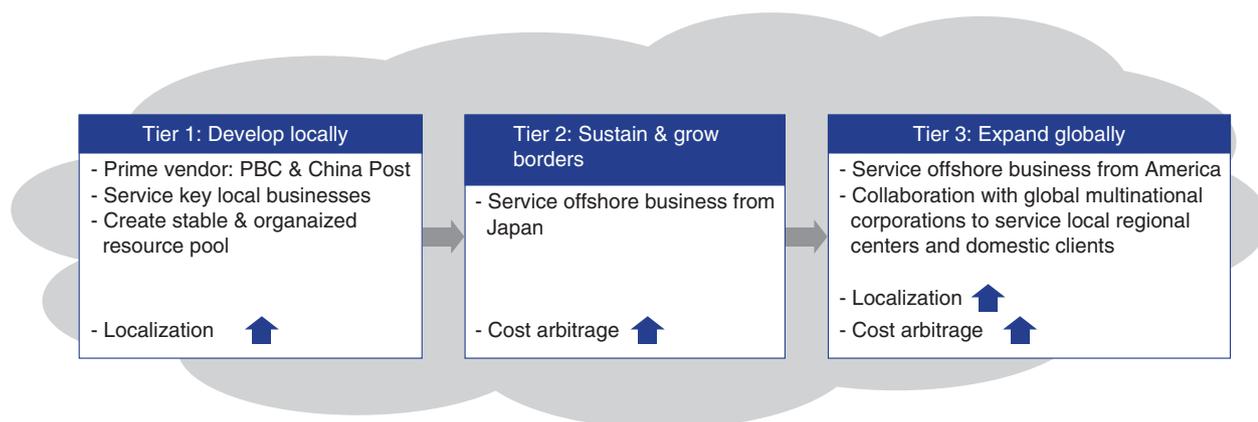


Fig. 6. Three-tier approach of NTT DATA (CHINA).

enhance its presence and capabilities in the local Chinese IT market with a global vision. We see it as following a three-tier approach: develop locally, sustain and grow borders, and then expand globally (Fig. 6).

2. Service offerings

NTT DATA (CHINA) leverages the expertise of the NTT DATA Group as well as excellent local talent in China to provide world-class IT services. It has a wealth of enterprise application experience across different domains such as finance, manufacturing, retail, transportation, public administration, and utilities. It has been one of the leading providers in China with its outstanding IT services and solutions including business consulting, software development, and application management outsourcing, system maintenance, and testing. For the last decade, it has earned an enviable reputation in the China IT services industry. Its services and solutions are built upon a solid foundation of business partnerships with clients and technical certifications (Fig. 7).

2.1 Consulting service

NTT DATA (CHINA)'s professional consulting team works together with clients to create business value and process solutions; its clients include both local and global clients in China. The consulting service includes business consulting (or process consulting) and IT consulting (or technical consulting). The business consulting focuses on finance, transportation, retail, and manufacturing, especially for the automotive and pharmaceutical industries. The IT consulting focuses on enterprise resource planning

(ERP) (for SAP, Microsoft Dynamics ERP, and Oracle's e-business suite (EBS)), customer relationship management (CRM) (for Oracle's Siebel CRM and Microsoft Dynamics CRM), business intelligence, and workflow systems (e.g., IntraMart).

2.2 Industry solutions service

NTT DATA (CHINA)'s solutions team provides best-practice and convincing solutions to help local Chinese clients build up satisfactory systems with low risk, such as credit settlement solutions, credit assessment and risk management systems, bridge realtime monitoring systems, and intelligent transportation systems.

2.3 Outsourcing delivery service

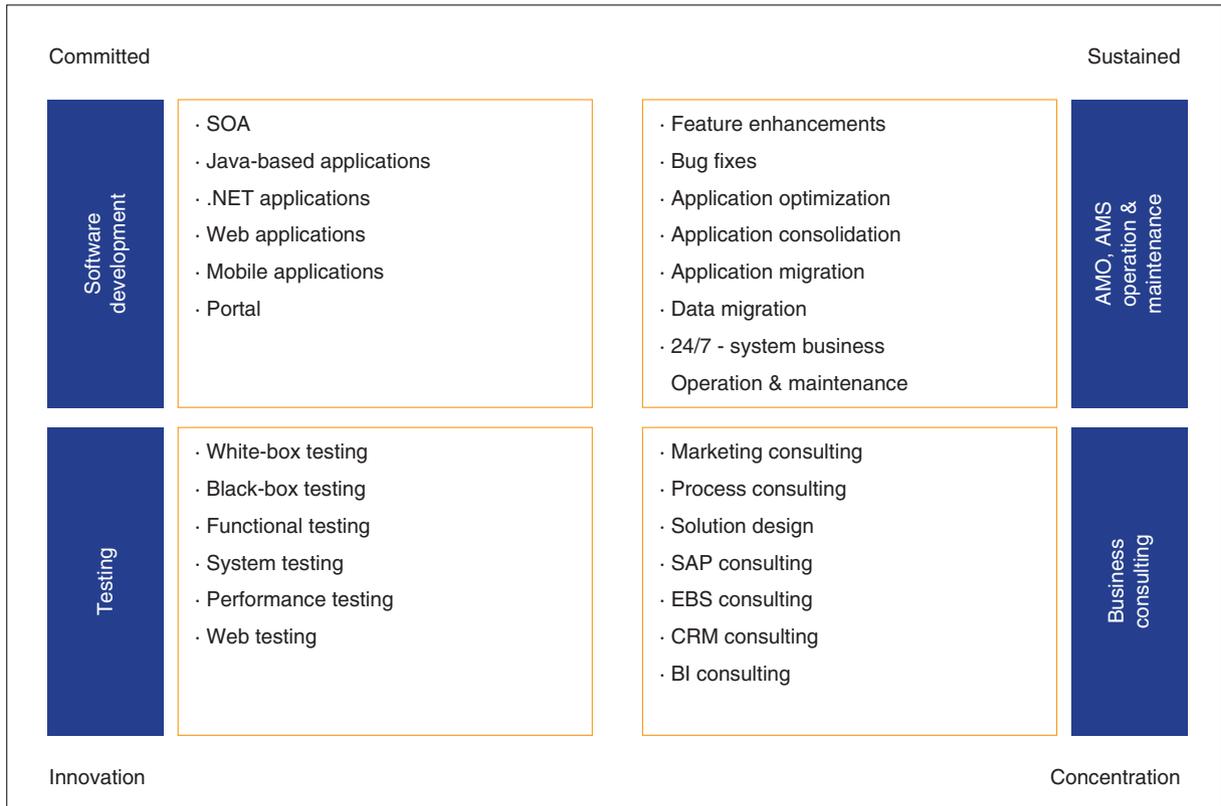
NTT DATA (CHINA)'s outsourcing delivery center provides the following services.

2.3.1 Software development service

The global team of experienced project managers, experts, and engineers can create a custom application, solution, or architecture to meet a client's business needs and help the client differentiate its company within the industry. The team has a wealth of enterprise application experience across different domains such as finance, insurance, telecommunications, logistics, retail, public administration, and utilities.

2.3.2 Application management outsourcing service

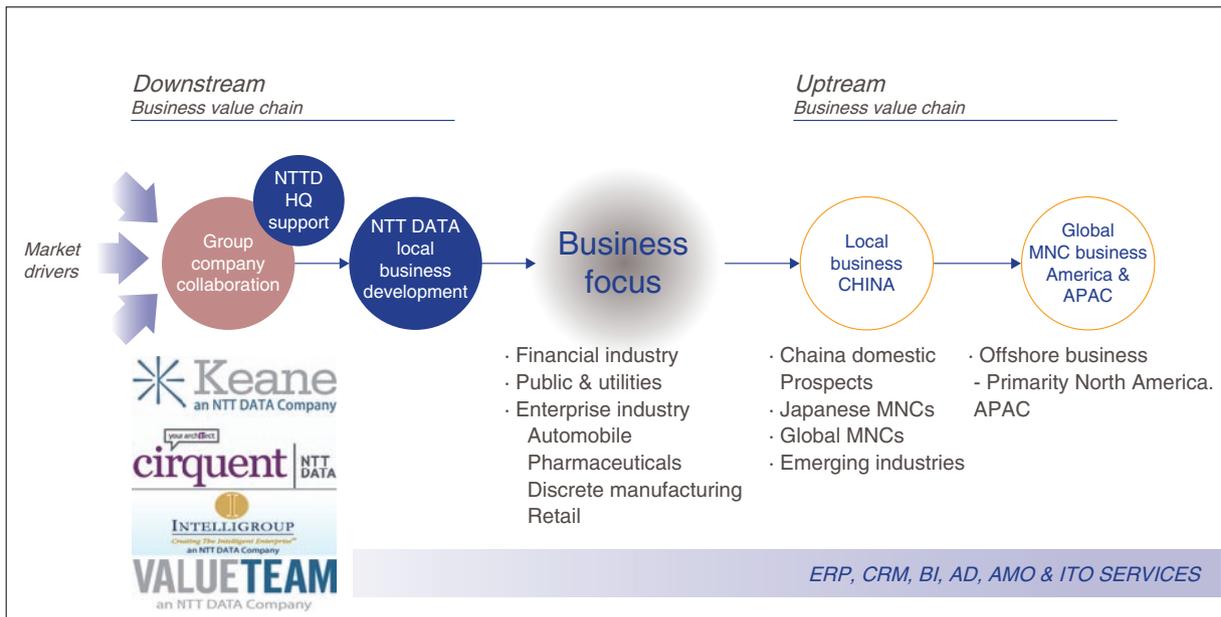
The application management outsourcing (AMO) service takes over management, development, and maintenance of IT applications for clients. The team uses a scalable staffing approach to meet the specific needs of each client. This service lets clients focus on



AMO: application management outsourcing
 AMS: application management service
 BI: business intelligence

CRM: customer relationship management
 EBS: enterprise business solutions
 SOA: service oriented architecture

Fig. 7. Service offerings of NTT DATA (CHINA).



AD: application development
 ERP: enterprise resource planning

ITO: information technology outsourcing
 MNC: multinational corporation

Fig. 8. Business focus of NTT DATA (CHINA).

more critical business areas and consequently develop a sustainable advantage in the marketplace. The professional employees are fully skilled in most of the popular programming languages, such as Java, VB, net, C#, VB, C/C++, COBOL, and ABAP.

2.3.3 Testing service

The professional testing team enhances the effectiveness of any product development process and the accuracy of the final product. The testing services span various testing techniques, platforms, and industries. Our functional testing includes unit testing, integration testing, system testing, regression testing, and acceptance testing, and our non-functional testing includes performance testing, security testing, stability testing, usability testing, and localization testing.

2.3.4 System operation and maintenance service

A non-stop operation and maintenance service (including system operation & maintenance and business operation & maintenance) is provided 24 hours a day, 7 days a week (24/7) with high efficiency and safety in order to help improve the business of our clients.

3. Future perspective

Besides expanding its existing offshore business, NTT DATA (CHINA) will also concentrate on expanding local Chinese business by collaborating with NTT DATA Group companies with a global vision. NTT DATA (CHINA) will continue to leverage the Group's expertise as well as local excellent talent in China to provide world-class IT services for both local Chinese clients and global clients in China (**Fig. 8**).

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NTT DATA (CHINA)—short column

Alcoholic beverages

Alcoholic beverages have a long history of more than five thousand years in China. They play a major role in etiquette. For several thousand years, however, the functions have also included drinking to bring joy, forget worries, and boost one's courage. People communicate and get to know each other by sitting together and drinking alcoholic beverages.

Traditional Chinese alcoholic beverages are classified mainly into three categories: white liquor, yellow liquor, and rice wine. White liquor, which is the strongest one, is the traditional distilled alcohol. It is made from various ingredients rich in starch like grains and potatoes through complex fermentation and distillation. Chinese white liquor often contains over 40% alcohol and is widely produced around the country in places like Sichuan, Guizhou, and Shanxi. The most well-known Chinese white liquors include Maotai Liquor, Five Grain Liquor, and Xifeng Liquor. White liquor is indispensable at banquets, espe-

cially in northern China. White liquor with 67% alcohol is also popular at banquets even in summer.

Ganbei is a kind of traditional way of drinking from ancient China, which means downing in one gulp a small cup of alcoholic beverage with a partner. Generally speaking, friendship could not be established until both parties had shared a drink together. Recently, this kind of custom has become less and less common, but it is being kept in our company: sometimes three cups one after the other act as a welcome for building closer relationships in a moment. Of course, people who do not wish to drink are never coerced, but everybody should take a sip or partake within their own limits. Japanese people often are very surprised and



confused the first time they encounter this custom, but most of them become fond of it. People say what they really think after a few drinks—it is well known that alcohol lubricates social interaction—so they can establish close communication even within one day. Of course, anyone who over-indulges and gets drunk is well looked after.

Water melon juice

Besides white liquor, water melon juice is also very popular at banquets across the country even in winter. Most Japanese have eaten water melon but have not had the experience of drinking its juice; it is a kind of unimaginable beverage for Japanese, but delicious after you get used to it. Slices of water melon are also served as dessert at the end of a dinner.



Scooters

Motor scooters are very popular in Beijing. It was reported in Japan five or six years ago that Beijing's roads were crowded with bicycles, but the number of bicycles is declining and scooters are becoming more and more numerous instead.

These scooters are quite different from the electric bicycles becoming common in Japan. They are dangerous because they are faster and quiet even when nearby, so foreigners who are not used to scooters need to be careful when walking along the roads.

Anyway, we are enjoying living in China and enjoying Chinese culture, and we hope that more and more of our colleagues from around the world will come here to work with us and enjoy Chinese culture.



Kosuke Yuasa, Management Director,
NTT DATA (CHINA) and
Akihiko Toshikiyo, Vice President,
NTT DATA (CHINA)

External Awards

Excellent Paper Award

Winners: Chaiwoo Lee, Daisuke Asai, Jarrod Orszulak, Richard Myrick, Joseph F. Coughlin, and Olivier L. de Weck, AgeLab, Massachusetts Inst. of Technol., Cambridge, MA, USA, and NTT Cyber Solutions Laboratories.

Date: Oct. 1, 2011

Organization: IEEE (Communications Society)

For “Integration of Medication Monitoring and Communication Technologies in Designing a Usability-enhanced Home Solution for Older Adults”.

Technology-enabled solutions have been increasingly developed for aging-in-place. Previous studies have developed systems to assist older adults in managing medications and maintaining social connections. However, although developed for direct user interaction, most have failed to be evaluated sufficiently highly by users. This paper describes the development and testing of a home solution for older adults’ medication management and communications. The system integrates RFID-based medication management and communications technologies with an intuitive interface (RFID: radio frequency identification). A long-term field trial was conducted for extensive usability testing and evaluation. With its current design, the system was found to be useful, easy to use, and satisfying.

Published as: C. Lee, J. Orszulak, R. Myrick, J. F. Coughlin, O. L. de Weck, and D. Asai, “Integration of Medication Monitoring and Communication Technologies in Designing a Usability-enhanced Home Solution for Older Adults,” Proc. of the 2011 International Conference on ICT Convergence (ICTC), pp. 390–395, Seoul, Korea.

IEEE CAS Seoul Chapter Award

Winners: Sadayuki Yasuda, Takahiro Hadano, Hiroki Suto, Masami Urano, Mamoru Nakanishi, and Tsugumichi Shibata, NTT Microsystem Integration Laboratories.

Date: Nov. 18, 2011

Organization: IEEE, ISOC2011

For “10G/1G Dual-rate EPON OLT LSI with Dual Encryption Modes Alternated Using DBA-information-based Algorithm Control”.

We developed a 10G/1G dual-rate EPON OLT LSI that fully conforms to the IEEE 802.3av standard (G: Gbit/s, EPON: Ethernet passive optical network, OLT: optical line terminal, LSI: large-scale

integrated circuit). To support Gigabit Ethernet optical network units (GE-ONUs) and symmetric/asymmetric 10-Gbit/s ONUs (10GONUs), we implemented a dynamic-bandwidth-allocation-information-based method for algorithm control for dynamically selecting the decryption algorithm that corresponds to the encryption algorithm used by the ONU burst by burst. In addition, while it basically conforms to the 802.1AE standard, we widened the category of encrypted frames to include multipoint control protocol data units (MPCPDUs) and operation, administration, and maintenance PDUs (OAMPDUs) by adding three simple steps of functions to existing blocks with little hardware overhead.

Published as: S. Yasuda, T. Hatano, H. Suto, M. Urano, M. Nakaniishi, and T. Shibata, “10G/1G Dual-rate EPON OLT LSI with Dual Encryption Modes Alternated Using DBA-information-based Algorithm Control,” Proc. of International SoC Design Conference (ISOC), pp. 357–360, Jeju, Korea, 2011.

Best Paper Award for Young Researcher at the 73rd National Convention of IPSJ

Winner: Hitoshi Kawasaki, NTT Cyber Solutions Laboratories

Date: March 6, 2012

Organization: Information Processing Society of Japan (IPSJ)

For “Recommendation for Improving Level of Skill Using Skilled People’s Life-logs”.

This paper describes a method of enhancing a user’s motivation to improve his/her level of skill in a given field. Currently, the number of skilled people, who record their knowledge and release it in the form of life logs in an attempt to achieve certain aims, is increasing. The number of users who are affected by such skilled people and who also make efforts to achieve their own aims is also increasing. We report on the development of a method of enhancing user motivation to begin making self-active efforts. The method should automatically select skilled people who can inspire users and be a good reference for them and present their life logs to the users. To achieve these functions, we propose a quantitative evaluation index between the life logs of skilled people and users. Through experiments, we verified the hypothesis that the higher the proposed index of skilled people, the higher the rate of user motivation.

Published as: H. Kawasaki, H. Tezuka, T. Yagi, and S. Muto, “Recommendation for Improving Level of Skill Using Skilled People’s Life-logs,” the 73rd National Convention of IPSJ, pp. 3-1, 3-2, Tokyo, Mar. 2011 (in Japanese).

Papers Published in Technical Journals and Conference Proceedings

Sensory-perceptual Transformations for Auditory Scene Analysis

H. Kondo

Proc. of NTT-ENS Workshop 2011, École Normale Supérieure, Vol. 1, No. 1, p. 3, Paris, France, 2011.

An essential function of perceptual systems is to structure the incoming flow of sensory inputs into auditory scenes (i.e., perceptual organization). Bistable perception phenomena provide us with clues enabling us to investigate perceptual organization mechanisms. We first clarified the relationship between different forms of bistable perception: auditory streaming, verbal transformations, visual plaids, and reversible figures. Factor analyses of the number of perceptual switches in the tasks demonstrate that the three-factor model provides a better fit to the data than other possible models. A genotype group comparison results reveal that the “auditory” and “shape” factors reflect the functions of the dopamine and serotonin systems, respectively. This suggests that perceptual organization is modulated by neurotransmitters released from the brainstem nuclei.

Polarization Property of Deep-ultraviolet Light Emission from C-plane AlN/GaN Short-period Superlattices

Y. Taniyasu and M. Kasu

Appl. Phys. Lett., Vol. 99, No. 25, p. 251112, 2011.

AlN/GaN short-period superlattices (SLs) are experimentally shown to have different polarization properties from AlGaIn. As the GaN well thickness decreases from 2.5 to 0.9 monolayers, the emission wavelength decreases from 275.8 to 236.9 nm owing to a quantum size effect. Because the quantized energy level for holes originates from the heavy hole band of GaN, the emission is polarized for an electric field perpendicular to the c-axis ($E_{\perp c}$). Consequently, the SLs show intense C-plane emission compared with AlGaIn, whose emission is inherently polarized for an electric field parallel to the c-axis ($E_{\parallel c}$). Using the SLs, we demonstrate an $E_{\perp c}$ -polarized deep-ultraviolet (UV) light-emitting diode (LED).

Constant-depth Exact Quantum Circuits for the OR and Threshold Functions

Y. Takahashi and S. Tani

arXiv, Cornell University Library, Vol. 1, No. 1, pp. 1–17, 2011.

We investigate the computational power of constant-depth polynomial-size quantum circuits with unbounded fan-out gates in the exact setting, where quantum circuits output the correct answer with certainty. We show that there exists an $O(1)$ -depth $O(n \log n)$ -size quantum circuit for the OR function on n bits. This is an affirmative answer to the question of Høyer and Spalek. We also show that there exists an $O(1)$ -depth small-size quantum circuit for the threshold function.

Ca²⁺ Ion Transport through Channels Formed by α -hemolysin Analyzed Using a Microwell Array on a Si Substrate

K. Sumitomo, A. McAllister, Y. Tamba, Y. Kashimura, A. Tanaka, Y. Shinozaki, and K. Torimitsu

Biosens. Bioelectron., Elsevier, Vol. 31, No. 1, pp. 445–450, 2012.

For the functional analysis of ion channel activity, an artificial lipid bilayer suspended over microwells was formed that ruptured giant unilamellar vesicles on a Si substrate. Ca²⁺ ion indicators (fluo-4) were confined in the microwells by sealing the microwells with a lipid bilayer. An overhang formed at the microwells prevented the lipid membrane from falling into them and allowed the stable confinement of the fluorescent probes. The transport of Ca²⁺ ions through the channels formed by α -hemolysin inserted into a lipid membrane was analyzed by employing the fluorescence intensity change of fluo-4 in the microwells. The microwell volume was very small (1–100 fl), so a highly sensitive monitor could be realized. The detection limit is several tens of ions per second per square micrometer, which is much smaller than the ion current in a standard electrophysiological measurement. Smaller microwells will make it possible to mimic a local ion concentration change in the cells, although the signal-to-noise ratio must be further improved for the functional analysis of a single channel. We demonstrated that a microwell array with confined fluorescent probes sealed by a lipid bilayer could constitute a basic component of a highly sensitive biosensor array that works with functional membrane proteins. This array will allow us to realize high throughput and parallel testing devices.

Compression of View on Anonymous Networks—Folded View—

S. Tani

IEEE Trans. on Parallel and Distributed Systems, Vol. 23, No. 2, pp. 255–262, 2012.

View is a labeled directed graph containing all information about the network that a party can learn by exchanging messages with its neighbors. View can be used to solve distributed problems on an anonymous network (i.e., a network that does not guarantee that every party has a unique identifier). This paper presents an algorithm that constructs views in a compressed form on an anonymous n -party network of any topology in at most $2n$ rounds with $O(n^6 \log n)$ -bit complexity, where the time complexity (i.e., the number of local computation steps per party) is $O(n^6 \log n)$. This is the first view-construction algorithm that runs in $O(n)$ rounds with polynomial bit complexity. This paper also presents an algorithm that counts the number of nonisomorphic views in the network in $O(n^6 \log n)$ time complexity if a view is given in the compressed form. These algorithms imply that some well-studied problems, including the leader election problem, can deterministically be solved in $O(n)$ rounds with polynomial bit and time complexity on an anonymous n -party network of any topology.