Optical Broadband Utilization Study Team

Interim Report

(Tentative Translation)

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1. Features and New Possibilities of Optical Broadband

(1) Elimination of broadband-zero areas (during FY 2010) and future challenges

- Our conventional communication networks were constructed on the premise of voice communications, particularly the telephone. Because of the restricted capacity of these communication networks, they were incapable of transmitting images, video, and other large volumes of data and, thus, were unable to address the communication requirements that began surfacing in the 1980s — namely, demands for multimedia and intelligent communications. This situation prompted the necessity of building new communication networks — through the introduction of optical fiber, ultra-high-speed transmission devices, etc. — that could be used to provide advanced, inexpensive communication services. In 1990, NTT announced it would proceed with its VI&P (visual, intelligent & personal) plan for new, advanced telecommunications services, and the Japanese government also decided on a plan to assist the construction of new-generation communication networks.
- Provisional Measures Law for Telecommunications Infrastructure Improvement (Infrastructure Improvement Act, a 10-year temporary law) went into force in June 1991, which triggered the large-scale development of telecommunications infrastructure needed to form an advanced information society.
- In February 1995, the Basic Policy on Promoting an Advanced Information Society was finalized. This policy statement included the provision to “promote the establishment of optical fiber networks nationwide as soon as possible with a benchmark date of 2010.” The Infrastructure Improvement Act was also amended. (The amendments went into force in July 1995.)
- Entering the 21st century, the Basic IT Act (Basic Act on the Formation of an Advanced Information and Telecommunications Network Society) was formulated in January 2001 along with the e-Japan Strategy. The strategy’s objective was to make Japan “the world’s most advanced IT nation” and it

set “the establishment of ultra-high-speed network infrastructure” as one of its priority policies. Additionally, the Infrastructure Improvement Act was extended by five years after expanding its assistance measures.

- The New IT Reform Strategy, introduced in January 2006, stated as one of its objectives “the promotion of the establishment of optical fiber and similar networks by FY 2010 and the elimination of broadband-zero areas.” In tandem with this, the Infrastructure Improvement Act was extended by another five years and went into force in May 2006.
- An estimated 640,000 households did not have access to a broadband network as of March 2009. Private carriers, without any incentives, are not likely service the majority of these remaining “broadband-zero” areas. Thus, public establishment of FTTH or other broadband technology is viewed as the only alternative in such areas if local municipalities demand these services. To this end, it was decided to push ahead with about 340 broadband development projects (at a total cost of approximately 235 billion yen) where local communities had requested broadband, making use of Local Information and Communications Infrastructure Development Grants (ICT Grants) and Extraordinary Regional Revitalization and Public Investment Grants provided for in the FY 2009 supplementary budget to counter the financial crisis. These measures are expected to bring broadband access to a further 340,000 households.
- Broadband is expected to reach almost all remaining 300,000 or so households as private carriers expand their service areas. There are still a few areas where it is too costly to supply broadband access and where the local community has yet to request assistance. It is assumed at the present time that satellite broadband will be used to supply broadband access to these areas.
- Through this combination of measures, all broadband-zero areas will likely be eliminated before the end of FY 2010. Moving forward, we face a number of new issues. Although about 90 percent of all households are able to use optical broadband, how to bring optical broadband access to the remaining 6 million households is a big challenge. Another challenge is how to promote greater utilization of optical broadband when the optical broadband

subscription rates are only about one in three.

(2) Superior performance of optical broadband and its supporting technologies

- Thanks to optical technology, the speeds and data capacity of both trunk lines and subscriber lines are skyrocketing. With the introduction of optical amplifiers and wavelength division multiplexing (WDM) technology, trunk lines have been able to reach 40 Gbps x 40 wavelengths (for a maximum throughput of 1.6 Tbps), and 1 Gbps subscriber lines are also practical.
- Bidirectional 1 Gbps services are now feasible with the introduction of GE-PON, a technology that utilizes Gigabit Ethernet — a technology that has been used for local area networks — to send and receive Ethernet frames unaltered between the central office and the subscriber's home. Moreover, it is possible to provide optical services relatively cheaply with GE-PON since a single fiber can be used to service up to 32 users.
- Other technical developments nearing the commercial stage overcome frequently cited optical fiber handling problems, such as connection difficulties and the inability to bend fiber cables. With these technologies in place, installing fiber cables is becoming dramatically easier.

(3) Optical broadband's potential to generate new services

- Data processing power has soared and the cost per process has fallen dramatically in line with Moore's Law, which holds that the number of transistors in a given integrated circuit chip (a rough indication of a computer's processing power) will double every 18 to 24 months. Distributed processing — such as typical client-server processing methods — became the dominant topology in the era when processing was thought to be more cost efficient than communications. But because communication network speeds have increased at rate much faster than Moore's Law, it is now felt

that accessing information via networks is more advantageous than maintaining a large pool of computers. One consequence of this shift in thinking is the gradual spread of centralized processing topologies that use communication networks and farms of servers and storage devices. These topologies are often referred to as cloud computing.

- At the same time, the maturation of virtualization technologies is driving the move to centralized processing at data centers and the move to seek greater efficiencies. Virtualization enables the integration of vast numbers of servers through decentralized processing even as the central processing ability of each server has expanded.
- In cloud computing scenarios, the user simply pays a set fee to use each required application rather than directly bearing the system construction and upkeep costs or the server and database operating costs. The more users using a particular application, the cheaper the per-user costs become. Furthermore, broadband access fees have become quite inexpensive since users can choose the appropriate communication plan for their needs, such as paying by IP packets (by data volume), paying flat rates for unlimited usage, or paying by the necessary bandwidth.
- This topology allows users to “use” many applications through software user fees and broadband access fees rather than “owning” standalone systems, which require large initial investments. Moreover, users normally only need a Web browser on their device to run cloud applications.
- Many applications are now coming out in cloud service configurations that take advantage of network environments. Applications range from small-business accounting software to CRM, SCM, and other enterprise applications, and include education, healthcare, security, transportation, water, and energy applications.
- Many new operational-support online services for local governments are expected to emerge, such as online planning, editing, and printing of PR newspapers, in addition to such mission-critical operations as taxes and national health insurance that have already been systematized.
- Direct online services for citizens and residents are also expected to appear. This can even extend to statistical data. For example, the United States has

embarked on the Data.gov initiative, which will provide residents with government information online as part of its Open Government Program. One point to remember when providing statistical data is that PDF or similar formats make it difficult to analyze that data later. For this reason, it is better to provide data with XML tags or other metadata that facilitate analysis.

- Standardization work for cloud computing, such as sharing application interface specifications (APIs), is imperative to maximize the use of servers, storage devices, and other infrastructure on which cloud computing rests. For this reason, it is vital to keep track of developments at the Global Inter-Cloud Technology Forum (GICTF) and other related organizations.

2. Considerations of Optical Broadband Utilization Policies to Resolve Regional Issues: Taking Advantage of Optical Broadband's Superior Distance-Independent Communication Performance

- Before considering optical broadband utilization policies, it is proper to first examine fields where the advantages of optical broadband can be harnessed the most effectively.
- As described earlier, optical broadband is a network infrastructure that permits relatively inexpensive communications at high speeds regardless of the physical distance between communication parties. When cloud computing is used over optical broadband networks, new solutions can be introduced with comparatively low initial investments and with operating costs that scale to the required usage volume. The Study Team believes this approach is applicable to economically disadvantaged areas.
- The Study Team, therefore, feels policies promoting the effective use of installed optical broadband networks may help to resolve two regional issues: reducing administrative costs while improving the quality of administrative services and supporting healthcare, education, and regional industrial development.

(1) Reducing administrative costs while improving the quality of administrative services

- Government organizations are looking into applying cloud-computing technology — which centrally processes data via networks by taking advantage of fast, relatively cheap communications — in the administration sector.
- While there are about 1,800 local governments in Japan, only a third — less than 600 — use mainframe computers and have their own dedicated hardware and software. The remaining two-thirds generally use commercially available computers and standard software programs that have been customized. Each local government, then, bears the responsibility for system construction and upgrading costs as well as server and database operating costs.

- By running cloud services on optical broadband networks, local governments can eliminate most of these costs except for broadband access fees and software user fees. Local government employees use online software applications that process everything at a data center, which takes advantage of optical broadband's high speeds and low costs.
- There are two problems with this scenario. One is that centralized processing will only give negligible cost savings unless the software (operation-specific applications) is shared.
- The second problem concerns network architecture. With cloud services, not only are the servers and databases external to the organization, data too reside outside of the organization. The organization needs to ensure adequate bandwidth to access the data from an operation continuity perspective, and it must deal with IT risk management from a security perspective. Cost feasibilities must also be worked out. For example, using a leased-line network service may provide sufficient security but it will introduce significant costs. VPN and other services must be evaluated by balancing cost and security considerations. The required levels of security, capacity (speed), and availability depend on the nature of the data — whether it is sensitive data on residents, backup communications, or email communications — and the nature of the operations and services. Fixed rules are needed for all these situations.
- MIC is slated to conduct pilot studies in FY 2010 on operation/service standardization and information security. Specifically, MIC plans to
  (a) verify the possibility of introducing shared applications for administrative operations using software packages, and
  (b) develop and verify methods of constructing secure networks between data centers and local government workers' terminals.

*Pathway to Open Government

Seeking to rein in administrative costs and raise the quality of administrative services through the use of optical broadband and cloud services runs parallel to

calls for open government. Open government aims to operate the business of government in a transparent fashion and to manage administrative affairs in a high-caliber, stable, and cost-effective way. This concept rests on publishing details of administrative operations and affairs for residents on the Internet and providing the means for residents to access the existence, location, and details of their own information records. Any practical implementation of open government requires robust security through strict user authentication and other procedures along with better data linkage between systems. The various system standards that will arise in conjunction with the move to administrative cloud services are expected to contribute in the open government direction as well.

(2) Supporting healthcare, education, and regional industrial development

- Optical broadband's greatest advantage is the possibility of smooth, vivid, bidirectional video communications. Consequently, there are hopes to use video communications over optical broadband in fields such as healthcare and education where face-to-face exchanges have been considered irreplaceable until now. The Study Team believes video communications will be especially helpful to people who currently have few opportunities to access healthcare and education due to geographical restrictions.
- Another benefit of using optical broadband and cloud services in tandem is that the user's terminal (a thin client) does not need to house applications or even data as long as it can access the required server via a broadband network with a browser or some similar application. Hopes are that this will permit centralized IT risk management on the data center side and slash costs on the user terminal side.
- In this regard, MIC has decided to verify network architecture and functionality that supports healthcare, education, and regional industrial development as part of its FY 2010 pilot project testing. The Study Team thinks carrying out the following specific verifications at this time will be beneficial:

  (a) software and terminal devices that are easy to use and that do not pose burdens on residents, and

  (b) the relationship between ensuring network performance that can handle

bidirectional video communications and the associated costs.

3. Broadband Open Model for Administrative Systems (requirements on adapting the model for administrative reform and the expected benefits)

(1) How the Broadband Open Model will work: Improving services to residents through vendor competition and local government selection

- In the Broadband Open Model for administration's operational applications, software applications (cloud services) are provided from a data center external to the organization and administration employees, working within the organization, execute their duties by calling applications from their terminal's browser. The cost performance of the model is raised by making effective use of public lines instead of using physical leased lines.
- As long as multiple vendors offer cloud service applications and compete on service quality, local governments' selections of the most appropriate services is expected to spearhead quality improvements.
- Moving data outside of the organization gives the impression that the Broadband Open Model's operation is fundamentally different from that of current systems, but in fact most current local government systems with branch offices and sub-branch offices use wide-area Ethernet or other topologies up to the trunk connection for each office and rely on common carriers for trunk networks. Data records are usually stored in a server room at the main municipal building. For example, when a branch office receives a change of address notification for a certificate of residence, the data record is entered and then encrypted at the branch office before being sent from a secure subscriber service via a telecom's trunk network to the head office's server room where the records are stored.
- When transferring data from the local government's servers to the data center's server in the Broadband Open Model, a secure line is established between the data center and the trunk network. This configuration is essentially the same as branch office data transfers in the current systems.
- Consequently, the Broadband Open Model poses virtually no changes in network configuration. The critical points are the overall security level of the network, including trunk networks, balanced with good cost performance,

and the data center's security capabilities. These points will also be major themes for FY 2010 pilot project testing.

(2) An early precedent: ICT system sharing by regional banks

<State of ICT system sharing>

- Regional banks are moving ahead with centralized processing through shared use of ICT systems, beginning with payment and settlement systems. Numerous configurations have emerged, depending on the incentives and catalysts that prompted the system sharing. Although banks usually rely on mainframes because of the processing volumes they must handle, banks that have invested in shared systems have seen significant cost reductions.
- One of these banking groups is known as NEXT Base. This group consists of banks with relatively small management forces. The group uses existing payment and settlement software packages at a Hitachi data center in Okayama. This group, then, achieves large cost efficiencies but uses existing software packages without any customizations.
- The K Pro group jointly created its own system under the leadership of top executives at three banks — Higo Bank (Kumamoto prefecture), San-in Godo Bank (Shimane prefecture), and Michinoku Bank (Aomori prefecture). The system has been in operation since January 2003. In this case, the three banks jointly outsource their operations to an Okayama data center.
- Another group is the Chigin Kyodo Center [Joint Regional Bank Center]. Member banks of this group join a payment and settlement system that was originally created by the Bank of Kyoto and NTT Data, and each bank outsources its operations to a shared data center in Yokohama. The group has been in operation since January 2004. What is particular about this configuration is that member banks use a system originally designed and constructed by the Bank of Kyoto. Member banks get inexpensive access to practical applications developed by the Bank of Kyoto, and the Bank of Kyoto is able to split its development costs among member banks as more banks use its applications.
- The Juudankai group shares systems and databases belonging to the Hachijuni Bank (Nagano prefecture). Hachijuni Bank promotes the sharing

of its systems and it grants licenses to banks belonging to the Juudankai group. System development is done by Hachijuni System Development Co., Ltd.

- Another project is the Kyodo Riyo F&H [Joint Utilization F&H] project. Fukuoka Bank and Hiroshima Bank partnered to set up a joint center company and to locate an operations center at Fukuoka Bank. The number of participating banks has increased since banks under the control of Fukuoka Bank also use the system.
- The Chance project began with system sharing among banks with close relationships to the former Mitsubishi Bank. The project's systems are based on the systems of the current Bank of Tokyo-Mitsubishi UFJ. Because of their former involvement with Mitsubishi Bank, the member banks already have a good understanding of the software and share payment and settlement and other software packages. What sets this project apart is that the member banks have relatively large parent management forces, and each operates independently.
- The TSUBASA project has just gotten underway, but its first step is to share a customer-service call center.
- As these examples show, regional banks are developing numerous sharing patterns across prefectural borders in reflection of the circumstances at each bank.

<State of wide-area networks>

- Wide-area networks are necessary to share ICT systems across prefectural borders.
- Internet banking and other applications that involve customers' personal data use a protocol such as SSL that encrypts data before sending it over the Internet. Authentication is done by ID/password or other means, and customers need only to subscribe to an Internet service provider.
- Typically a wide-area Ethernet is used between a bank's head office and its branches and between banks and the data center, with a common carrier's IP VPN service used to form the trunk network.
- The Data Telecommunications System of All Banks (Zengin Net) uses a

frame-relay network and an ISDN network for backups, but the Japanese Banker's Association is now considering adopting an IP-VPN network that may begin operation as soon as FY 2011.

- The BOJ-NET (Bank of Japan's network) has used physical leased lines and dedicated terminals, but IP-VPN is now widely used as computer interconnections have migrated from the Japanese Banker's Association's protocol to TCP/IP.
- Similar networks have also been established for securities and insurance.

(3) Potential for local government's to use the Broadband Open Model to promote administration reform

(i) Examples of shared ICT system use

Kyoto prefecture

- Kyoto prefecture led the nation in embarking on sharing of ICT system resources between its municipalities. Kyoto's first project was TRY-X in which the Kyoto Municipalities Board began sharing commercially available software packages.
- The Kyoto Municipalities Board chose joint system development primarily out of tough financial pressures. For example, sharing the costs of advanced-elderly healthcare systems, which were costing towns and villages in the area tens of millions of yen, greatly reduced the expense to several million yen in most cases and 10 million yen in the most extreme case. It cannot be overstated that much of this cost cutting was due to efforts by officials to raise the functionality of municipal systems while sticking to a policy of avoiding customization wherever possible.
- Already 21 ICT systems are now being shared by towns and villages in Kyoto prefecture as well as all 31 municipalities in the Kagoshima and Kumamoto prefectures.
- The second phase was the construction of joint municipal systems and centralized operations using broadband technologies. As a first step, Kyoto prefecture established the Kyoto Digital Sosui Network, an intra-prefecture

high-speed optical network that enables the centralized operation of shared systems. The Kyoto Digital Sosui Network was completed in 2003. The network integrated, using Layer 2 technology, disaster-response, education, and administration networks, which previously had been separate systems.

- The efforts of the Kyoto prefectural government and local governments have moved beyond just sharing ICT systems. Using shared systems to promote standardization of prefectural government and local government operations and jointly running shared systems over a high-speed optical network, the governments hope to improve the quality of front office operations and optimize back office structures.
- Joint operations over networks have also been implemented, and some local governments now access services over networks from servers located at a single data center in the prefecture. These servers run systems that support mission-critical tasks, such as managing the basic resident register. There is, however, a sense that the current hosting services are expensive, and there are plans to have SaaS or a similar setup provided through a cloud service.
- Based on ICT system sharing with towns and villages in the prefecture, Kyoto prefecture is also moving ahead with sharing operations and services between the prefectural government and local governments. Shared tax services began in January 2010 under the supervision of a broad alliance that already includes the Kyoto prefectural government and local governments.
- Very large administrative reform benefits have ensued from this program.
  - † Shared tax services resulted in a reduction of 300 people (a savings of more than 2 billion yen per year)
  - † Joint customer affairs services: reduced initial investment from billions of yen to 150 million
  - † Integrated geographical information systems: reduced initial investment from billions of yen to 260 million
  - † Municipal mission-critical systems: savings of about 300 million yen per year for all municipalities
- The facilities reservation system greatly improved convenience to residents

by having a single ID for all prefectural and municipal facilities, including those in the city of Kyoto. Even applications that are expensive for a single local government to purchase can be introduced relatively easily, such as an integrated geographical information system (GIS), and be put to use in administrative operations.

(City of Yokosuka)

- Since 2000 the city of Yokosuka has been pushing ahead with plans to open up its mainframes — in other words, to cut costs by using its mainframes as general-purpose servers. Yokosuka has been opening up its systems sequentially in three areas: basic resident register, taxation, and insurance.
- Yokosuka's objective is to lower ICT expenses by migrating from mainframes to computers that are astronomically cheaper to run. At the same time, the city has a policy of avoiding any unnecessary software customization that will add to its operating expenses.
- Mission-critical system customizations that have been pointed out include customizing the layouts of external forms such as tax notifications. Because tax notifications and other external forms are sent regularly to large numbers of residents, it is difficult to change formats without an inviting opportunity. The Study Team feels that on a cost basis, however, such forms ought to be unified under a broad nationwide program.
- There are other customizations made necessary by regional characteristics or population sizes. For example, smaller local governments find many batch processes and other functions unnecessary when they use software programs intended for larger-scale local governments. And in localities with small populations, a single government department may process many kinds of operations and services, whereas in a larger municipal region, these tasks are carried out by separate departments.
- The city of Yokosuka's current direction is to completely rebuild its ICT systems and eliminate waste and redundancy wherever possible and to update systems without customizations unless they are absolutely necessary. The city's approach also includes using existing software packages for forms while also examining the introduction of cloud services

and other alternatives. The unique problem Yokosuka faces is the frequent turnover in its taxpayer base because members of the Self-Defense Forces are stationed within the city limits. Thus, there are several customization issues that the city cannot resolve on its own.

(Yamagata prefecture's Okitama region)

- The Okitama region in Yamagata prefecture is one of the first regions in the country to decide on utilizing cloud services and embark on a full-fledged implementation plan.
- Municipalities in the Okitama region found that the smaller their revenue base the more system expenses took from their total budget. At the same time, they were under mounting pressure to reduce the percentage spent on system costs. For these reasons, municipalities in the Okitama region moved ahead with a joint outsourcing initiative in coordination with Yamagata prefecture.
- The initiative faced two major obstacles: standardizing the operations and services that would be subject to system sharing and unifying management practices so that systems could be jointly operated.
- The participating municipalities included some that used mainframes and some that had customized software packages running in client-server configurations. The problem was how to standardize and share operations and services that each municipality processed differently. On the system operation side, how could these municipalities jointly operate ICT systems that were housed and managed in each municipality's own server room?
- One proposed solution for the sharing of operational applications was to use unmodified commercial software and have clerks and officials in each municipality adapt to the commercial software. And regarding system operation and management, one proposal suggested using a private data center located outside the prefecture instead of placing it in one of the municipalities. In this case, the shared commercial software would be provided online to the municipalities from the data center.
- The region decided to proceed with mission-critical operations, such as the basic resident register, various taxes, national pension, and nursing

insurance, and internal operations, such as financial accounting and personnel salaries, using non-customized commercial software packages.

- Cloud services bring about two inherent cost-cutting benefits. The first is the possibility of splitting software construction costs because common applications are used. An added savings possibility is splitting the software recovery expenses associated with system revisions because software packages do not have to be customized for each local government. The second benefit is multitenancy, which uses virtualization technology to lower hardware operating costs.
- The Okitama region is not using multitenancy. Although a single data center was used, it was used in a single-tenant configuration in which each municipality maintained its own servers. Hence, the region has only taken advantage of one of the two major cost-cutting benefits of cloud services. Even so the cost savings have been huge.
- The town of Nagai, which had been using a mainframe, saw a 53.5 percent reduction in software installation and operating costs. Other municipalities using client-server methods saw cost savings in the vicinity of 40 percent.
- Although there are a number of views on data centers, it is true that the use of private data centers will allow 24/7/365 operation and improve security levels at the same time. When municipalities house their own data center, the municipality must cover the management operations, so the use of private data centers can eliminate these costs as well.

(ii) Standardization of operations (commercial software and customization)

- A software vendor submitted a report detailing which parts of local government operational systems the vendor felt should be standardized. The report indicated such items as forms, layouts, and associated data should be standardized as soon as possible. It also stated that an increasing number of commercial software packages could be tailored to suit specific operations through parameter configurations rather than customizing the software. Despite this, some custom software will have to be purchased after conducting a cost comparison to handle the few remaining regional

characteristics that simply cannot be standardized.

- A number of specific customizations were mentioned. For example, there are differences in how certificates of residence are handled. According to the Residential Basic Book Act, certificates of residence are to be managed on an individual basis. Nevertheless, some municipalities have long managed certificates of residence on a household basis because it was easier and used less paper in the days of paper records. Consequently, some municipalities have customized their electronic records to continue to manage certificates of residence on a household basis. In the view of the Study Team, however, there is room for reconsidering the necessity of this household-basis customization, since individual-managed systems can still output certificates by household.
- One mismatch between municipalities is different naming systems for the same data field. For example, when a resident submits a relocation notification and is registered in the basic resident registry at a new municipality, a number is usually issued. Where Package A calls this number an ID Number, Package B may call it a Roll Number. Because there is no officially designated name for this field, differences have arisen in how this number is handled.
- Another difference occurs with the treatment of birth dates. For instance, where organization A uses only the Western year notation, organization B uses the Japanese year notation alongside the Western year notation. Therefore, when organization B uses organization A's software, it needs to customize the software to handle Japanese year notation. Although both functions can be regarded as necessary, having only one of the functions is not necessarily insufficient either.
- Again, organization B when listing a new resident, enters the date the person in question became a resident, the date on the relocation notice, and a code indicating the relocation. B organizes its records with the code. Organization A, however, creates an information record for each resident and enters the relocation date, the notice date, and the reason. Because the sorting methods differ, a need for customization arises.
- National health insurance premiums are either collected or assessed. Since

the law permits both methods, software packages must support both methods. Because of unavoidable customizations like these, organizations must look for software that can be adapted to specific situations through parameter configurations or similar methods.

- The Study Team believes there are virtually no format or data field issues than cannot be standardized through some workaround.
- And as more specific adaptations can be handled with provided service options — i.e., setting parameters in commercial software packages — instead of customization, there is less need for customization in this area as well.

  *Efficiently connecting different systems together requires standard rules on such things as interfaces, communication procedures, and data formats in addition to standards on the data to be shared. Standard specifications for these particulars are stipulated by the regional information platform. If commercial software packages satisfying the regional information platform can be introduced with a minimum amount of customization, it is possible to hold down costs associated with specification adjustments and system modifications needed to connect to later systems that other vendors provide when adding new systems or when adapting to new legal amendments.

(iii) Current state of network security services

- A paramount issue when introducing cloud services for local government operations is how to divide up functions between in-house servers and the data center's servers. According to one viewpoint, unless master data and backup data are managed on the cloud services side — i.e., at the data center — minimal cost-savings benefits will be seen and the overall costs will tend to be fairly expensive. Nevertheless, this scenario invites a loss of trust among residents should a fault occur at the data center and the minimum administrative services cannot be provided. Therefore, the Study Team believes certain key data records, such as certificate records, must be stored on in-house servers.
- Another contentious point is whether to transfer to cloud servers legacy data

records existing on mainframes or customized systems. Even after an organization begins using new cloud software services at the start of a fiscal year, it will still be necessary to verify past records, such as records of non-payments. There are basically two ways of handling legacy data: either move all data records, including past data records, to the data center or else use online services for new data records only and configure systems so that past data records can be retrieved as needed from the existing databases.

- There are generally two approaches to operational functions as well. For example, when receiving information from external entities, each local government can enter the data and send it to the data center, or the data center vendor can be contracted to process and enter all the data in bulk.
- The same holds for form printing. The standard approach has each local government retrieve the data to be printed from the data center, print the forms on its printers, and mail out the forms. It is also possible, however, to have the data center print, package, and mail out the forms in bulk.
- Regardless of the approach taken, the master data and backup data are housed at an external data center. Therefore, organizations must ensure the communication network is sufficiently robust and secure to handle these operations.
- The Study Team examined network security by first separating operations into three lines. Mission-critical operations related to resident data records such as the basic registry, taxes, national insurance, and nursing insurance were classed as Line A. Line B operations were defined as information operations — i.e., information sharing such as email and teleconferencing. Line C included all other important operations such as financial accounting, personnel salaries, and other internal management operations.
- Line A requires the highest security since these operations involve residents' information. Because the data itself is mostly numbers and text, the bandwidth requirements are modest. But high availability is essential since system crashes will trigger a loss of credibility and trust. Working from these conditions, the Study Team felt that for Line A operations it was probably necessary to employ closed IP-VPN or wide-area Ethernet networks for backbone trunk lines and Ethernet access lines as subscriber lines that

connect to the trunk lines.

- Line C operations are important, but their security demands are moderate and their data volumes are not large because they are related to internal management. Availability is not as great an issue as for Line A operations since system outages would not have a direct effect on residents.
- Line B operations, particularly if teleconferencing systems are introduced, require large bandwidths. But in terms of security and availability, Line B operations' demands are lower in priority than Line A and Line C operations. Therefore, Line B studies should include cost considerations as well as the adequate necessary functionality.

(iv) Trial calculations of administrative reform benefits resulting from optical broadband and cloud computing

- The Study Team made several trial calculations assuming a local government running mission-critical operations for a population base of 400,000 to 500,000 people.
- Calculation A assumed the local government used mainframes. Calculation B assumed the government used a client-server model with customizations to 40 percent of the software. Calculation C assumed the local government adopted the Broadband Open Model with cloud computing and an unmodified commercial software package. The trial calculations found that the cost ratio of the three scenarios A:B:C was roughly 3:2:1.
- The calculation divided the system costs into two segments: application running costs and hardware running costs. Costs for both development and operation were rolled into one annual sum.
- The first application running costs calculated were the expenses associated with running a commercially available software package. The cost of developing the software package was set at 100. If 20 local governments used the software package, the operating cost per government would be 100 ÷ 20, or 5. On the other hand, customizing 40 percent of the software package would incur a cost of 40. Since only one government benefited from the customization, it would have to bear this cost alone. Consequently, the

total installation cost for this government would be 45 — 5 to purchase the software and 40 to customize it.

- While we assumed the fundamental portions of the system would be in place from the first fiscal year, we also accounted for modifications (customizations) needed for items that are revised each fiscal year, such as local taxes. The calculation assumed that 20 percent of the system would need modifications over the five-year system operation term. A cost of 20 would be incurred to modify the portions of the basic software packages that were originally unmodified. The cost per government when split among 20 participating local governments is 1. Conversely, the local government that had customized 40 percent of its software would have to bear an additional cost of 8, in proportion to the cost of 40 for its original modifications.
- In total, the local government using commercial software as is would pay a cost of 6 (5 + 1) whereas the local government that customized 40 percent of its software would have to bear a cost of 54 (5 + 40 + 1 + 8). The software cost ratio between the two governments would be 1:9.
- The local government with a mainframe system has to cover the full cost of the software (100) plus the annual modification costs (20), for a total cost of 120. Commercial software, however, requires the construction of a double-track system to allow for parameter configurations, whereas the mainframe is created specifically for one organization. Therefore, the mainframe development expenses are estimated empirically to be 70 percent of that for systems based on commercial software. As a result, the mainframe-using government's cost would be 84 (120 x 0.7).
- From these calculations, we found the software cost ratio for A, B, and C to be 84:54:6. Replacing these with actual past expenditures, the estimated costs for the three scenarios were 217 million yen, 140 million yen, and 15 million respectively.
- The Study Team next made trial calculations for hardware running costs. For the mainframe scenario, the hardware running costs were estimated to be about 260 million yen — about 120 million yen for hardware installation and maintenance costs, about 110 million yen for 110 man-months of SE support, and the rest for internal LAN and other network usage costs.

- For the client-server model, hardware installation and maintenance costs were pegged at about 15 million yen a year because servers running Intel or other generic CPUs are very cheap. SE support was estimated at 110 million yen, or 110 man-months, the same as in the mainframe scenario. Network usage fees were slightly higher than the mainframe's because of server-terminal communications. Nevertheless, the total hardware running costs were lower, at an estimated 155 million yen.
- Since no hardware is owned in the Broadband Open Model, hardware maintenance costs do not apply. It was very difficult to estimate SE support costs. Initially, 38 million yen per year for 38 man-months was considered sufficient because hardware maintenance was unnecessary. This figure was doubled to 70 million yen in the final calculation simply because all the factors are unknown. The data center fees, which replace owning servers, for maintenance and operation were doubled since both a main data center and a backup center were assumed. At the same time, a 20-percent cost savings was forecast if multiple organizations use the same application because servers can be operated more efficiently using virtualization technology (the multitenancy effect). Because of the traffic with the data center and backup center, network fees were expected to be somewhat higher than the client-server model. The final trial calculation came to 135 million yen.
- The Study Team was given the impression that over time Calculation C's total will decline somewhat if practical implementations stabilize. As the argument above shows, the Broadband Open Model can provide substantial administrative reform benefits.
- Additionally, the costs of cloud computing are decreasing year by year, so that in 10 years time cloud computing is anticipated to have an overwhelming cost advantage over owning, maintaining, and operating in-house information systems.

(v) Requirements for SLAs

- Cloud computing structures are unique in that the user is usually reliant on

the service provider for security against data disclosures and other problems. The security of stored data, of server hardware and software, and of other areas is dependent on the security levels maintained by the service provider.

- This is why it is crucial to complete an agreement with the service provider beforehand on such issues as the data storage configuration (is storage contiguous or distributed, is stored data encrypted?), the scope of data recovery in the event of a failure (types of recoverable data and non-recoverable data), the mean time to recovery, minimizing the number of service provider employees with access privileges to one's data, and limits on the scope of their data access.
- Compliance is another issue. The law in some cases sets out responsibilities related to the exchange of data (for example, the Personal Information Protection Act). One must confirm whether a specific cloud service complies with such legal requirements before using the service. Matters relating to system audits must also be clarified beforehand.
- When a user switches from a current contracted service to a new service provided by a different vendor, the user must cancel the old service contract and port the data to the new service. One must be aware, however, that in practice it may not be possible to port data to the new service because of data format issues with the old service or difficulties in exporting the data from the old service. Similar problems arise when a service provider folds or goes bankrupt.
- Consequently, to ensure you can port data to new services, one must examine when completing a service agreement how matters are stipulated such as conditions on the user's right to output and receive data entered, tabulated, and processed during the term of the agreement at the conclusion of the agreement, the possible data output formats, and the ease of outputting data.
- Another point to check to prevent security breaches is whether the provider is obliged to delete data at the conclusion of the agreement. It is also important to confirm data interoperability, both technically and in operation, between the old and new systems.
- One must examine how relief for contract violations is handled prior to

entering an agreement. Not only are there many cases of provisions providing indemnity to the service provider, it is difficult from the user's side to establish the cause of a fault or outage. Because the "cloud" is just that — a multilayered black box — sorting out responsibilities is complicated. Indeed, even confirming the country where the server is located can be problematic. The user, therefore, has no choice but to accept on faith the explanation given by the service provider, which makes it hard to push the service provider to take responsibility under a SLA.

- If the cause is established, the provider is responsible for incidents that occur on the cloud side even if a third party commissioned by the provider to operate a portion of the service is at fault. The third party in this case is considered a contracted performing agent of the provider.
- On the other hand, if the incident occurs at a server located in another country, there are limitations on what can be controlled through agreements since Japan's legal system does not have jurisdiction. The same risk applies when data transits through other countries. Therefore, very careful studies must be made particularly when using cloud services for public operations and services.

4. Projects to Optimize Public Networks using Broadband (FY 2010 budget measures)

(1) Verifying local government reform models

(i) Web-based reform feasibility study (about 400 participating organizations are expected)

- The execution of administrative affairs using cloud services over optical broadband networks is premised on a large number of local governments sharing applications. This scenario will not be feasible, however, if the differences in local government affairs are too great. The Web-based reform feasibility study is designed to verify this aspect of the Broadband Open Model.
- Although the system for the Web-based reform feasibility study is still being put together, it will be able to verify the appropriateness of the Broadband Open Model with desktop terminals used by local government officials.
- What this system will do is have local government officials compare the data fields on their current system, mainframe, or customized software with the data fields already included in a commercial software package provided by the vendor that participated in the preliminary study. For example, the system will display a local tax data field on the local government official's screen. If local government's system has the same field, the official can compare the two fields by clicking on an empty field on the screen.
- There are likely almost no data fields included in the commercial software package that the current local government systems do not have. This is because taxation, national insurance, nursing, and other operations are legally mandated, so all local government systems are certain to have the minimum required data fields. The system asks the local government official to fill in any unique data fields needed for local government operations that the commercial software package lacks. The system also asks the official to enter the reason for having the data field.
- At the end of the study, the vendor providing the software package will be asked to explain why the software does not have the data fields local

governments have indicated as necessary.

- The vendor will also provide an estimate of how much it would cost to customize the software package to add extra data fields.
- The same study will also look at processing functions. It is difficult to envision local government systems that do not have the processing functions built into the software package, but the study still provides the capacity for comparing unique processing functions in the same way as data fields.
- The study will cover IT risk management. The IT risk management standards at private data centers will be preprogrammed in the study's system for comparison with local governments' server room management practices.

(ii) Live operational testing (about 5 to 10 participating organizations and including network security verification)

- Live operational testing, which includes various real-world durability tests, will be run in order to demonstrate the system's adequate security to residents. Of particular contention is finding out what type of trunk networks and subscriber networks meets cost and security concerns when data are stored in an external data center.
- For the tests, an IP-VPN will be built and an environment set up in which officials at municipal halls and town offices in the participating local governments will run software applications from an external data center. Testing will examine, in conjunction with local government security policies, how the network performs in relation to the local government's LAN structure, whether security zones (DMZs) are required, and whether security devices must be installed.
- Preliminary studies have revealed issues that turn up under real usage resulting from differences between local governments' systems and the commercial software packages. Local governments also want to introduce document management systems but it is a stretch for the governments to build these systems from scratch. If it is possible to use trial online versions of document management systems, these will also be included in the testing scope.

* The testing has two broad objectives. The first is to clarify by how much data fields and processing functions, as well as user interfaces, differ by having local government officials run verification operations. The study will also conduct comparative evaluations of the cost to customize these items.
* Testing will also examine how well the current commercial software meets the needs of local governments by looking at the current state of commercial software.
* As far as scheduling goes, the participating vendor is currently incorporating the fields and processing functions in the test software in April. After this, the software will be installed at each local government. About one to two months has been set aside for preliminary verifications of the data fields and processing functions. Live operational testing will commence once the preliminary verifications are finished.

(2) Verifying assistive systems intended to resolve regional issues

(i) Workload reduction for elementary and junior-high educators (about 400 educators, though details with the Miyakojima Board of Education are still being worked out)

- The Miyakojima Board of Education was planning to distribute computers to about 480 elementary and junior-high teachers working in the city of Miyakojima. The computers were to be used for school duties, such as managing student grades and recording home visits. The following issues, however, were pointed out.
  * Installing software (now and in the future) on all computers may become very expensive.
  * If home visit records and personal information on students are stored on computers, the damage cannot be recovered if a computer is lost and information stored is leaked.
- Because of these objections, the city of Miyakojima, which already has the necessary broadband environment, is considering verifying the actual

benefits — reduced software usage costs and improved security because data are not saved on computers — of having teachers run software applications from cloud services.

(ii) Provision of opportunities to challenged people to obtain first-rate skills training (interactive online classes at about 10 locations nationwide)

- This project's objective is to give more challenged people opportunities to learn and master jobs using ICT. To this end, the project will construct the necessary systems using broadband networks so that challenged people can participate in simultaneous, interactive cooking classes from Tokyo given by top chefs and patissiers. About six classes per year are planned. The project aims to identify problems and suggest improvement measures for interactive learning programs.

(iii) Construction of a network to share and decentralize healthcare statistical information

- This project, in cooperation with university hospitals and other institutions, will construct an environment in which prescription data from electronic clinical records, after being anonymized, are distributed and stored outside of the respective hospital and used for healthcare statistical purposes as needed. The project hopes to identify problems and suggest improvement measures for sharing healthcare information.