Attachment-4

Smart Cloud Study Group Report

- Smart Cloud Strategy -

May 2010

Smart Cloud Study Group

http://www.soumu.go.jp/english/ict

Introduction

Cloud services are about to bring about a paradigm shift in the information and communications sector. Rapid dissemination of the internet over the last 10 years and progress made in the development of broadband infrastructures that support it is significantly changing the ways ICT (Information and Communications Technology) is used.

With a view to promoting cloud services the said Study Group, chaired by the Senior Vice-Minister for Internal Affairs and Communications (in charge of information and communications), has to date met a total of six times in deepening discussion of it. The course of discussions resulted in an interim report being compiled in February this year and opinions being collected from a wide variety of relevant parties. In addition, a new attempt has been made to hold discussions on using twitter (#scloud). The opinions amassed were also referred to in compiling this report. Reports by the “Study Group on Measures to Revitalize Data Centers in the Cloud Computing Era”, the “Study Group on the Development of Government Information Systems”, and the “Optical Broadband Utilization Study Team”, etc. were also incorporated where appropriate that summed up discussions made on the dissemination of cloud services by the Ministry of Internal Affairs and Communications overall in determining the direction policies should take.

The subtitle of this report is “Smart Cloud Strategy”. The major purpose of this report is to enable an enormous amount of information and knowledge to be accumulated and then shared by all the social systems to all the different enterprises and industries on the optimal use of cloud services and to realize a 21st century “knowledge based information society”, which follows the “agricultural society” and then the “industrial society”.

ICT is a strategic sector that will be the basis for all social and economic activities. It can be used to create a society in which the general public plays a leading role and be a core industry that redirects the Japanese economy onto a new growth path while also strengthening our international competitiveness. Cloud services will therefore be one of the main pillars of future ICT. Worldwide dissemination of cloud services, led by the USA, has been making progress, and a delay in the creation/dissemination of cloud services in Japan could result in a “hollowing out” of the overall ICT industry in Japan and significantly weaken our international competitiveness, thus making immediate action necessary.

Japan is a “frontier of emerging issues”, including aging and a declining birth rate, and thus is expected to ensure cooperate with foreign countries, although mainly in Asia, through developing new solutions to social problems thorough utilization of cloud services.

In light of this report the government will need to actively promote a comprehensive and concrete “Smart Cloud Strategy”.

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Chapter 1　Points of View with Discussion

Cloud computing is an achievement of technologies that were developed to utilize computer resources on networks. Services that utilize cloud computing technologies (cloud services) can be used as in utilizing information and communications systems in a completely different way to that of existing systems in that they provide users with access to computer resources “only when needed and only in the quantity needed”, and will thus result in a paradigm shift in the information and communications sector.

1. Characteristics of cloud services

Cloud services are still in the process of active technological innovation and service development, and thus cannot at present be easily defined in a univocal manner, but the following working definition can be provided after taking into consideration the current situation with them.

Cloud services can be defined as:

> “services that provide third parties (users) with use of computer resources that are stored at data centers from remote locations via the internet and other broadband access in which users may not be able to identify the location where the computer resources are stored,”

and generally have the following characteristics.

- Scalability: Users have access to computer resources in the quantity they need, thus securing “scalability” in the flexible use of computer resources which is in accordance with the amount of work involved.
- Availability: Service providers can secure “availability” in preventing any termination of services in the case of an accident occurring with a specific server group by passing any necessary processes over to other server groups.
- Agility: Users have immediate access to computer resources as a service, thus securing “agility” in significantly shortening the time required for provision of the relevant service. In addition, users have access able to sustainable use of cloud services through changes in the cloud service infrastructure while still being able to continue doing business.
- Measured service: Both users and cloud service provision business operators (cloud service business operators) can improve transparency through enabling “measurement and management” of resources accessed through cloud services.
- Economy: “Economy” in that a cost advantage is available to both users and cloud service business operators.

Users can access computer resources through a unit-based pricing model (OpEx) without having to make any of the initial investment (CapEx) required in purchasing information systems, etc. as they do not have to procure/operate the actual computer resources themselves, which include both devices and applications, thus realizing greater “economy” through improved cost-effectiveness.

When computer resources are utilized over the long-term, however, cloud services may not necessarily be relatively more economical in terms of TCO (Total Cost of Operation).

In addition, cloud service business operators should be able to improve the operating rate of computer resources through accommodating a number of users through common data centers and flexibly allocating computer resources according to the amount of work needed by individual users via virtualization technologies, and thus realize greater “economy” through lowering ICT usage costs.

2. Issues with cloud services

As described above cloud services have many advantages, but some negative issues also exist, such as the following.

- Securing safety/reliability: Many users share computer resources via cloud services but particular efforts still need to be made in ensuring the service is provided with a high level of safety/reliability.
- Data location: Users are not necessarily aware of where their data is located with cloud services, thus leading to the issues of problems with the data management system, etc. being difficult to determine if the data is located overseas.
- Borderless services: Cloud services can be freely provided freely without being limited by borders, and hence its relationship with domestic legislation concerning the protection of consumer (user) rights and protection of personal information, etc. needs to be clarified.
- Original business development: Cloud services are still being developed but are expected to rapidly spread. Cloud service business operators individually develop businesses, but the formulation of international rules and standardization, etc. involving both usage and technical aspects are in progress at a number of standard organizations, etc. which will ensure interoperability between cloud services and prevent any unreasonable lock-ins. This will then result in such incidents as users facing difficulties in continuing doing business through alteration/termination, etc. of service contents at the convenience of cloud service business operators being avoided.

3. Dissemination of smart cloud services

Dissemination of cloud services itself is not the overall goal, with instead efforts needing to be made with the aim of solving various issues that social systems face through utilization of ICT via dissemination of cloud services and exploiting the advantages of them.

Cloud services have the characteristics described above, namely “scalability”, “availability”, “agility”, “measured service”, and “economy”, but the essence of them is their ability to enable massive amounts of information and knowledge to be amassed and then shared by entire social systems and different enterprises and industries and thus realize a “knowledge based information society”.

It is therefore considered appropriate that basic policy objectives should include not only replacing existing systems with cloud services but also realizing more efficient use of ICT resources by different enterprises and industries, and not just limited to ICT industries, through utilizing ICT resources over networks in the most efficient manner (overall optimization) and thus improving people’s lives, strengthening our international competitiveness, and reducing any environmental impact through the development/dissemination of “smart cloud services”, which can be considered “next generation cloud services” that will create new value added knowledge and realize the advancement of all social systems by collaborating on amassing massive amounts of knowledge stored in clouds.

Development of the internet with its basic principles of being “autonomous, distributed, and cooperative” took place in free “collaborations”, with the development of cloud services basically being an extension of that. If cloud services are to be incorporated into social systems by different enterprises and industries, similar to the case of the internet, the expectation is that the accumulation and sharing of knowledge/information will be facilitated via an entire “eco-system” which the many relevant stakeholders will be involved in, including users of cloud services (end users and enterprise users), cloud service business operators, the government/local governments, governments of other countries, etc., thus leading to the realization of people’s lives being improved and new economic ICT based growth.

Chapter 2　Basic Idea with Dissemination of Cloud Services

1. ICT environment and cloud services in Japan

Optical fiber networks and high-speed and large volume communication networks in both directions have already been established in Japan, with broadband services being available for use at the lowest price in the world. The number of fixed broadband service subscriptions totals 31.71 million and 96% of 110.62 million mobile phone subscribers are using 3rd generation mobile phones (3G) that support high-speed data communication (all figures are as of December 2009). Japan therefore has the best network environment in the world for utilization with cloud services that use computer resources via networks [Document-1 and 2].

However, utilization of ICT in various sectors, including governmental, medical, educational, agriculture, forestry, and fisheries, etc., is falling behind that of other countries. It is therefore considered appropriate that network environments suitable for using cloud services be taken advantage of and efforts to facilitate sustainable utilization of ICT through dissemination of cloud services superior in terms of economy, etc. promoted. [Document-3].

2. Expected effects of dissemination of cloud services

(1) Realization of greater efficiency in different industries

Utilization of cloud services lowers barriers to ICT utilization and by shortening the time needed to procure ICT services, etc. can facilitate more ICT utilization.

It can also make enterprises easier to start up and facilitate greater efficiency in small- and medium-sized enterprises through lowering the cost of ICT utilization, data storage and rapid data processing that utilize massive amounts of computer resources, which are not available to individual enterprises, etc. in thus realizing revitalization of the Japanese economy.

In addition, the broadband environment being available for use enables cloud services to be used without any geographical limitations and thus the dissemination of cloud services can also contribute to the revitalization of local economies. Utilization of cloud services enables easy realization of ICT environments in a short time that can then be shared by enterprises which previously faced difficulties in cooperating with each other, especially those located in remote locations. The expectation is therefore that joint developments and cooperative businesses between enterprises and the development of new technologies and industries through “collaborations” that were previously not possible will be facilitated.

(2) Realization of advanced social infrastructure

An advanced social infrastructure is expected to be realized with regard to public services through the utilization of massive amounts of real-time stream data collected via cloud services.

More concretely, centralized control of flow of human resources, materials, money, and information, including traffic control, river and port management, disaster measures, and energy control, etc., is considered very important in facilitating advancement of the entire social infrastructure. Facilitating the advancement of the entire social infrastructure will, however, require that the conditions needed in securing an adequate level of reliability, etc. be carefully determined.

In addition, the facilitation of the creation of new added values and new industries can also be expected[1] through collaborations (including both public sector collaborations and public-private sector collaborations) taking place that utilize the knowledge/information stored in clouds (data centers). For example, realization of the integration and disclosure of ant information in government possession through utilizing cloud services is expected to create new added values through utilizing the wisdom of the private sector.

(3) Environmental impact reduction

Cloud services can help reduce harmful environmental impact by concentrating computer resources. Some concerns do exist however over a rapid increase in CO_2 emissions from data centers, etc. Therefore, and in order to realize a reduction in the environmental impact over all social systems, enterprises are expected to be able to reduce their electricity consumption (CO_2 emissions) by avoiding having to make any redundant ICT-related investment and the active introduction of green electricity (solar electricity, etc.) is expected on the assumption of developing/disseminating environment-friendly green cloud data centers, etc.

In addition, facilitating ICT utilization through dissemination of cloud services is expected to eventually have an effect on reducing the environmental impact by making the flow of human resources and materials more efficient. According to an estimation made by the Environmental Issues Working Group, Global Issues Study Group, “ICT Policy Task Force for a Global Era” of the Ministry of Internal Affairs and Communications, the facilitation of ICT utilization will result in ICT being expected to have the effect of reducing CO_2 emissions by at most 12.3% from 1990 levels by 2020, with the level of CO_2 emissions from use of ICT devices, etc. remaining at the same

[1] UK “Power of Information” project involves an attempt to create new value thorough utilization of government information by openly disclosing information in government possession (map data, medical information, statistical information, etc.) and also publishing an API (Application Programming Interface).
In Korea, the Ministry of Public Administration and Security, the Ministry of Culture, Sports and Tourism, and the Korea Communications Commission jointly published a “Comprehensive Plan for the Utilization of Public Information by Private Sectors” in March this year. The plan aims to create employment at new businesses and small- and medium-sized enterprises through promoting utilization of public information, including traffic and weather information, etc., by the private sector and intends to promote the establishment of “private sector utilization support centers” in enabling one-stop retrieval of public information available for use. [Document-5]

level as in 2012 (up 2.4% from 1990)[2] [Document-6].

(4) Promotion of global development of enterprises

Development of broadband environments is also progressing is other Asian countries, etc. The establishment of broadband environments that enable use of cloud services can result in rapidly deployment of necessary information systems, etc., and thus cloud services are expected to help facilitate the global development of enterprises in Japan.

In addition, establishing an international division of work system via utilization of cloud services can be expected to enable more efficient business development of enterprises through, for example, Japanese enterprises being able to select the appropriate managerial resources in other Asian countries, etc. when developing/providing products and services.

3. Securing diverse cloud services

Cloud services and their related technologies are still in the process of being developed. Securing an environment that supports “diverse” cloud services in enabling various forms of services to be provided and that does not interfere with or impair potential innovations taking place in regard to the services and technologies is therefore required.

Diverse cloud services can be classified into three types, namely “diverse service models”, “diverse service components”, and “diverse SLA (Service Level Agreement)”.

(1) Diverse service models

Forms of cloud services will be provided in include the following.

- ✓ Public clouds made available to the majority of the general public
- ✓ Private clouds provided within the same enterprise or to groups of enterprises with the common goals
- ✓ Hybrid clouds in a combination of public clouds and private clouds
- ✓ Multi-clouds in a combination of multiple public clouds

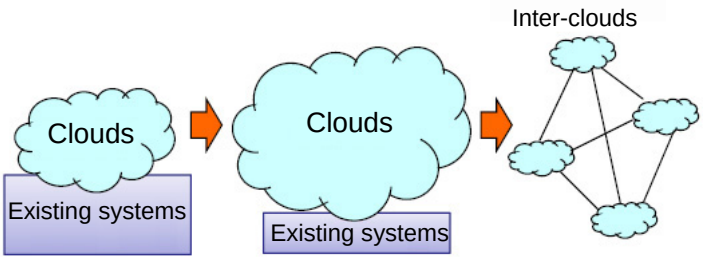
In addition, independent private cloud type services are also being provided within public clouds in recent years.

[2] In the “Recommendation on Mobilizing ICT to Facilitate the Transition to an Energy-Efficient, Low Carbon Economy” adopted in October 2009, etc. the EU expects to be able to reduce CO_2 emissions by 15% through ICT by 2020 and intends to promote concrete ICT utilization methods in improving energy efficiency and by introducing smart meters, etc. [Document-7].

Users of cloud services can be divided into end-users and enterprise users, with the use of cloud services increasing among end-users. Enterprise users, however, mainly utilize the customer management systems of public clouds, but have started using parts of private clouds.

Taking into consideration the use of cloud services by enterprise users results in the assumption that service models will be developed through the following steps: existing enterprise systems will be combined with cloud services as the first step, the percentage of cloud service usage will then increase, and finally move toward an inter-cloud environment in which multi-clouds and hybrid clouds involve mutual collaboration.

Forms of service development



(2) Diverse service components

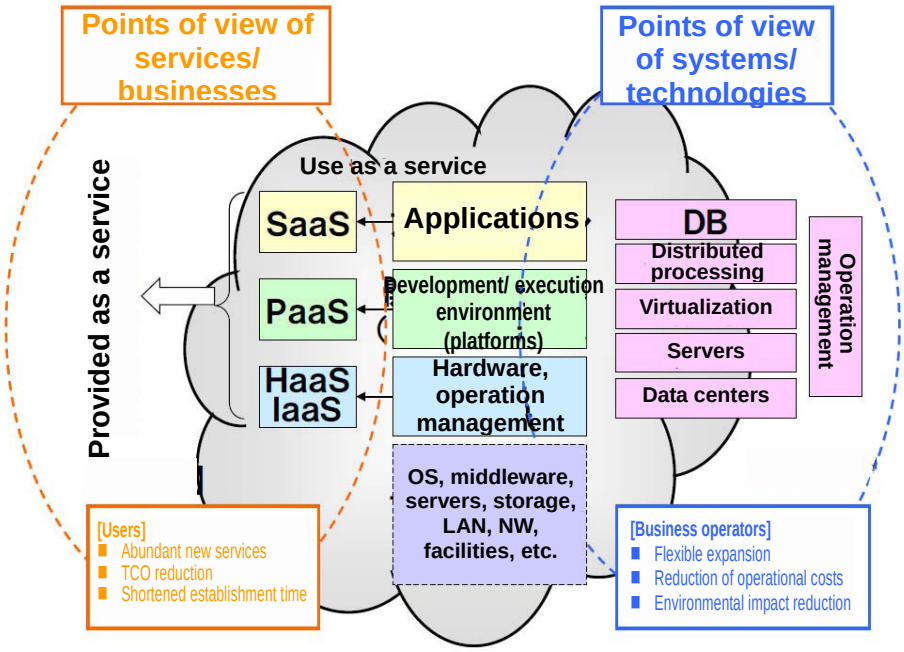
Components of cloud services can be classified into the following.

- ✓ IaaS (Infrastructure as a Service) that provides the infrastructure which includes servers, CPUs, and storage as the service
- ✓ PaaS (Platform as a Service) that provides the platform for executing applications as the service
- ✓ Saas (Software as a Service) that provides applications (software) as the service

Enterprise users may procure these components of cloud services as necessary according to their needs or use them in combination with existing internal systems.

Some cloud service business operators are being provided with cloud services by other business operators and then combine them with own computer resources, etc. in adding value and then offering them as their own original cloud services. Diverse cloud service components that can be freely combined therefore will need to be continued to be secured.

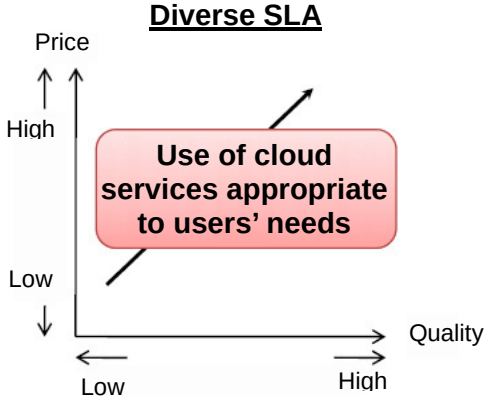
Diverse service components



(3) Diverse SLA

The quality of cloud services can vary. From the users' points of view a trade-off exists with the relationship between quality and reliability of services and the cost of procuring the necessary services. In view of enabling "reasonable choices" when selecting cloud services to use at a quality that is appropriate to the users' individual needs, therefore, diverse SLA can be expected to need to be secured through clarifying/publishing the basic level service items which service providers will need to offer and the optional level service items provided upon user request.

Diverse SLA



4. Three basic policies with dissemination of cloud services

Dissemination of cloud services will need to be promoted from the users' points of view and with the following principles in mind while persistently securing diverse forms of cloud services.

- **Principle 1: Initially promote users of diverse cloud services.**

The use (dissemination) of cloud services should initially be promoted without requiring any environmental development of cloud services as a precondition and with the highest priority of policy objectives being improvement of user literacy (correct understanding and ability to make fullest use) of cloud services.

The development of cloud service dissemination measures will need to be individually discussed with respect to the various user groups (for example, general households, small- and medium-sized enterprises, and public agencies) in achieving that. Regularly identifying users' wishes/intentions with cloud services and promoting the necessary environment developments based on objective data in parallel will therefore be desirable.

- **Principle 2: Facilitate cloud-related technology development with consideration given to user needs and at the same time promote strategic measures that lead to innovations.**

In view of realizing the provision of easy-to-use services cloud-related technology developments will basically need to be facilitated in the order of the highest priority being attached to user needs. At the same time the government can be expected to establish technological strategies in the future and identify the real strengths Japan has in cloud-related technologies in taking the appropriate measures, including concentrated allocation of resources.

- **Principle 3: The government will play a public role in the dissemination of cloud services from three points of view, namely "environment development", "public support", and "procurement entity".**

The government can be expected to play the following public roles in the dissemination of cloud services.

(a) Environment development that supports the dissemination of cloud services: The government can be expected to play a public role in supporting the promotion of cloud service dissemination and eliminating any systematic factors preventing it from taking place, environment development in enabling users to access cloud services in a safe and secure manner, and in developing an international consensus, etc.

(b) Public support for research and development, etc. by the public sector: The government will need to play a public role in supporting the basic research and development that the private sector cannot promote themselves, promoting standardization, and supporting cloud service development by small- and medium-sized enterprises, etc. as well as in supporting technological developments that individual enterprises will face difficulty taking on, including making the entire social system more efficient through the utilization of cloud services.

(c) Procurement of cloud services: As the public entity that will procure cloud services the government can be expected to take the lead in establishing the cloud infrastructure and actively procure external cloud services in making duties more efficient, improving residential services, and raising the level of related technologies, etc.

5. Environment development toward dissemination of cloud services

In view of facilitating dissemination of cloud services discussions will need to take place on promoting it from both usage and technical points of view. The direction of policies toward full ICT utilization through cloud services will initially be discussed with respect to the environment development in the dissemination of cloud services (Chapter 3).

Improving people's lives through the development of the next generation cloud technologies that Japan has strengths in while also strengthening our international competitiveness, etc. will involve the direction of the development of the next generation cloud technologies that should be focused on being discussed (Chapter 4). Furthermore, in view of standardizing the technical specifications involved in linking a large number of existing cloud services the ideal standardization of cloud technologies, etc. will need to be discussed (Chapter 5).

In addition, cloud services are provided in a borderless manner, thus making consistency between domestic legislation and international rules needing to be secured. From this point of view the direction an international consensus regarding cloud services will also need to be discussed (Chapter 6).

Lastly, issues in future discussions by this Study Group, etc. will be clarified and a smart cloud strategy decided upon (Chapter 7).

Chapter 3 Full ICT Utilization through Cloud Services

Full ICT utilization through cloud services can significantly contribute to the realization of improved convenience for people and the revitalization of the Japanese economy, etc. through the creation of advanced social systems and improved added value in respective industries, etc., thus making the environment development in promoting the dissemination of cloud services essential. In doing so, and in view of strengthening international competitiveness, etc., the expectation is that utilization of cloud services will adopt open global standards.

1. Realization of electronic government clouds

(1) Basic idea

Although the government has long been making the effort to establish an electronic government system achievements have been lacking from the point of view of realizing government services that are based on the user perspective and in making government services more efficient.

This is due to insufficient clarification of the purposes of promoting an electronic government system and a lack of cross-over efforts between the different ministries and agencies involved under a unified concept. Realization of an electronic government system will be the basis in the realization of government services for the benefit of the people and its purposes can be summarized using the following three points.

[1] "Government services being more identifiable": The establishment of a system similar to that of the Korean "government application system" for the general public to use in identifying the progress of government procedures and manage their own personal information, etc. is necessary in enabling applicants to manage the status of the progress of government processes themselves and access logs held on personal information by respective government agencies, etc.

[2] Promotion of "open government": Similar to the application using smart phones3[3] (G-Apps on SmartPhone) that has been promoted in the USA the realization of more open government through improved accessibility to government services via utilization of smart phones and government kiosk terminals and disclosure of information in government possession4[4] is needed.

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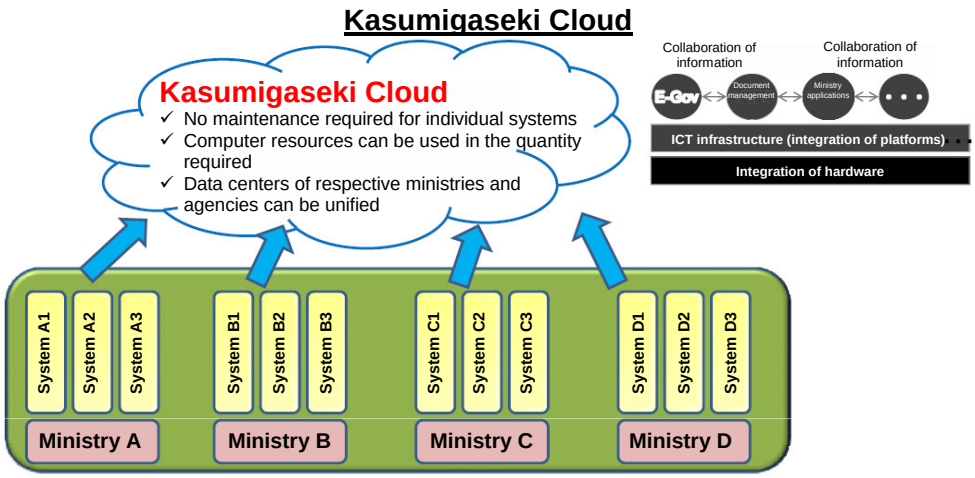
[3] For example, applications (for Apple iPhone and iPod Touch) that support live streaming of official events at the White House and distribution of update information from the White House Blog are available.

[4] In the report "Digital Britain" (June 2009) the UK proposed the establishment of the government cloud of "G-Cloud". It is expected to help in making the government itself more efficient and entry to government application markets, etc. by small- and medium-sized enterprises easier, while also creating new businesses through the disclosure of information in possession of the government and other public agencies [Document-8].

[3] “Administrative reform” through elimination of waste: Efforts to promote integration/consolidation of the governmental administrative systems and other administrative system reforms steadily promoted with the aim of reducing operating costs of governmental administrative systems by approximately 50%.

The electronic government cloud of the government known as the “Kasumigaseki Cloud” and local government electronic clouds known as “Local Government Clouds” will need to be promoted in achieving the above.

Technical requirements in establishing electronic government clouds will include the formulation of a BCP (Business Continuity Plan), which is a plan that enables businesses to continue in the case of a failure, and discussion of matters that take into consideration safety and reliability, in particular. In addition, electronic government clouds will require full implementation of BPR (Business Process Reengineering) by the respective ministries and agencies. Establishment of a governmental CIO (Chief Information Officer) and development of a system for use in promoting the establishment of electronic government clouds throughout the entire government is therefore needed. In addition, efforts to realize one-stop administrative services should be accelerated, including the establishment of a citizen ID system[5] that will be able to collaborate with public IDs and “enable citizens to control their own information themselves”, along with common enterprise codes, etc.



[5] In February this year the Ministry of Internal Affairs and Communications published “Haraguchi's 5 Principles on Identity”. More concretely, it required that [1] IDs shall only be used protect people’s rights, [2] the system shall disallow any unauthorized use/storage but enable verification/modification of self-information in support self-information control, [3] the scope of use shall be clarified and system shall fully protect privacy, [4] the system shall be cost-minimizing, reliable and efficient, [5] the government and local government shall cooperate in promoting it.

(2) Establishment of common government platform[6]

The effects of integration/consolidation etc. will first need to be verified before realization of the “Kasumigaseki Cloud” plan of the government and with regard to integration/consolidation of the government information systems and “common government platform”, which will be the basis for data collaboration, can take place. The results of verifications using sample systems revealed operational expenses could be reduced by reducing the number of servers through sharing them between multiple systems and by reducing the number of outsourced system operators through unifying operational management. In addition, in reducing the environmental the electricity consumed by the servers could also be reduced by reducing the number of servers, etc.

In order to more strongly promote total optimization of the government information systems, therefore, efforts should be made to aim at further integration/consolidation of the government information systems by utilizing a common government platform.

In addition, since integration/consolidation is not necessarily effective for all information systems the priority of discussions should be the integration/consolidation of “systems that do not depend on specific technologies/environment” and “systems which do not have to always available”, etc.

Depending on the level of functional generality and confidentiality of the information involved, however, some information systems can be considered to be capable of being developed/operated more efficiently by utilizing the advantages of private cloud services than integrating/consolidating a common government platform.

Utilization of private cloud services should also therefore be considered if it would be more cost effective. Utilization of private cloud services does include some issues, as noted in Chapter 1, however, and hence whether to utilize it or not should be comprehensively determined after taking into sufficient consideration the advantages and negative issues.

Dissemination of the relevant technologies in securing the safety/reliability of the “Kasumigaseki Cloud” that the government will establish, etc. should be facilitated through disclosure of the specifications and interfaces, etc. With the establishment of the “Kasumigaseki Cloud”, etc. the international standards and technologies to adopt will need to be determined through a transparent process that is open to the public and discussion by experts, etc. In addition, collaborating with private sector cloud services with security measures against cyber attacks, etc. taken into account will require the greatest possible consideration given to open (common) interfaces.

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[6] Refer to the final report of the “Study Group on the Development of Government Information Systems” (April 2010) for more details on the discussion of a common government platform.

(3) Promotion of local government clouds

Local governments are entities that provide the government services which are the most closely associated to residents, including statutory entrusted functions of the government, and thus have special requirements, including strict management of information with regard to the rights/obligations and property of residents and enterprises, imposed upon them. For this reason respective governments to date have generally procured mainframe computers, servers, and business applications, etc. and established the systems required in performing their duties themselves. Reflecting the requirements of respective governments and annual system revisions, however, will require the information systems to be modified, thus resulting in high development, operational, and maintenance costs. The recent tight financial conditions in particular have increased the burden of them.

Reducing the fixed burden involved in the operation and maintenance of the information systems while maintaining the quality of existing government services and responding to diverse administrative needs in these circumstances will require the establishment of an efficient electronic government service infrastructure, including active introduction of ASP/SaaS, being promoted[7]. Small scale local governments, in terms of population and finance, in particular, will need to actively discuss not only utilization of ASP/SaaS but also sharing information systems with adjacent governments and others.

The Ministry of Internal Affairs and Communications has been making the effort to further promote a reduction in the information system burden of local governments and establish electronic local governments[8] while implementing the "Local Government Cloud Development Verification Project" using the FY 2009 supplementary budget. This project involves the efficient establishment/consolidation of information systems using data centers and promoting standard (common) duties and shared use of them. Six prefectures and 66 municipalities plan to participate in the project. Local government clouds involve an effort being made by local governments to establish private clouds in more efficiently providing government services over a Local Government Wide Area Network (LGWAN)[9] while concurrently promoting consolidation of information systems and their shared use.

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[7] The Ministry of Internal Affairs and Communications formulated and published the "Guidelines for Introduction and Utilization of ASP/SaaS by Local Governments" on April 1, 2010. (http://www.soumu.go.jp/menu_news/s-news/02gyosei07_000026.html)

[8] The Ministry of Internal Affairs and Communications established the "Local Government Cloud Portal Site" in March 2010 to provide information on local government cloud development projects. (http://www.soumu.go.jp/main_sosiki/jichi_gyousei/c-gyousei/lg-cloud/index.html)

[9] The Local Government Wide Area Network (LGWAN) involves a government specific private network that connect all prefectures and municipalities operated by the Local Government Wide Area Network Operation Committee, which consists of local governments, and is the basis for the electronic local government and electronic government systems.

Consolidation of information systems and shared use, as seen in the example of local government clouds, will contribute to a reduction in the cost of the information systems of local governments[10] and the establishment of a local-sovereignty based society through provision of government services that are appropriate to the needs of residents and can be seen as a reinvestment in efforts to improve local self-sustenance and wealth creation. Nationwide development of local government clouds will, however, require further promotion of the consolidation and shared use of information systems through, for example, agreements being concluded between the government and local governments, etc. on the promotion of local government clouds, formulation of standard specifications[11] in securing the appropriate collaboration between local government systems that are making the effort to develop local government clouds and between local government and the government systems, and increased utilization of cloud computing by the government when the system needs to be revised or new systems concerning the duties of local governments, etc. introduced.

(4) Principles for procuring cloud services

Handling the information critical to the government and local government duties will require the establishment of their own individual cloud systems, for example the above mentioned "Kasumigaseki Cloud". In view of reducing governmental costs and improving the quality of services, however, active procurement of cloud services that private business operators provide will also need to be promoted[12].

However, no governmental principles are in place for use in procuring cloud services and the full-scale introduction of cloud services has not taken place yet by local governments, although they are being used in some cases. In the USA efforts are already being made to procure cloud services[13]. The respective ministries and agencies will therefore need to cooperate on and discuss

[10] Local government cloud development projects are expected to be capable of reducing costs by 30% to 40% through the "split cost effect" of both consolidation and shared use of information systems.
[11] The Local Authorities Systems Development Center (LASDEC) is formulating standard specifications for use with local government clouds.
[12] Development of package software for duties, including statutory duties and financial accounting, etc., is progressing, with business models for providing respective municipalities with those general-purpose applications from data centers using broadband networks (cloud services using broadband open models) also having been commenced upon. Refer to the interim report (March this year) made by the "Study Group on the Development of Government Information Systems" of the Ministry of Internal Affairs and Communications for more details of the discussions.
[13] The Obama USA Administration is promoting an "Open Government" initiative that aims at improving government transparency and commenced operation of "Data.gov" in May 2009, a website which facilitates the utilization of data in possession of the government. In addition, in view of facilitating the introduction of cloud services by the federal government the GSA (General Services Administration) published an RFI (Request for Information: May 2009) and RFQ (Request for Quotation: July 2009) in presenting SLA standards for use with IaaS that can be provided using public clouds, with operation of "Apps.gov", a website which provides ministries and agencies with cloud-based ICT services, also having commenced in September 2009 [Document-9 through 16].

the principles to use in procuring cloud services after taking into consideration some of the reference cases of efforts made in foreign countries. In doing so the relationship with the necessary division involved in the procurement of the large-scale systems and the cloud services will also need to be discussed.

In addition to the actual discussions a system that enables, for example, the government to request cloud service business operators to appropriately disclose information on their security policies and business continuity, etc. will need discussing. The discussions will need to not only include the SLA but also the indices that can serve as specific standards for private enterprises and other users using the cloud services.

2. Thorough utilization of ICT in medical, educational, agriculture, forestry, and fisheries, etc. sectors.

ICT utilization through dissemination of cloud services needs to be promoted from the point of view of sharing accumulated knowledge/information and facilitating its utilization. In addition, the point of view of also needing to improve the “ability to connect” for community residents through dissemination of cloud services in realizing the revitalization of communities through which people can help support each other is also pertinent.

Simply introducing cloud services will not necessarily make governmental duties more efficient, thus making the creation of a system for use in setting access levels and confidentiality priorities with regard to respective data items stored in clouds and review of systems, etc. obstructing these efforts also needing to be promoted in parallel.

This report has clarified the direction of cloud service development in the medical, educational, agriculture, forestry, and fisheries, etc. sectors where ICT utilization has not made much progress. Further concrete discussions on the direction thorough ICT utilization should take, including in other sectors, and through dissemination of cloud services, will also need to continue to take place.

(1) Medical clouds

Medical information belongs to both medical institutions and individuals. Promotion of online receipts and rapid complete implementation of EHRs (Electronic Health Records) that enable individuals to manage their own electronic medical information themselves is therefore needed.

Progress made in using electronic medical information will enable electronic medical information, excluding personal information, to be stored in “medical clouds” and its utilization in the development of new drugs and the establishment of new treatments that are based on massive medical evidence information, including examination data.

The establishment of emergency medical systems over “medical clouds” is also important. For example, the establishment of a system for use in identifying hospital bed vacancies, the status with placement of specialists, and the status with placement of ambulances, etc. in real-time, with patients being delivered to the most appropriate hospital, can be expected to result from that. “Medical clouds” are also considered to be utilizable with triage[14] in the case of large-scale disasters, etc. occurring.

(2) Educational clouds

Reducing expenses and the burden can be enabled through integrating the portal sites and school duty systems that are established individually by schools and Boards of Education and the systems for evaluating and providing information on the status of school operations, etc. into “educational clouds” and then making them available via SaaS.

In addition, the nationwide distribution of digital materials used at educational sites and a knowledge database via “educational clouds” can be expected to significantly contribute to the realization of a “collaborative education” (future school) system in which people can teach and learn from each other through utilizing ICT devices.

Furthermore, utilization of cloud services in remote education areas will no longer be limited to conventional classroom learning but also enable system development practices, etc. due to it ability to easily establish virtual systems and services, and thus can expected to significantly contribute to collaborations between educational institutions.

(3) Agricultural clouds

At present the aging of agriculture, forestry, and fisheries workers is becoming quite severe. For example, 58.6% of 2,365,000 core agricultural workers are aged 65 or older (as of 2005, “Survey on Movement of Agriculture Structure”). Because of that the accumulation of know-how of those engaged in agriculture using “agricultural clouds” is expected to enable anyone newly engaging in agriculture to then utilize it, etc.

In addition, cloud services are also considered to be utilizable in the management of fields and gardening facilities through the provision of data (soil, humidity, rainfall, volume of water, planting status, etc.) using “agricultural clouds” and sensor networks and satellite images, with the development of industries through more efficient distribution by integrating the production, distribution, and sales of products, etc. also being expected.

[14] Securing optimal lifesaving effects necessitates the priority of treatment being determined based on the objective and simple criteria that comes from classifying the severity and emergency of injuries and diseases, etc. into four categories.

(4) Community clouds

In view of establishing a self-sustainable “New Civil Society” in which people support each other, including the development of cloud service platforms for use by NPOs, etc. that play such an important role in providing public services in communities, the promotion of measures to facilitate dissemination of community clouds for realizing community revitalization is being considered.

Establishing self-sustainable communities based on the idea that “community issues should be solved by communities” requires the creation of “new public” services which integrate the wisdom of community residents through use of community clouds, with issues expected to then be resolvable through use of them.

In view of community revitalization, for example, measures for improving the “ability to connect” of people through utilization of the internet, etc. is expected to be promoted. More concretely, the creation of bases for resolving community issues in the public service sector (medical, long-term care, welfare, disaster prevention, crime prevention, etc.) through ICT utilization will need to be promoted in cooperation with the local governments and NPOs, etc. In resolving community issues through the “ability to connect” in communities the development of community media with the participation of the general public, such as community SNS (Social Networking Service), will need to be supported.

“New public sector” or NPOs, etc. activities, in particular, can be rather labor-intensive. Revitalize the activities of NPOs, etc. will therefore make the establishment of “NPO clouds (tentative name)” desirable. More concretely, rather than NPOs individually establishing their own systems the operational costs of individual systems will need to be reduced through the provision of support, and with an aim of realizing a wide area collaboration of NPOs that engage in common activities through cloud services.

3. Advanced social infrastructure with the establishment of smart cloud infrastructure

Promotion of cloud service dissemination in sectors requiring large-scale data processing is also considered appropriate. More concretely, a smart cloud infrastructure will need to be established that optimizes the flow of information, physical matters, finances, and energy, etc. based on massive amounts of real-time streamed data that is integrated through an advanced social infrastructure via cloud technologies.

Japan has component technologies of ICT related devices, environmental impact reduction technologies, and advanced communications technologies, etc., and continues to dominate some sectors of the global market. The establishment of a smart cloud infrastructure that combines the

technologies which Japan has strengths in is thus important from the point of view of not just improving people's lives but also strengthening the international competitiveness of Japan.

More concretely, the establishment of a system for use in optimizing power flow by integrating real time data, including the amount of electricity generated by natural energy and electricity consumed by each household collected via smart meters, will be first be enabled through cloud technologies via smart grids that integrate the management of power flow and information flow.

Secondly, easing traffic congestion and the reducing CO_2 emissions via traffic light control and regulating traffic using probe information (status of use of accelerators/brakes, location information, CO_2 emissions, etc.) produced by individual vehicles through integrating them with cloud services is realizable with next generation ITS.

Thirdly, the establishment of large-scale wide area sensor networks will enable the integration, via cloud services, of river information, ground information from mountains and forests, rainfall information, etc. that is collected through the sensors. In addition, local governments, etc. can make good use of cloud services in disaster measures, including amassing data on the flow of people in disasters as streamed data that displays the most appropriate evacuation route through digital signage.

Fourthly, the percentage of roads in Japan with 50 year or older bridges is currently about 8% and 18% for tunnels, but those percentages will have rapidly increased to 51% for bridges and 47% for tunnels by 2030 (“New Growth Strategy (Basic Policies)” (Cabinet Decision on December, 2009). Responding to that rapidly aging social capital stock will necessitate repair records of facilities, etc. being amassed and data collected in daily inspections and via sensor networks to be analysed from various angles using cloud services, which will then enable greater safety and security through appropriate management of the social infrastructure and in reduction in costs through more efficient repair, etc.

Fifthly, identifying 3D-based product location information through the development of space codes, etc. and integrating that information using cloud services will enable the realization of more efficient stock management systems for all businesses and a stock-based financing system in which money can be lent using goods in stock, etc. for collateral.

The establishment of a smart cloud infrastructure that will realize the integration of information and social infrastructure collaborations via cloud services, etc., as indicated above, will require government and local government promotion as a national project in cooperation with industries and universities, etc.

4. Promotion of ICT utilization by small- and medium-sized enterprises and venture enterprises, etc.

In come cases small- and medium-sized enterprises and venture enterprises will be able to make their business more efficient or start new businesses through utilizing cloud services, which could then result in revitalizing local economies.

For example, according to a questionnaire survey[15] on small- and medium-sized enterprises "human resources" was the highest percentage at 67.7% of the management resources that small- and medium-sized enterprises lack, and in particular "business sales staff" (66.1%) and "planning/marketing staff" (40.5%). The percentage of small- and medium-sized enterprises lacking "soft management resources" was 29.0%, and in particular "sales channel development" (79.2%) and "planning and marketing" (87.5%). Matching the necessary human resources and soft management resources by realizing wide area collaborations between enterprises through ICT utilization will help strengthen the management resources of small- and medium-sized enterprises. However, the ICT related management resources of "information manager" (44.1%) and "funds for introducing devices" (17.6%) are also lacking. Cloud service utilization by small- and medium-sized enterprises will therefore facilitate ICT utilization while also strengthening their competitiveness through supporting collaborations between enterprises.

Support for the establishment of a small- and medium-sized enterprise platform with a matching function that enables small- and medium-sized enterprises in different regions and of different business types to collaborate over clouds and more efficient distribution through support for the establishment of a supply chain in different business forms by utilizing clouds, etc. will therefore be considered.

5. Cloud services and protection of the rights of customers (users)

(1) Intentions with cloud services provided by enterprise users

The creation of an environment through which customers (users) can correctly understand cloud services and be capable of making reasonable selection from the various cloud services available based on their own choice will be needed. A questionnaire survey[16] on executives involved in the introduction of enterprise systems, etc. was therefore conducted in both Japan and the USA, with the following results being obtained.

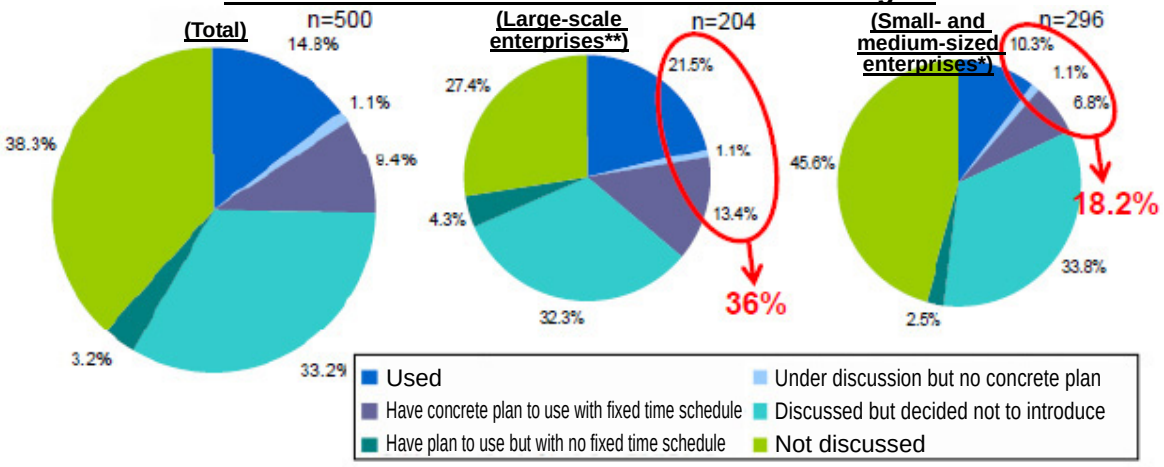
The results of the questionnaire survey conducted in Japan revealed that 25.3% of the respondent enterprises, etc. were using cloud services or intended to use them, with the percentage

[15] "Questionnaire on Management Issues of Small- and Medium-sized Enterprises (Report of Survey Results)" (April 2009) by the Small- and Medium-sized Enterprises Committee, Tokyo Chamber of Commerce and Industry

[16] This survey was conducted in Japan (November 2009) and in the USA (November 2009) by the Nomura Research Institute, Ltd. in cooperation with Yahoo Japan Value Insight Corporation as an Internet survey using 500 sample panels nationwide (in both countries).

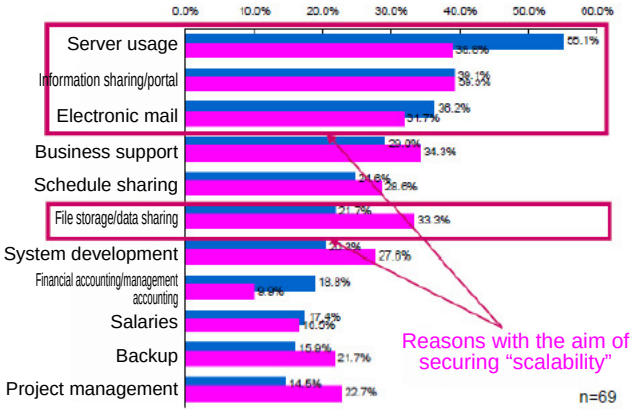
of large-scale enterprises (with 300 or more workers) being 36.0% and small- and medium-sized enterprises 18.2%. Among large-scale enterprises an awareness of cloud services was already high at 74.6% and the phase has shifted from being merely aware of to actually using them. Only 56.9% of small- and medium-sized enterprises, however, were aware of cloud services and the percentage of them intending to use them was also low. Improving awareness on cloud services therefore remains to be an issue with their dissemination among small- and medium-sized enterprises.

Actual/intended use of cloud network technologies

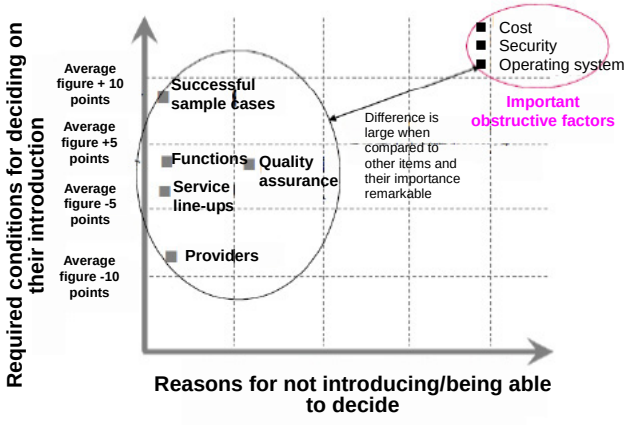


Enterprises already using cloud services or intending to use them had in common the intended use of information systems, including server usage, information sharing, electronic mail, and file storage/data sharing. Enterprises that have not decided upon their introduction listed three items, namely “cost”, “security”, and “operating system”, as the reasons that made the decision difficult.

Breakdown of cloud network technology usage



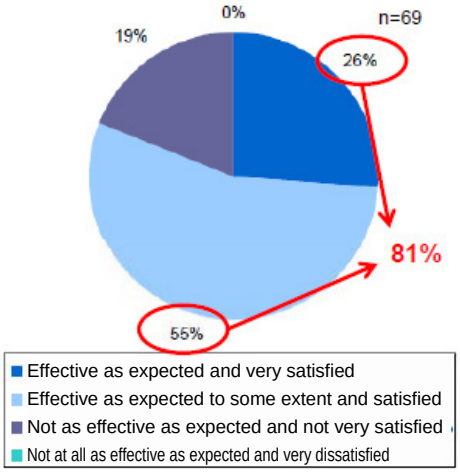
Obstructive factors to introducing cloud network technologies



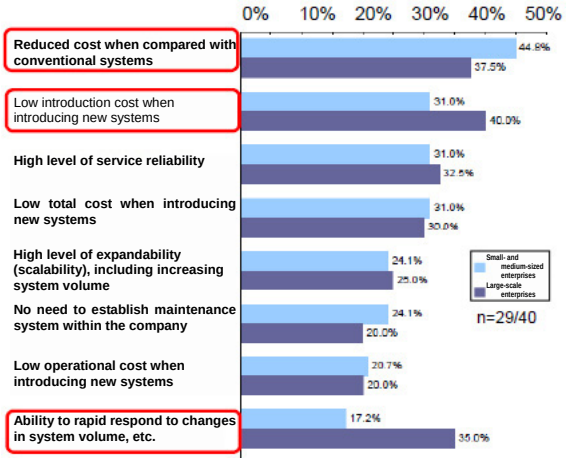
However, approximately 81% of enterprises that had introduced cloud services were satisfied and evaluated their “high level of service reliability”, “ability to rapid respond to changes in system

volume, etc.", and "advantage in terms of cost" as advantages. Of those not satisfied the percentage of "insufficient service convenience" and "security concerns", etc." was high. In addition, many enterprises listed "measures for improving security" and "measures for promoting understanding of cloud services" as requests to the government regarding the use of cloud services.

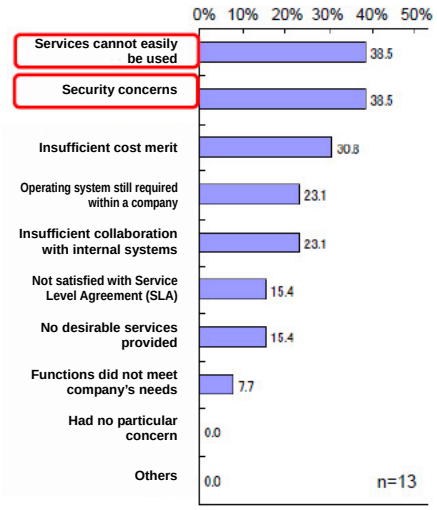
Post introduction evaluation of cloud network technologies



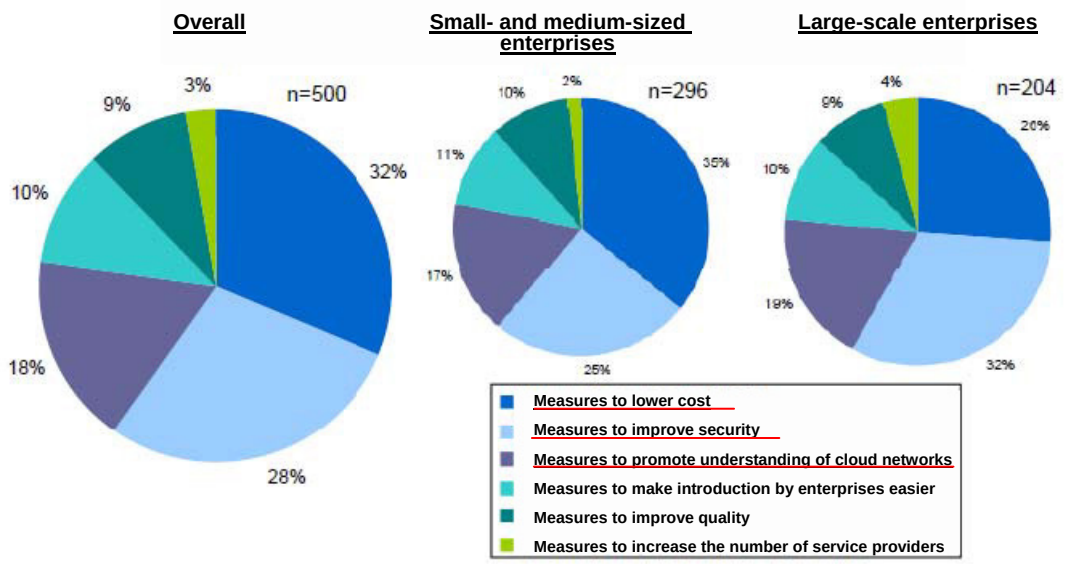
Reasons for introducing cloud network technologies



Points with dissatisfaction after introduction



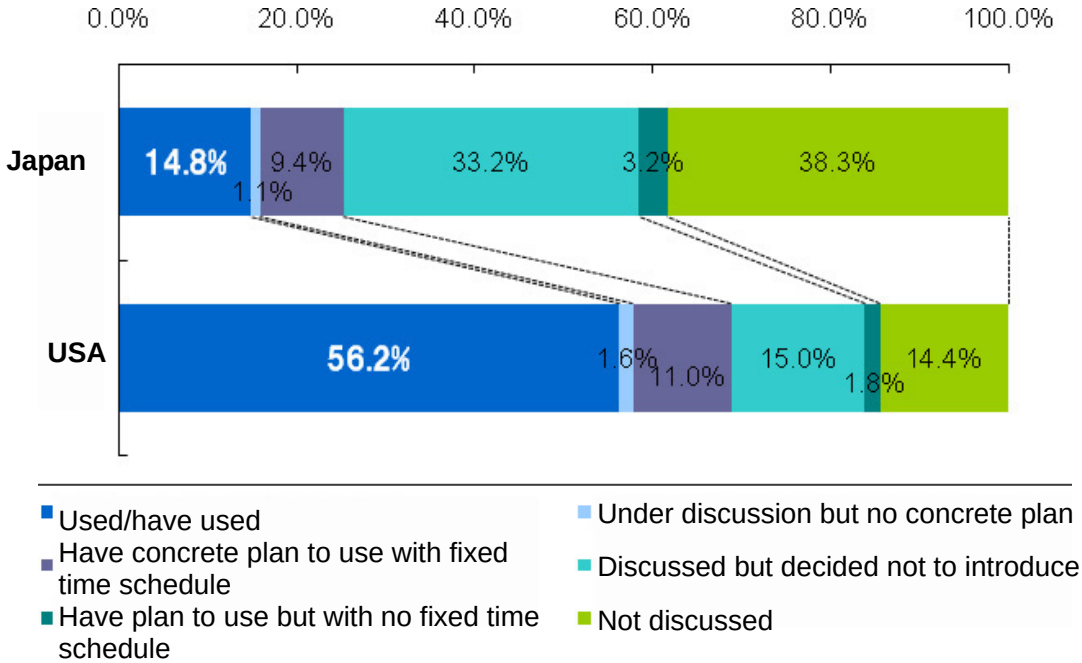
Requests to government



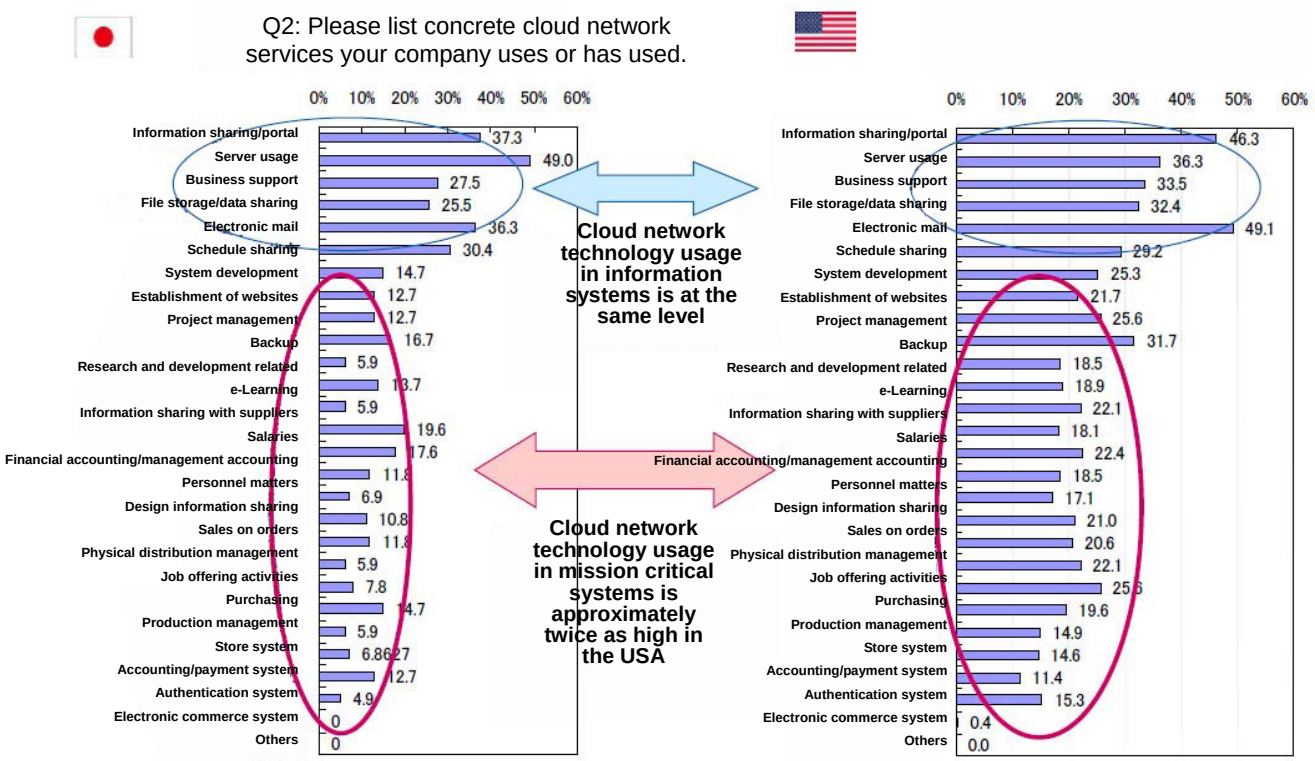
The following characteristic results were obtained from the questionnaire survey in the USA. Whereas 14.8% of respondent enterprises were already using or had used cloud services in Japan approximately 4 times as many or 56.2% of enterprises were using or had used cloud services in the USA.

The reason for this is considered to be that while the use of cloud services in information systems was high in percentage in Japan its use in mission critical systems has made more progress in the USA (twice as high as in Japan). In addition, although the level of penetration of cloud services is high at 75% among large-scale enterprises both in Japan and in the USA it is already in the "phase of actual use" in the USA whereas still in the "preparation phase for use" in Japan.

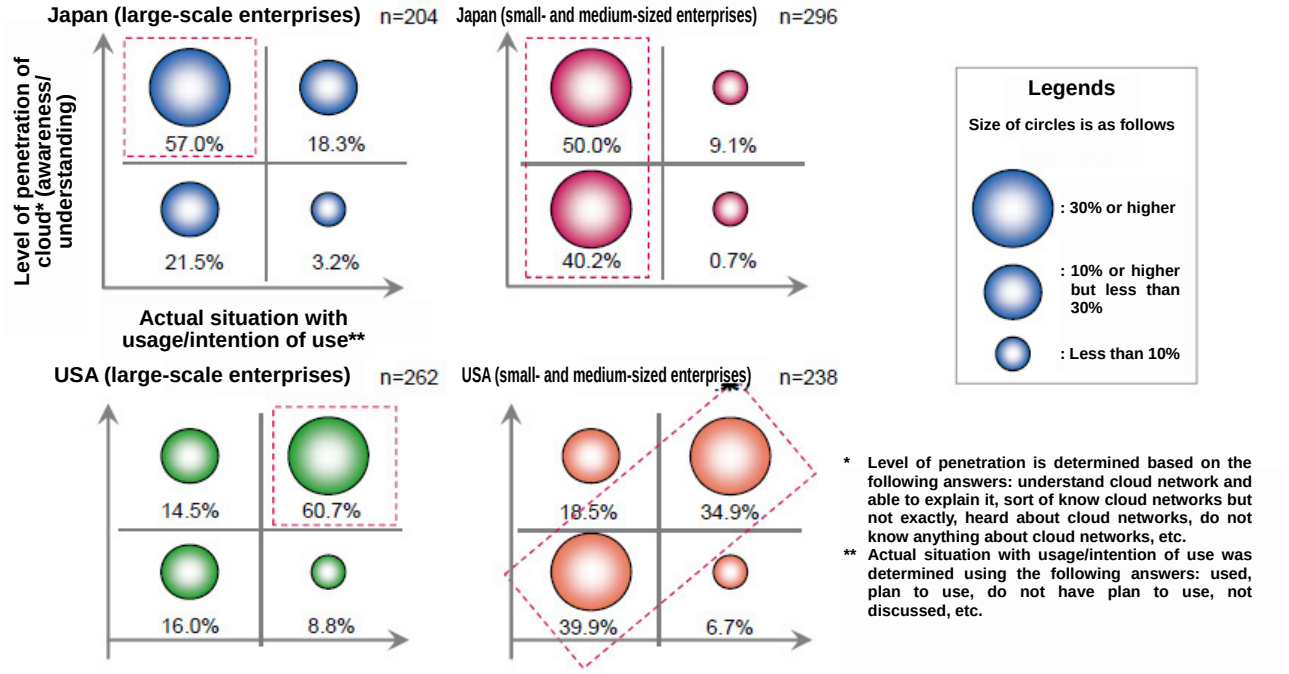
Actual situation with cloud computing usage in Japan and the USA



Breakdown of cloud computing usage in Japan and in the USA



Level of penetration of cloud computing and actual situation with usage/intention of use in Japan and in the USA



Taking the results of this questionnaire survey into consideration reveals that the government needs to implement measures to improve the ICT literacy of users and protect the rights of

consumers (users) in terms of using cloud services and in facilitating ICT utilization through dissemination of them. This point of view then necessitates the formulation of “model cloud service contracts” and “guidelines on the use of cloud services for consumers”, etc. In doing so consideration will also needs to be given to ensuring that their content is not institutional or compulsive in not obstructing the original ideas of cloud service providers.

At the same time identifying points with cloud services that need to be reviewed and ensuring they can be provided in a borderless manner from a systematic point of view and clarification of their system operation, etc. needs to be promoted in parallel.

(2) Formulation of model cloud service contracts

In promoting the use of cloud services the formulation of model cloud service contracts, including the ideal SAL, and under the leadership of the private sector, is considered the most appropriate. In doing so, and from the point of view of protecting the rights of users, discussions on prior notification of service termination to users and ideal ways of returning data to users and certifying that data has been deleted, etc. are also considered to be needed. In addition, the government needs to provide appropriate support, including formulation of principles that are the equivalent of the “Safe Harbor Principles” used in the EU and the USA in appropriately managing subtle information such as privacy information, etc.

The Personal Information Protection Act stipulates that “when a business operator handling personal information entrusts an individual or a business operator with the handling of personal data in whole or in part it shall exercise the necessary and appropriate supervision over the trustee in ensuring the security of the entrusted personal data” is appropriately controlled (Article 22). Although whether private information management with cloud services falls under the “entrustment” of the above provision or not needs be discussed separately, specifying the acquisition of official certification (ISO 27001/ISMS, Privacy Mark[17], etc.) through model contracts is considered appropriate in enabling enterprise users to at least determine whether private information is being adequately protected or not. In addition, “Guidelines on Protecting Personal Information” provided in each industry in accordance with the Personal Information Protection Act will need to be reviewed on the assumption that cloud services will be used [Document-17 and 18].

Prior to formulating any such model contracts the government promoting the formulation of

[17] ISO 27001/ISMS is a third-party certification system for the information security management systems of organizations (a system of technical information security measures for use with individual problems and for the management of organizations to use in determining their necessary security levels through assessments, formulation of plans, distribution of resources, and operation as a system). In addition, the Privacy Mark system involves certification for business operators that have established systems for use in taking appropriate personal information protection measures, etc. where they are awarded with a Privacy Mark to indicate that fact which they can then use in their business activities.

guidelines and assembling the appropriate items that need including in model contracts, etc. is considered appropriate. In addition, ensuring that the model contracts are consistent with the contents of the above mentioned principles for procuring cloud services is considered desirable.

(3) Formulation of guidelines on the use of cloud services for consumers

Protecting the rights of consumers (users) will necessitate the promotion of the formulation of principles for facilitating the use of cloud services by experts, including cloud business operators, users, and audit corporations, etc., under the leadership of the private sector while securing the rights and properties of consumers, including the advantages and disadvantages of cloud services according to their type and risk and the responsibility when using cloud services. In doing so risk distribution methods, including formulation of a BCP in response to any disconnection of networks due to catastrophic earthquakes, etc., will also need to be included in the principles.

These efforts will enable the use of cloud services according to user needs, such as being able to use cloud services in Japan that attach great importance to security, including those with concern over data leakage.

(4) Development of environment to support borderless cloud services

[1] Ideal data storage

With cloud services the physical location of resources is not always clarified upon. In view of information management, etc., a system for ensuring cloud services business operators provide sufficient information is also needed in enabling users to select, depending on the stored information, whether to store the information domestically or allow overseas storage[18].

Fulfilling this ideal will necessitate guidelines being discussed, for example on handling personal information based on the information usage policies that individual users set. The Ministry of Internal Affairs and Communications to date formulated and published “Medical Sector Guidelines for ASP/SaaS Business Operators” in July 2009 in cooperation with the Ministry of Health, Labour and Welfare. Expanding upon these efforts across other sectors and overall cloud services and then reviewing them in an appropriate and timely manner in facilitating dissemination of cloud services will thus be desirable [Document-19 and 20].

[2] Securing enterprise compliance

Cloud services get provided in a borderless manner, and hence the relationship between cloud

[18] In the USA, for example, the GSA (General Services Administration) included in the IaaS procurement guidelines provides the requirement that all resources (hardware) must be in CONUS (Continental United States), but excluding the state of Hawaii, etc. [Document-13 and 14].

services and applicable domestic legislation needs to be clarified for enterprises, etc. to use cloud services. For example, the relationship between external storage management of data, etc. via cloud services and enterprise compliance (audit procedures) will need to be discussed.

Major discussion points on compliance include those concerning confidentiality protection at the time contracts are made, secondary use of entrusted user data by third parties, the return of data to users, and the ideal way of certifying data deletion, etc. has occurred, along with those concerning compliance with relevant laws and regulations.

Examples of the relevant laws and regulations include the Personal Information Protection Act, the Foreign Exchange and Foreign Trade Act, and the Financial Instruments and Exchange Act. Enterprise information can be classified into technology-related enterprise information (technical specifications, development design information, algorithms, etc.) and personnel-related information. If that information is moved overseas the former enterprise information on specific technology will need to be inspected by the competent government agency in accordance with the Foreign Exchange and Foreign Trade Act. The latter personnel-related information is regulated in accordance with the Personal Information Protection Act [Document-21].

In addition, provisions concerning internal control of business processes, including system development/maintenance/operation and security, etc., exist within the so-called “J-SOX Act” or as part of the Financial Instruments and Exchange Act. If enterprise information is stored using cloud services they will need to appropriately use it after having first clarified the relationship with these relevant laws and regulations.

In addition, service providers are expected to discuss the governing laws and secure auditability as required in preparing to respond to legal requests for information disclosure and audits, etc.

[3] Relationship with audits

Use of cloud services will also require discussion of their relationship with audits. For example, two audit standards exist for use in evaluating internal control when preparing and submitting financial statements, namely SAS70 (standards for the duties of auditors evaluating the internal control of outsourced businesses with regard to outsourcing services, etc.) provided by the American Institute of Certified Public Accounting and Auditing Standards Board Report No. 18 (standards for audit operation status of internal control of outsourcing, which corresponds to “Japanese SAS70” of the Japanese Institute of Certified Public Accountants. Discussion on clarifying policies used in the application of these standards when using cloud services will need to take place [Document-22 and 23].

In doing so specific rules will need to be discussed for the system used to disclose information from business operators under certain conditions when users request access to the resources of

cloud service business operators for the reason of an audit, etc.

In addition, to ensure the protection of privacy and auditability of cloud service business operators, etc. a certification system was commenced upon in April 2008 as a system to use to disclose information on the safety and reliability of ASP/SaaS business operators and in accordance with the “Guidelines on Information Disclosure for Safety and Reliability of ASP/SaaS”. Expanding these efforts to encompass all cloud services in the future is considered desirable. Furthermore, establishment of audit systems by independent third parties with regard to all cloud services also needs to be discussed in enabling objective evaluations from the user side [Document-24].

6. Political support for introduction of cloud services

(1) Support for introduction of cloud services by enterprises, etc.

Facilitating the use of cloud services by enterprises, etc. will contribute not only to reducing their expenses but also the realization of political goals, including the creation of new industries through collaborations between different industries, revitalization of local economies, and environmental impact reduction. The government needs therefore to ensure sufficient support measures are in place for enterprises, etc. to introduce cloud services.

Cloud services do not require equipment to be purchased, and hence system investment (depreciation expenses) will become variable expenses. Conventional political support for facilitating ICT utilization was implemented through such measures as taxation support in allowing accelerated depreciation expenses. Political support for facilitating the use of cloud services, however, will require a different approach. For example, from the point of view of the contribution of cloud service usage by enterprises, etc. to environmental impact reduction certain tax reduction measures, etc. will need to be discussed.

Dissemination of cloud services will also require discussion of ideal information and communications statistics. With current information and communications statistics investment in information systems refers to “computers and accessory devices”, “wired and wireless communications devices”, and “software” related investments. Future dissemination of cloud services will replace those types of investments in information systems (CapEx) with the expense of using cloud services. This will result in, with regard to information and communications statistics, a reduced investment in information systems by enterprise users, despite facilitated ICT utilization. Appropriately identifying the contribution of investment in information systems to economic growth will therefore require the definition of investment in information systems to be flexibly reviewed.

(2) Support for cloud service business operators

Dissemination of cloud services was promoted by major US leader cloud service business operators based on their strong market competitiveness. Cost factors, including land and electricity, would, however, make it difficult for cloud service operators in Japan to be sufficiently competitive. Allowing this trend to continue could also induce a “hollowing out” of the ICT industry and prevent Japan from becoming hub of an intellectual information society, thus resulting in a significant loss of national strength. In addition, the concern of the serious problem of “information security” could arise with the trend that Japanese knowledge and information will be accumulated overseas.

Preventing any hollowing out of ICT industry is politically very important, and hence the development of highly value-added cloud services that fully utilize the most advanced broadband infrastructure in the world through network technologies that Japan are strong in, etc. need to be promoted. The government is also expected to actively support these efforts.

Firstly, for example, with the advancement of FMC (Fixed Mobile Convergence) that harmonizes fixed communications services and mobile communications services, promoting the development of services for the benefit of users using cloud services and cloud technologies in a seamless network environment is considered appropriate. Especially in the mobile communications sector, 3.9G services can be assumed to become widespread in the future, with development of mobile cloud services via mobile phones and smart phones also being expected. In addition, regions considered ideal for use as data centers, including cold regions and regions near power plants, will help enable the establishment of data centers that use new technologies, including data center businesses using simple facilities such as container-type data centers which utilize containers used for export, thus reducing the environmental impact. Container-type data centers, however, have regulations, etc. that do not match the actual situation, such as those requiring construction confirmation in accordance with the Building Standards Act. Realizing innovative cloud services will therefore require the establishment of systems that differ from conventional systems being considered, including the development of “special data center zones (tentative name)” in creating new businesses by relaxing the regulations on an exceptional basis if necessary while still securing a sufficient level of personal information protection.

Secondly, in Singapore, the “National Grid Office” was established by the Infocomm Development Authority (IDA) in promoting cloud services, with cloud innovation centers being established in cooperation with private enterprises in May 2009 to develop new services through education and training of cloud related technologies for use by enterprises, government agencies, software vendors, and newly-emerging enterprises, etc. Japan should also hold discussions on establishing new cloud service development platforms with the aim of supporting the development of new cloud services by small- and medium-sized enterprises and venture enterprises, etc.

[Document-25].

Thirdly, when small- and medium-sized enterprises intending to develop and provide new services such as SaaS it can be difficult unless sufficient reliability is obtained in ensuring the business continuity, etc. of those enterprises. Concrete discussions therefore need to be held on the creation of a system of complementing the business continuity of services provided by SaaS business operators.

Fourthly, in view of promoting data centers in Japan[19] and dissemination of cloud services that can contribute to environmental impact reduction discussions will need to be held on providing taxation support, etc.

Fifthly, comprehensively amassing information on measures for data centers by local governments, etc. and know-how on establishing/operating data centers that conform to legal systems according to the location can be difficult for individual business operators, and hence bulk information collection by business operator organizations, with it then being shared, is important.

Sixthly, in order to optimally provide services that suit domestic users the rapid compilation of "Requirements for Desirable Data Centers (tentative name)" and facilitating establishment of data centers that meet those requirements will be desirable. In addition, formation of "Guidelines for Collaborative Use of Data Centers (tentative name)" also needs to be discussed in enabling easier combined use of multiple data centers.

(3) ICT human resource development

There is a shortage of approximately 350,000 advanced ICT human resources with a certain level of management skills, including system planning, and technical skills, which include system design/development, etc. in Japan ("Survey on ICT Human Resource Development" made by the Ministry of Internal Affairs and Communications (March 2006)).

The development of cloud-related technologies/services and dissemination of cloud services will therefore require the development of advanced ICT human resources in the Cloud Era who can fulfil those roles.

[1] Human resource development for cloud users

In utilizing cloud services the skills of identifying which parts of cloud services should be used and which parts that system will need to be developed for, after clarifying the requirements for information systems and implementation technologies that take consideration component

[19] Refer to the report made by the "Study Group on Measures to Revitalize Data Centers in the Cloud Computing Era" of the Ministry of Internal Affairs and Communications (May 2010) for more details on discussions on data centers in Japan.

technologies and constraints specific to clouds after identifying individual cloud characteristics, will likely be needed. In addition, increased utilization of IaaS and PaaS is assumed to result in making the development and operation of applications the main constituent over the long-term and the establishment of test beds, etc. will therefore need to be promoted through public and private sector collaborations in developing human resources who can then fulfil the role of developing applications using clouds and operating large-scale clouds, etc.

[2] Human resource development for cloud providers

Conventional system development has mainly been carried out by network, hardware, OS, and middleware, etc. experts. Cloud computing, however, will require design/development skills for the overall optimal system after grasping the overall system should be. Taking into consideration that cloud related technologies, including large-scale distributed/parallel processing technologies, etc., and graphic computing technologies are in the process of being advanced makes the provision of opportunities for engineers to experience the most advanced technologies in the world necessary.

[3] Human resource development for CIOs and CTOs

Consistent overall strategies and ICT utilization policies are important for enterprises in improving their value through ICT utilization. CIOs and CTOs, who are responsible for information system sections/organizations, are expected to have not only the skills needed with conventional internal information systems but also those needed with information utilization, including on possessing systems/using services and the formulation of information disclosure/protection policies. Improving the literacy of cloud service users will therefore need to be promoted, including training for the CIOs and CTOs of enterprises and other cloud service users in deepen their understanding of cloud services.

7. International development of cloud services and strengthening international competitiveness

The international competitiveness of Japan ranks 21st in the world (World Economic Forum[20]), with a delay in ICT utilization being the main factor in that lower rank. Increasing Japan's international contribution through ICT utilization and improving its international competitiveness in global markets will require cloud services to be used to contribute to resolving global issues, including environmental issues, natural disasters, food issues, and water resource issues, etc. [Document-26 and 27].

Standardizing the specifications of cloud services, including the above mentioned electronic government clouds, medical clouds, educational clouds, agricultural clouds, and community clouds,

[20] “Global Information Technology Report” made by the World Economic Forum (March 2010)

and related know-how and promoting them in Asian countries, is therefore expected to be needed. In addition, in view of maintaining and making the social infrastructure more efficient promoting further dissemination of smart cloud infrastructure that will realize advancement of the above mentioned social infrastructure in helping those countries to solve their issues and contribute to the establishment of an ICT sector “East Asian Community” is also expected.

Strengthening international competitiveness will require the formulation of projects that incorporate cloud technologies that may be considered important in the global development of the ICT industry. Adding more value to products/services by combining them with cloud services and strengthening international competitiveness, etc. in the industrial sectors that Japan is strong in (embedded OS, vehicles, robotics, home appliances, etc.) will require the selection/development of projects with international development potential needs to be discussed. In addition, the formulation of joint projects, including joint solution developments between Japan and China, India, or other Asian countries, may also be considered.

Thoroughly utilizing ICT through the use of cloud services and establishing issue resolution-type ICT systems that utilize the characteristics of Japan as a “frontier of emerging issues” can empower developing countries to resolve their various social issues. Leading the world in formulating a number of such cloud utilizing issue resolution-type ICT systems is also important from the point of view of strengthening the international competitiveness of Japan in the ICT industry. The introduction of cloud services will proceed through discussion between cloud service providers and users (countries of concern), differing from conventional solutions, and hence a system for strengthening consulting skills will need to be developed in cooperation with the relevant industries.

8. Market size of cloud services

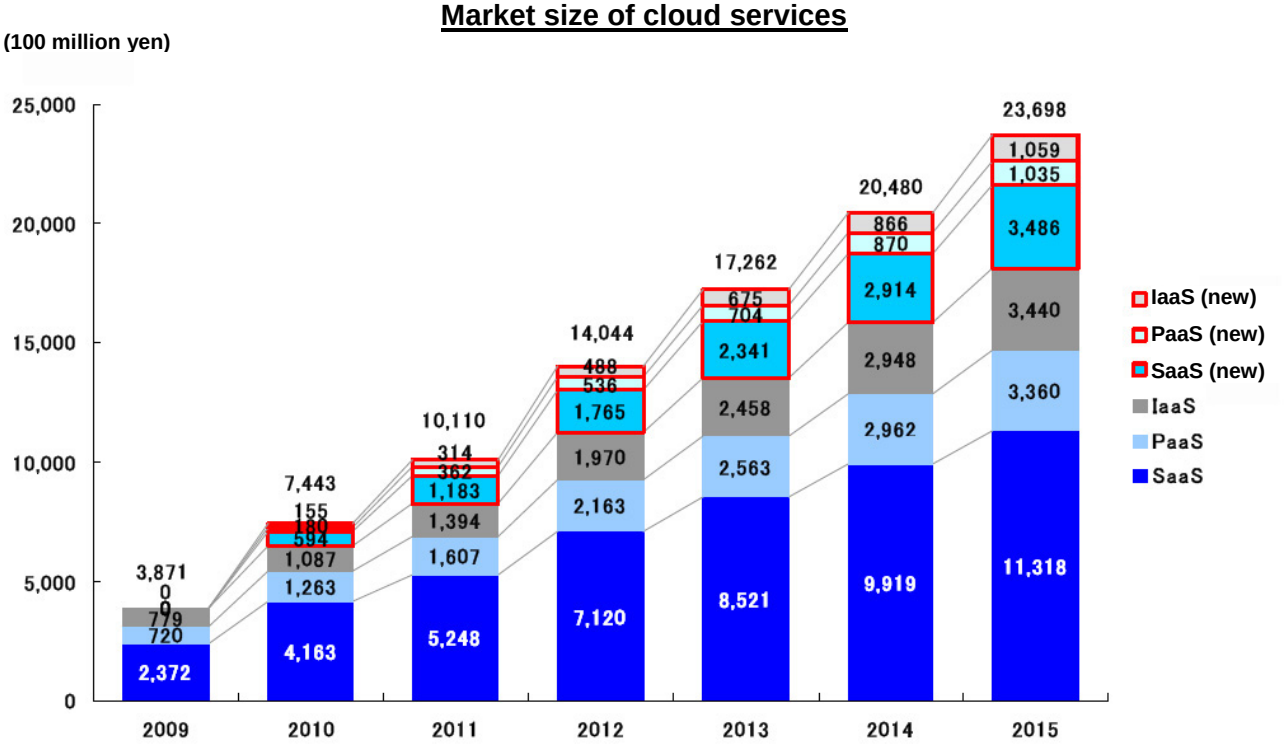
The Study Group estimated the market size of cloud services (refer to the Supplemental Discussion at the end of this document) to be approximately 390 billion yen as of 2009. The size of the SaaS market is relatively large, accounting for 61.3% of the entire market.

Estimating the future cloud market size based on the results of the above mentioned questionnaire survey on the intentions with introducing cloud services by enterprises, etc. results in the expectation that it will be more than 4 times as large or 1,810 billion yen by 2015, and with the annual growth rate of the market being extremely high at 30.5%. Examining its components reveals that the SaaS market will still be expected to account for 62.5% as of 2015, but the IaaS market and PaaS market can both be expected to have grown to approximately 340 billion yen, respectively, by then.

The above estimates were calculated using current intentions with introducing cloud services

(from the above mentioned questionnaire survey). As already described politically supporting dissemination of cloud services in government, medical, education, agriculture, forestry, and fisheries, etc. sectors and the establishment of a smart cloud infrastructure, etc. can be expected to create new markets worth approximately 560 billion yen by 2015, with the cloud service market being expected to grow to approximately 2,370 billion yen (creation of new markets of approximately 2,000 billion yen).

Market size of cloud services



Chapter 4　Ideal Next Generation Cloud Technology

The main technologies that will realize cloud services include virtualization technologies and distributed processing technologies. Virtualization technologies realize improved server operating rates and reduced electricity consumption for server operations through integrating the computing power of large server groups when operated, etc.

In addition, distributed processing technologies enable high-speed large-scale data processing through distributed parallel operation across server groups, represented by Big Table and Map Reduce, the distributed database systems of Google, and their open source version Hadoop. Distributed processing technologies enable data to be stored on multiple servers, and distributed file systems, represented by GFS (Google File System) of Google, can provide “non-stop” services consistently by referring to data that is backed up on other serves in case of a server failure.

These technologies are already being operated by major cloud service providers and are maturing. Developing world leading next generation cloud technologies by utilizing the advanced broadband infrastructure of Japan and improving our international competitiveness in the ICT industry through promoting the development and standardization of products/services that utilize those technologies is therefore necessary.

Selecting cloud technologies that Japan can lead the world in and promoting focused research and development is therefore required.

1. Cloud technology for realizing smart cloud services

Facilitating dissemination of smart cloud services that realize the sharing information/knowledge by different enterprises and industries requires identifying the technology development factors needed from the point of view of promoting cloud services and discussions to be held on the ideal ways of taking measures to promote development, mainly in sectors in which ICT utilization is not progressing, including government, medical, education, agriculture, forestry, and fisheries, etc. sectors in which large-scale data processing is required, along with the sectors of small- and medium-scale enterprises and venture enterprises, etc.

Examples of common cloud application factors are [1] amassing a large amount of various sensor information produced on site through networks, [2] rapidly processing that information to extract meaningful information/knowledge for visualization and storage in databases, [3] extract that information/knowledge for use in modelling by assuming the actual usage scenario, and [4] optimizing it according to changes in the situation through large-scale parallel processing via a large amount of computer resources in clouds.

Cloud technologies to realize smart cloud services include

- ✓ Network technologies for automatically collecting a variety of large-scale sensor information
- ✓ Real-time pre-processing technologies for converting the data in various formats into common formats and extracting meaningful information
- ✓ Technologies for efficiently storing the above mentioned real-time stream data (large-scale information) as time-series information
- ✓ Technologies for performing distributed parallel processing under certain rules according to the content and volume of the large-scale amount of information and then visualizing it
- ✓ Data mining technologies for extracting reusable information/knowledge from the large-scale amount of information and database technologies to store the extracted data
- ✓ Modelling technologies for converting/processing the extracted data into models suitable for usage scenarios
- ✓ Control technologies for optimizing systems based on the information/knowledge stored above and development of relevant application execution environments
- ✓ Technologies for optimizing resources in clouds according to the volume of consistently produced large-scale amounts of data, including cloud infrastructure dynamic reconfiguration technologies for optimized processing of flow-type data and stored-type data

, etc. needing to be developed.

2. Cloud technology for realizing improved security and reliability

Cloud services will require the provision of various services that are safe and reliable needing to be realized, and users must be able to select services according to their own needs. Facilitating dissemination of cloud services, however, requires focused development of highly safe and reliable next generation cloud technologies.

For example, the development of technologies for realizing systems that can flexibly reallocate resources within the cloud or between clouds in case of the overload of a cloud system in securing end-to-end based SLA, including networks, and the development of technologies for realizing improved security of encryption technologies and virtualization technologies that are required with cloud services in enabling users and cloud service business operators to take appropriate information security measures, etc. are needed.

In realizing cloud services that suit users' needs, therefore, the development of the following example technologies can be considered necessary.

- ✓ Technologies for realizing mutual complementation of communication control technologies

and cloud technologies, including collaboration of multiple clouds via networks and dynamic reconfiguration of computer resources and network resources, etc.

- ✓ Autonomous monitoring of control technologies in monitoring the massive infrastructure in real-time and performing the required control according to services
- ✓ Technologies for enabling users to control placement and use of data on servers and storage
- ✓ Easy-to-use API for users to control collaboration with on-premise systems (internally operated within companies)
- ✓ Cloud service and device technologies that resist malware
- ✓ Technologies for performing computation directly on encrypted data
- ✓ Technologies for visualizing security levels
- ✓ Monitoring technologies for identifying unauthorized use and alteration of services, and technologies for preserving trace of evidence for auditing
- ✓ Integrated management technologies for improving comprehensive safety/reliability not only of servers but also of networks and operations
- ✓ Technologies for making data anonymous when utilizing collected data

In addition, assuming that various applications will be executed on clouds in the future, including large-scale parallel processing of large amounts of sensor information and highly efficient processing of large amounts of information such as ultra-high resolution/3D video pictures, etc. makes the further advancement of virtualization technologies, including networks, needed in realizing more safe/reliable environments for the use of clouds while also facilitating individual optimal network control and flexible protocol use without being limited by IP, etc.

3. Cloud technology contributing to reduced environmental impact

Environmental impact reduction being one of the most important current global political issues makes the following measures needing to be promoted after consideration is given how of the establishment of environment-friendly green clouds will have a direct impact on reducing operational costs of data centers, etc.

(1) Promotion of green ICT industry (Green of ICT)

Promotion of green ICT industry will require, firstly, unified support toward the establishment of green cloud data centers (data centers utilizing cold regions, natural energy, direct current electricity, and basement space, etc.), with the development of low electricity consumption control

technologies, etc. then needing to be promoted in an integrated manner and efforts also made in their global development. In doing so, formulating front-runner standards in accordance with guidelines, including "Ecology Guidelines in ICT Sectors[21]", and discussing measures for providing political support for green cloud data centers that accomplish these standards after being evaluated by third parties, including external auditing, is considered desirable.

Secondly, in order to promote low energy consumption via dynamic load balancing and consolidated tasks through placement of virtual machines within a data center or across multiple data centers through utilization of cloud technologies, technologies, for example, that monitor the status of system loads in real time and enable dynamic (automatic) optimization of virtual machine placement will be required to be developed.

Thirdly, continuously contributing to the establishment of the methods for measuring the effects of CO_2 emissions reduction through ICT that is currently being promoted by ITU (International Telecommunication Union) and discussion on systems by public agencies to audit/rank cloud services with high environmental impact reduction effects will be necessary.

(2) Promotion of green industry through utilizing ICT (Green by ICT)

As described above the application of cloud services in operating the social infrastructure will facilitate effective utilization of knowledge and information, thus making the infrastructure itself more advanced and efficient, and reducing its environmental impact in a variety of ways. From this point of view technology development needs to be facilitated in establishing a smart cloud infrastructure that introduces cloud technologies in such systems as smart grids (smart meters), next generation ITS, port management, and disaster management.

4. Political support for technology development

Development of next generation technologies will be in principle promoted under the leadership of the private sector. As described by the "three basic policies toward dissemination of cloud services" above, the role of the government is in supporting technology development by private sectors.

Discussion on ideal political support for technology development should continue to take place with the main focus on the following four points.

First, projects that will be the subjects of technology developments as highly competitive next generation cloud technologies will require the concrete purposes and goals to be clarified, including

[21] The "ICT Ecology Guidelines" were formulated in February 2010 by the "Council for Ecology Guidelines in ICT Sectors" in evaluating efforts toward CO_2 emissions reduction by communications devices and data centers using five grades.

improved international competitiveness, the environmental impact reduced, and standardization, etc. promoted, with road maps being drawn up with clear time lines also being considered appropriate.

Second, systems for facilitating research and development, including a competition-based funding system, etc. for developing cloud component technologies originating in Japan from venture enterprises, etc., and support for establishment of a “Cloud Research and Development Platform (tentative name)” in producing open innovations in industry-academia-government collaborations with the aim of developing technology development seeds, although primarily assuming international collaborations, will be needed.

Third, core cloud service technologies will not be limited to new technologies but also include new know-how on operating them. Development of that know-how, etc. will therefore need to be included in the subjects of political support. Realization of strengthened international competitiveness of the smart cloud infrastructures that Japan is strong in through combining component technologies of ICT related devices, environmental impacts reduction technologies, cloud technologies, and social infrastructure operation know-how, etc. that Japan has can therefore be expected.

Fourth, a “place” for exchanging opinions on joint technology developments and standardization, etc. needs to be created through holding an “Asia/Pacific Cloud Forum (tentative name)” for developing next generation cloud technologies in cooperation with Asia/Pacific countries.

Chapter 5　Standardization of Cloud Technologies, etc.

In view of enabling cloud services to be used without any anxiety on the user's part and eliminating unreasonable lock-ins (enclosure) that obstruct emergence of new services by cloud service providers will require standardization of cloud technologies, etc. needing to be promoted.

Cloud services are in the process of being continually and rapidly developed, thus giving rise to the concern that the over promotion of standardization, etc. could inhibit service and technological innovations and block the realization of diverse cloud services.

Collaborating with domestic and overseas relevant enterprises in making the minimum necessary standardization, etc. from the users' point of view and promoting standardization, etc. from a global point of view, including making inputs to a number of currently active international standardization organizations, etc. is therefore needed.

From the users' point of view and in developing an environment that will enable users to use cloud services in a safe and secure manner, contributing to the activities of the international standardization organizations (de jure standard and de fact standard) which are conducting various activities in securing interoperability, etc. can be expected with higher priority on standardization of an ideal SLA and ideal way of securing security/privacy, etc.[22]

1. Ideal SLA

As described above a system that enables users to reasonably select services which suit their needs from cloud services provided based on various SLA (Service Level Agreement) is needed. Discussion on the SLA that is required with cloud services and its standardization, etc. therefore needs to be promoted.

Establishing an SLA framework will enable the provision of an environment for users to use cloud services without anxiety by clarifying the reliability level of cloud services. Cloud services that require a minimum security level will be then able to set a price according to the security level, which will possibly facilitate cloud service usage, including use in such mission critical sectors as government, medical, and financing, etc.

With regard to SLA, therefore, discussion on standardization, etc. of the following example matters is considered necessary.

- ✓ Common objective standards, including ratings on QoS (Quality of Service) and security level

[22] The "Global Inter-Cloud Technology Forum (GICTF)" was established in July 2009 to promote research and development and standardization, etc. of collaboration interface technologies, etc. between multiple cloud systems.

of individual cloud services, etc.

- ✓ SLA standards that take into consideration not only the operating rate of data centers but also to end-to-end based QoS, including networks that connect multiple clouds
- ✓ SLA standards on performance, data backup and restoration, failure recovery time, and failure notification time of data centers

2. Ideal service quality and privacy protection

In view of securing quality of cloud services and privacy discussion of the following example points can be considered necessary.

- ✓ Ideal ways of securing security in multi-tenant environments in which multiple customer data is stored in a cloud (multi-tenant data processing or multi-tenant data storage) by explicitly separating the data processing of individual customers or prohibiting cross-reference between the different data groups in which individual customer data is stored
- ✓ ideal ways of securing disaster recovery via transferring data and processes to other cloud services in the case a certain cloud service fails
- ✓ Ideal mechanisms for obligating cloud service providers to disclose security policies upon request from users

3. Security of Interoperability

Individual cloud service providers will adopt different technologies and thus their interoperability will be difficult. In enabling uses to smoothly use multiple cloud services standardizing the following example matters will therefore be desirable.

- ✓ Ideal distributed processing that ensures safe and dynamic distribution of respective resources when multiple clouds collaborate in processing a job (not only implementing distributed processing at the individual programming level but also realizing overall optimization through implementing distribution/collaboration functions at the system service level)
- ✓ Ideal common interface, including an open API that makes collaboration between different clouds easier and can be used by anyone
- ✓ Ideal common data format and data processing between different clouds
- ✓ Methods for realizing data portability, including common data code, in enabling users to transfer data between different clouds (for example, implementing functions for use in exporting data, programs, and virtual machine information, etc. in an open format)

- ✓ Ideal boundary of responsibility between cloud service business operators when multiple clouds are used at the same time

In addition, discussions will need to be held on methods to use in realizing collaborations between the various ID management systems that are currently being internationally discussed, including authentication policy and recognition ID format for authorizing use between different clouds, etc. In doing so discussions will also need to be held on ideal ID lifecycle management from issuing IDs to deleting them, and an ideal easy-to-use highly reliable authentication system, including IC cards, network connection authentication, network connection agreements, etc.

These discussions on the ideal ID management will need to be promoted in cooperation with the relevant forums, etc. on methods of collaborating multiple ID management technologies, including open ID and SAML, etc. In addition, cooperation will also need to be promoted with the "Authentication Infrastructure Collaboration Forum"[23] established in December 2009 under the leadership of the private sector.

Distributing information on clouds, collaboration between clouds, and transfer systems between clouds will require adjustment in handling character codes, external character codes, and kanji variants that are defined individually on respective systems.

4. Matters to be considered in promoting standardization, etc.

At present various cloud service related standards organizations exist. However, each organization covers different areas, including API, storage, virtualization, and interoperability, and hence a system needs to be established in contributing not only to specific international organizations but also international standardization activities, including de facto standards aiming at facilitating the collecting and sharing of information on the activities of the various standards organizations [Document-34 through 36].

In addition, although there is concern that the over promotion of standardization, etc. may inhibit cloud related technological innovation, holding discussions on clarifying the areas of the minimum necessary standardization, etc. and realizing a market environment that favours "collaborations and competition" in which individual enterprises provide functions that are not covered by the open standard as value added services is considered appropriate.

[23] A forum established in December 2009 with the aim of making recommendations to society, industries, and governments through discussion of systems for use in collaborating between the various authentication services provided by communications business operators and vendors and thus enable mutual use. At present 22 enterprises/organizations are participating in the forum.

Chapter 6 Building an International Consensus on Cloud Services

1. Necessity for international consensus

Cloud services are provided in a borderless environment, regardless of the location of users, and hence clarifying the relationship between owners, managers, and users of information resources and promoting formulation of international rules will enable users to use cloud services in a safer and secure manner.

Data is already being distributed in a borderless manner over networks. The full-fledged dissemination of cloud services will, however, result in more data likely being stored and processed overseas than in the past. In addition, users of cloud services may not be unable to determine the location where their data is stored. In consideration of that the need to develop international rules is expected to increase[24].

International discussion of the ideal rules needs to be continued to be promoted with consideration given to the relationship between domestic legislation and legislation of countries where the data centers are located that are used for clouds (data centers), including jurisdiction of the court with regard to databases, etc. in respective countries, the Personal Information Protection Act, protection of intellectual rights and copyrights, measures against harmful information, and the possibility of governments intervening with private data, etc.

More concretely, these discussions may take place at APEC, OECD, etc. toward building an international consensus[25]. In addition, addressing issues concerning cloud services at the APEC Ministerial Meeting on the Telecommunications and Information Industry to be held in Japan this fall, for example, and commencing political discussions between Asia/Pacific countries at ASEAN+3, etc. may be considered.

The EU prohibits transfer of personal data outside the EU in accordance with the “Data Protection Directive”, but storing personal information outside the EU is permitted using third countries deemed to maintain a “sufficient data protection level”, and is stipulated in the said Directive, and countries that have concluded an agreement with any such third country. Whether Japan should hold discussions on ideal application of the “Data Protection Directive”, etc. with the EU or not needs to be discussed with consideration given to public needs [Document-37 and 38].

As described above the issues with handling information on data, services, logs, etc. stored at

[24] The United States Department of Commerce announced the establishment of an “Internet Policy Task Force” in April this year. The Task Force will discuss the directions of policies in realizing economic growth and employment creation using the internet and will also discuss barriers to international data distribution, etc.

[25] For example, Haraguchi of the Minister of Internal Affairs and Communications conferred with Choi See-joong, the chairman of the Korea Communications Commission, in March this year and agreed to commence upon a Japan-Korea discussion of cloud policies.

data centers in foreign countries are closely related to the administrative rights and jurisdiction of the court in foreign countries. Any cases in which the submission of information is requested by the authorities in accordance with the legal system of the country where the data center is located, for example, will require discussion of mechanism to use in notifying contractors (cloud service users) of the fact and for allowing objections to be considered.

2. Dissemination of cloud services and network neutrality (open internet)

In recent years the amount of information distributed (traffic) over the internet in Japan has been approximately doubling every three years. Because of that the dissemination of cloud services will tend to result in any data that has been processed in closed systems which is then distributed over networks possibly making network congestion worse. In addition, cloud services provided in a borderless manner may require discussion of network congestion issues at the global level.

More concretely, analyzing the internet traffic in Japan reveals the total internet traffic to have increased 4.3 times over the last five years (from November 2004 to November 2009). During that period the percentage of incoming traffic from overseas of total traffic doubled from approximately 20% (November 2004) to approximately 40% (November 2009). This indicates that the use of services provided from overseas data centers is increasing more rapidly than those provided from domestic data centers [Document-39].

Moreover, major overseas cloud service business operators are starting to internationally distribute their data centers. Even businesses that are based in North American regions distribute their data centers over three other global regions, namely North American regions, European regions, and Asian regions, in improving the continuity of their service provision and reducing the time required for communication when providing services. In Japan, due to insufficient progress in the use of domestic data centers, etc., the percentage of incoming traffic from overseas is increasing[26].

Cloud service business operators in general pay communication fees to telecommunications carriers of countries in which data centers are established, but the revenue from those fees does not necessarily get distributed between all the telecommunications carriers involved in the traffic relevant to the cloud services provided.

Increased traffic from overseas to Japan may not therefore automatically lead to increased revenue for domestic telecommunications carriers. In this case investing in equipment for use in reinforcing networks in responding to continued increases in incoming traffic from overseas may

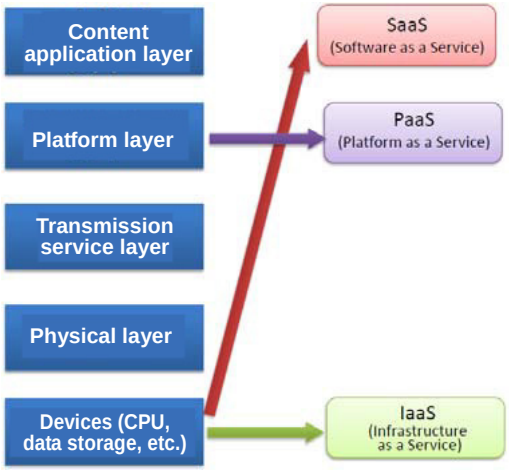
[26] Refer to the report made by the “Study Group on Measures to Revitalize Data Centers in the Cloud Computing Era” of the Ministry of Internal Affairs and Communications for the discussions on the necessity for data centers in Japan.

not be recoverable from revenue, and thus eventually lead to increased communications prices in Japan.

This issue is not just limited to the ideal methods of bearing the expense between domestic and overseas communications carriers and cloud service business operators. Cloud services involve individual layers of IaaS (device layer), PaaS (platform layer), and SaaS (content application layer), and maintaining in eco-system that consists of a large number of cloud service organizations an environment in which reinforcement of networks needs to be sound through appropriate bearing of expenses. However, the legal systems and jurisdictions of courts in the large number of domestic and overseas players can vary.

Discussion of the impact of dissemination of cloud services on network neutrality (open internet)[27] thus needs to take place. The characteristics of cloud services are that they are provided in a borderless manner, and hence any such discussions will need to be addressed in building an international consensus, with Japan needing to make an active contribution.

Relationship between dissemination of cloud services and network neutrality



[27] Network neutrality (report of the "Panel on Network Neutrality" of the Ministry of Internal Affairs and Communications (September 2007))

1) Consumers should be able to freely access content application layers by flexibly using networks (IP networks).
2) Consumers should be able to freely connect to networks (IP networks) using devices that meet the technical standards stipulated in laws and regulations and flexibly carry out communications between devices.
3) Consumers should be able to use communications layer and platform layer (authentication infrastructure, etc.) fairly at a reasonable price.

Chapter 7　Future Discussions

As described above Japan has the most advanced broadband infrastructure in the world and which is suitable for dissemination of cloud services. ICT utilization, however, is not making much progress. The dissemination of cloud services should be used as an opportunity to facilitate thorough ICT utilization and realize an improvement in people's lives, new economic growth, and strengthened international competitiveness, and is thus an important political issue.

Research and development on smart cloud services therefore needs to be promoted as next generation cloud services will enable the accumulation and sharing of massive amounts of information and knowledge by the entire social system and different enterprises and industries.

More concretely, dissemination of cloud services in the medical, educational, agriculture, forestry, and fisheries, etc. sectors, where ICT utilization has not made much progress, and community revitalization through utilization of community clouds, etc. can be expected to be realized. In addition, a smart cloud infrastructure that will realize an advanced social infrastructure through optimizing the flow of information, traffic, finances, and energy, etc. needs to be established.

In view of facilitating the use of cloud services in a safe and secure manner the dissemination of cloud services will require the promotion of environmental developments in protecting the rights of consumers (users) and securing enterprise compliance in supporting borderless cloud services, etc.

The development of next generation cloud technologies through the focused research and development of cloud technologies that Japan is strong in, including the development of technologies for securing a smart cloud infrastructure which will enable the collection/analysis/use of large amounts of real-time stream data, technologies for realizing improved safety/reliability, and technologies to contribute to environmental impact reduction, etc., can be expected to result in strengthening the international competitiveness of Japan while also increasing cooperation with Asia/Pacific countries. In order to realize an open cloud environment, however, standardization, etc. with the aim of securing interoperability, etc. also needs to be promoted.

At the same time, and taking into consideration that global development is assumed to occur with cloud services, Japan needs to actively contribute to building an international consensus, including ideal international rules, etc.

In consideration of the above discussion this Study Group recommends the action plan of the "Smart Cloud Strategy" that is provided as the Annex. Incorporating this recommendation into the discussions currently taking place at the "ICT Policy Task Force for a Global Era" under the initiative of the Minister for Internal Affairs and Communications and flexibly taking various measures toward dissemination of smart cloud services is needed. In doing so the creation of

standard cloud service models, etc. will be promoted in sectors in broad areas from the users' point of view. Promoting the "Smart Cloud Strategy" in an integrated manner through establishment of a "Smart Cloud Consortium (tentative name)" with the participation of the government, local governments, and private business operators, etc. is therefore considered desirable.

The market environment surrounding cloud services will likely to continue to rapidly and drastically change and the structure of ICT industry itself may also change. The results of discussions held by this Study Group therefore need to be reviewed in case any significant structural changes take place in the market.

Annex

Smart Cloud Strategy

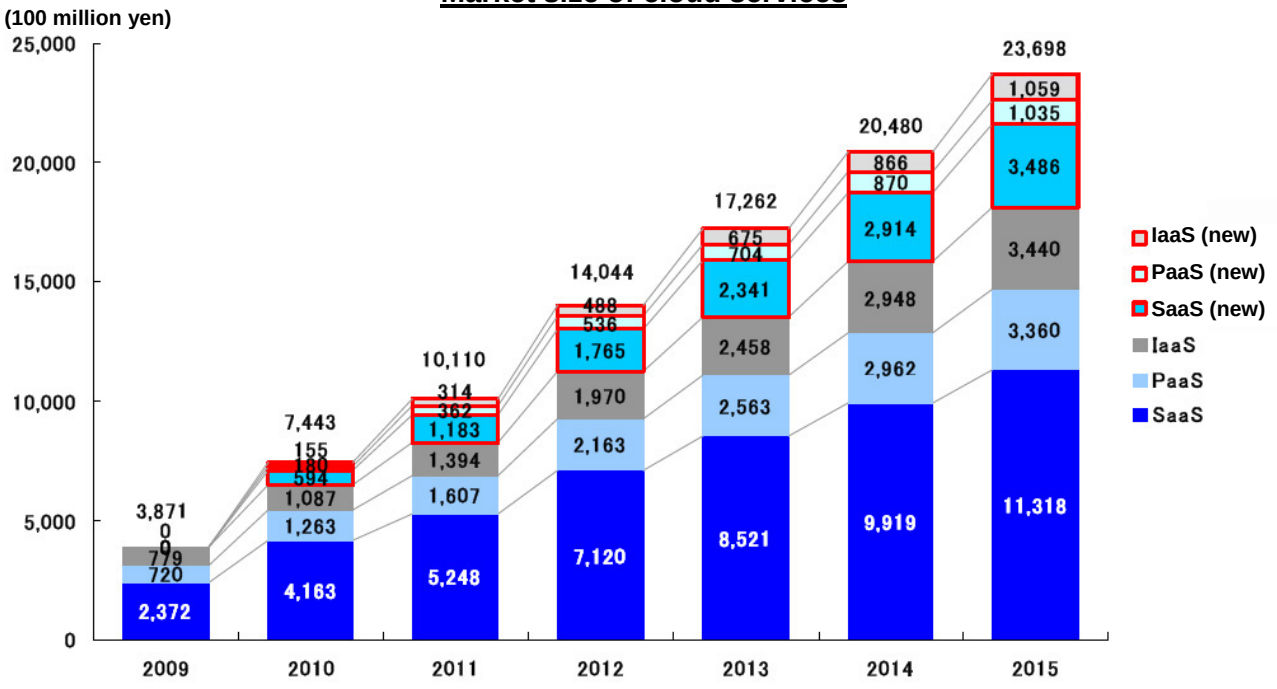
I. Basic Policies

In view of facilitating thorough ICT utilization this Strategy aims to realize a “knowledge based information society” for the benefit of the people, new economic growth, and strengthened our international competitiveness through facilitating the accumulation and sharing of massive amounts of information and knowledge by the entire social system and different enterprises and industries via optimal use of cloud services (services that utilize cloud computing technologies).

In disseminating cloud services the following individual strategies will be promoted from three points of view, namely [1] facilitating cloud service utilization (utilization strategy), [2] promotion of strategic research and development, etc. of next generation cloud technologies (technological strategy), and [3] promotion of international consensus and global collaboration (international strategy).

Through these efforts the Strategy aims to realize the creation of a new market worth approximately 2 trillion yen through expanding the cloud service market that is worth 390 billion yen (2009) to a level of approximately 2.4 trillion yen by 2015.

Market size of cloud services



II. Individual Strategies

1. Utilization strategy

(1) Promotion of thorough ICT utilization

- In view of realizing electronic government for the benefit of the people the government will decide “Electronic Government Promotion Policies” by the end of FY 2010 and promote rapid establishment of a “common government platform” for the integration/consolidation of government information systems, etc. with the aim of commence operation around FY 2012. Administrative system reforms, including efforts to promote integration/consolidation of governmental administrative systems one by one in a stepwise manner, will then be steadily promoted with the aim of reducing the operating cost of governmental administrative systems by approximately 50% by 2020.
- In addition, the formulation of a BCP (Business Continuity Plan) for electronic government clouds, placement of government CIOs (Chief Information Officers), development of a citizen ID system that will be able to collaborate with public IDs, and collaboration with and common enterprise codes, etc. will be promoted and the necessary legal systems developed.
- Establishment of “government clouds” by local governments will be actively supported in realizing a reduction in the relevant operating costs by approximately 30% by 2015, and efforts toward utilization of “broadband open model” via general-purpose SaaS, etc. and collaborations between the government system and “government clouds” will be promoted.
- With regard to procurement of cloud services by the government research on efforts, etc. made by other countries will be conducted by around the end of FY 2010, and then policies rapidly decided after taking into consideration the results of analysis/discussion of their issues, etc.
- Dissemination of cloud services in the medical, educational, agriculture, forestry, and fisheries, etc. sectors where ICT utilization has not made much progress will be supported.
- Establishment of “NPO clouds (tentative name)” that support the activities of the “new public sector” or NPOs will be supported.
- Establishment of a smart cloud infrastructure will be promoted that will realize an advanced social infrastructure through facilitating cloud service utilization with smart grids, next generation ITS, IPv6 sensor networks, facility management, including road and bridges, etc., and development of space codes, etc.
- Support for establishing a small- and medium-sized enterprise platform with a matching function to enable small- and medium-sized enterprises in different regions and business types

to collaborate on clouds, and thus a more efficient distribution system through supporting the establishment of a supply chain for different business forms by utilizing clouds, etc. will be promoted.

(2) Environment development toward dissemination of cloud services

- Formulation of "model cloud service contracts" and "guidelines on the use of cloud services for consumers" will be promoted under the leadership of the private sector with active support by the government with the aim of completing it by the end of FY 2010.
- Expanding the scope of the application of the guidelines on using cloud services will be promoted through utilizing existing channels, including the specified non-profit corporation ASPIC (ASP/SaaS industry Consortium).
- Discussion on the above environmental development will be promoted in cooperation with the relevant organizations with consideration given to ideal enterprise compliance when enterprises, etc. use cloud services (the Personal Information Protection Act, the Foreign Exchange and Foreign Trade Act, and the Financial Instruments and Exchange Act, etc.) and ideal enterprise auditing, including establishment of audit systems by independent third parties.

(3) Support toward creation of new cloud services

- Development of "special data center zones (tentative name)" in which regulations will be relaxed in promoting domestic highly efficient data centers, etc. will be discussed and efforts made toward commencing their development in FY 2011.
- Development of platforms aiming at supporting new cloud service developments by small- and medium-sized enterprises and venture enterprises, etc. will be discussed and a conclusion reached by the end of FY 2010. At the same time concrete discussions will be promoted on the creation of a system for use in complementing the business continuity of services provided by small- and medium-sized SaaS business operators.
- In view of facilitating data centers in Japan and the dissemination of cloud services with reduced environmental impact discussions on taxation measures, including tax reduction measures for investment in equipment related to clouds with specific levels of energy conservation, and reducing the service life and making retirement of fixed assets easier, etc. in facilitating the replacement of equipment and facilities, etc., will immediately be commenced upon by efforts being made to implement it in FY 2011.
- Measures on data centers made by local governments, etc. and systems for collecting/utilizing

information, including know-how on establishing/operating data centers that conform to the legal system of the location, will be developed under the leadership of private business operator organizations by the end of FY 2010.

- "Requirements for Data Centers" (to be compiled by around summer of 2010) that confirms users' needs and "Guidelines for Collaborative Use of Data Centers" (to be discussed by the end of FY 2011) will be promoted under the leadership of the private sector. In order to facilitate these efforts requirements of data centers for use of cloud services in the environmental sector, including cases of using multiple data centers in a collaborative manner, will be compiled by the end of FY 2010.
- In view of developing advanced ICT human resources with the ability to oversee the grand design of an architecture that comprehensively combines network technologies, computing technologies, and solution development technologies, discussions on new systems and support measures for comprehensively implementing educational material development, educational environment development, cloud test bed usage, and joint research with overseas research institutes, etc. will take place in an industry-academia-government collaboration and materialized by the end of FY 2010.

(4) Global development of cloud services

- Standardization of cloud service specifications for the government, medical, education, agriculture, and NPO, etc. sectors and their development in Asian countries, etc. will be promoted.
- With regard to the highly value added products/services that combine sectors that Japan is strong in (embedded OS, vehicles, robotics, and home appliances, etc.) and cloud services, the selection and development of projects with international development potential will be promoted. At the same time joint development of new cloud-type solutions in cooperation with Asian countries will be promoted. In doing so the development of systems toward strengthening consulting abilities in cooperation with the relevant industries will be promoted.

2. Technological strategy

(1) Promotion of research and development of next generation cloud technologies

- In order to realize a smart cloud infrastructure research and development that will realize an optimized response to the collection, extraction, accumulation, and modelling of massive real-time streamed data and changes in the situation using large-scale distributed/parallel processing technologies for use with cloud services will be promoted.

- Research and development of safe/reliable related technologies will be promoted, including those realizing end-to-end based SLA, which will include networks, systems for flexibly reallocating resources within the cloud or between clouds in case of overload, and improved security of encryption technologies and virtualization technologies.
- Green ICT industry (Green of ICT), including support for establishing green cloud data centers, energy saving control with the internet, development of virtualization technologies for implementing dynamic load balancing, establishment of methods for measuring the effects of CO_2 emissions reduction through ICT, etc., and environmental impact reduction through utilizing cloud services (Green by ICT) will be promoted in an integrated manner.
- In view of supporting research and development in the above focused areas the creation of a competition-based funding system for developing cloud component technologies originating in Japan, support for establishment of a "Cloud Research and Development Platform (tentative name)" that primarily assumes international collaboration, and holding an "Asia/Pacific Cloud Forum (tentative name)" in developing next generation cloud technologies in cooperation with Asia/Pacific countries, etc. will be promoted.

(2) Promotion of standardization

- Standardization of the SLA required for cloud services, standardization of ideal methods for securing service quality and privacy, and standardization in securing interoperability, etc. will be promoted through utilizing places such as the "Global Inter-Cloud Technology Forum (GICTF)".
- In doing so the systems for collecting and sharing information on activities of a number of cloud service related international standardization organizations will be developed at GICTF by the end of 2010.

3. International strategy

- In view of accelerating consensus building toward formulating international rules concerning cloud services active national contributions will be made via industry-academia-government collaborations to the discussions through utilizing places of multilateral discussions, which include APEC, OECD, and ITU, etc. At the APEC Ministerial Meeting on the Telecommunications and Information Industry to be held at Okinawa in October 2010, in particular, efforts will be made to build a consensus between individual countries toward dissemination and development of cloud services. At the same time bi-lateral political talks with Korea and other countries will be promoted.

- Political discussions in an industry-academia-government collaboration, including Japan-USA public-private dialogue on cloud services, etc., will immediately be commenced upon.
- Ideal application of the EU "Data Protection Directive" in Japan will immediately be discussed with consideration given to public needs, etc.
- Active participation will be made in international discussions concerning dissemination of cloud services and network neutrality (open internet).

III. Promotion System

In view of promoting the creation of standard cloud service models, etc. in sectors across broad areas from the users' point of view the "Smart Cloud Strategy" will be promoted in an integrated manner through establishing a "Smart Cloud Consortium (tentative name)" in around fall of 2010 with the participation of the government, local governments, and private business operators, etc. Once every year the status of progress of the strategy will be compiled and published as a progress report, and the "Smart Cloud Strategy" also revised.

Supplemental Discussion - Estimate of Market Size of Cloud Services

The market size of cloud services was estimated using the respective categories of SaaS, PaaS, and IaaS.

(Process 1: Estimating the current cloud service market size)

A questionnaire survey on current cloud usage and future intentions with its introduction was conducted in November 2009 [Document-40 through 42]. The survey classified cloud services into 27 types and the current usage rate obtained for the respective service. The current market size of cloud services was estimated using the usage rate and the current market size of software and SI (System Integration).

The base data for the current market size of software and SI was taken from figures for "information services" of the "Survey of Selected Service Industries" (Minister of Economy, Trade and Industry) and used for the respective categories as follows.

- SaaS: Basic software services, including custom software, application package, and computers, etc.) and SI (size of SI was estimated through separate categorization)
- PaaS: Data processing services, system management/operation outsource services, DB services (SaaS and PaaS use the "Survey of Selected Service Industries" as the basic data)
- IaaS: Data centers (market size in FY 2009 from the "IT Market Navigator 2010" of the Nomura Research Institute, Ltd. (December 2009) was used as the basic data)

(Process 2: Estimating the future market growth rate)

In the above mentioned questionnaire survey three types of responses, namely "plan to expand (introduce)", "plan to expand (introduce) but with no concrete schedule", and "under discussion", were obtained from current users with regard to their future expansion plans and non-users their future introduction plans, etc. The results of this survey were then used in the future market growth rate.

Of them, for current users, those responded that they "plan to expand" was assumed to occur in 2010, "plan to expand but with no concrete schedule" in 2010-2012, and "under discussion" in 2011-2015 in estimating the market growth rate.

For non-users, those responded that they "plan to introduce" was assumed to occur in 2010, "plan to introduce but with no concrete schedule" in 2010-2012, and "under discussion" in 2011-2015 in estimating the market growth rate.

More concretely, the usage rate for the respective services in the respective year was estimated by adding the market growth rate in the respective year calculated by levelling the above market growth rate of the respective periods to the cloud usage rate in 2009 for the respective service. With regard to the response of “under discussion” from non-users, approximately 70% of those whose reasons for not currently using cloud services did not include reasons concerning policies were assumed to “introduce cloud services in the future” in making the estimate.

(Process 3: Estimating the cloud market size)

Market size of respective categories of SaaS/PaaS/IaaS in the respective years was estimated by multiplying the usage rate of respective services in the respective years obtained in process 2 by the market size of the respective category obtained in process 1.

In addition, the development of cloud markets was assumed to make part of systems that were conventionally internal become then outsourced. The estimate was made by regarding this as the size of the newly created areas. More concretely, the market size of systems conventionally established internally was estimated to be the difference between the amount of investment in software by users and the amount of orders received by enterprises providing software and SI, or approximately 3, 518.3 billion yen. The size of newly created areas of approximately 267.2 billion yen was calculated by multiplying this by the average usage/intention usage rate of 7.6% that was estimated by adding the average usage rate of SaaS related services in the questionnaire survey to the percentage of responses of “plan to introduce”, “plan to introduce but with no concrete schedule”, and “under discussion”. With regard to the response of “under discussion” approximately 70% of those whose reasons for not currently using cloud services did not include reasons concerning policies were assumed to “introduce cloud services in the future” in making the estimate.

Estimated figure of newly created areas obtained from this result was then prorated according to the percentage of SaaS/PaaS/IaaS in respective years. Finally the market size of respective categories was estimated by adding that figure to the market size estimated in process 1 and process 2 above.

(Process 4: Estimating the size of market created by political support)

The estimation was made for the "agricultural sector”, “educational sector”, and “medical sector” as being sectors in which new markets are created through politically supporting dissemination of cloud services in sectors in which ICT utilization is at present not progressing and the establishment of a smart cloud infrastructure, etc. is yet to occur.

More concretely, with the “agricultural sector” all farmers that are not currently using ICT

related devices, but excluding management/product management, etc., and 50% of farmers that are not using ICT related devices and gave a response other than “no need to” were assumed to introduce them and the estimate made by assuming the unit price of usage to be the usage fee of the relatively simple business management/product management software, etc. of 10,000 yen per month.

With the “educational sector” cloud utilization is at present limited to approximately 30% in sectors of schedule management and student management, etc. among approximately 36,000 public schools. The estimation was made by assuming that utilization in these sectors would be facilitated and the unit price of usage 600,000 yen per school.

With the “medical sector” the estimation was made by assuming the introduction of an electronic medical record system, which is at present limited to 15%, will progress in the future at a monthly usage fee of 55,000 yen.

In addition, the estimation was made assuming “use of clod services for optimizing power distribution control, etc. via smart grids” and “use of cloud services for information management and analysis in BEMS and HEMS” and the emergence of a market for smart grids in which efforts are currently being made.

Glossary

(In alphabetical order)

Item	Page (first appeared)	Description
APEC [Asia-Pacific Economic Cooperation]	42	A forum that aims at sustainable development in the Asia/Pacific region that major countries/regions participate in. Main activities include liberalization/facilitation of trade and investment, and economic and technical cooperation.
API [Application Programming Interface]	5	Procedures and formats specified for applications to communicate with and control other applications, OS, or hardware.
ASEAN+3 [Association of South-East Asian Nations+3]	42	An international cooperation system with the participation of 10 member countries of ASEAN (Association of South-East Asian Nations) and 3 others, namely Japan, China, and Korea. The purpose of ASEAN+3 is to facilitate economic growth and social/cultural development, and secure political/economic stability, etc.
BCP [Business Continuity Plan]	12	A comprehensive plan that specifies measures to avoid important businesses having to cease in the case of a failure or restart within a target recovery time when a business interruption, etc. occurs.
BEMS [Building and Energy Management System]	55	A system for identifying the status of indoor environment/energy use and reducing energy consumption by devices or managing the operation of facilities, etc. according to the indoor environment of office buildings, etc.
BPR [Business Process Reengineering]	12	Drastic reformation of business processes by setting goals (sales, earning rate, etc.) with the aim of improving enterprise competitiveness, and analyzing and optimizing the content of business, business flow, and organizational structure in achieving those goals. It involves the streamlining of organizations and businesses, and hence advanced information systems are often utilized.
Data mining	35	Technology for analyzing massive amounts of data

		accumulated by enterprises and identifying the relationship with certain items and patterns, etc. in that data. Raw transaction data has not conventionally been put to use, but advanced information technologies enable data mining from a “mine” in which potential customer needs lie unexploited.
De fact standard	39	A standard as a result of being accepted by the majority of the market concerned. “De facto (actual)” becomes a standard without going through the standardization processes as de jure standards do.
De jure standard	39	A standard established by the standardization organization which is formulated under explicitly specified procedures with participation from relevant parties from various areas.
Digital signage	19	Advertising medium that displays video pictures and information using flat displays and projectors through utilizing digital technologies on displays and communication devices.
EHR [Electronic Health Record]	16	Electronic health records of individuals that can be electronically utilized as health information (medical information, receipt information, medical examination results, and health related information) over a long term of time.
HEMS [Home and Energy Management System]	55	A system for use in promoting energy saving measures through installing network-enabled energy saving management devices that utilize ICT technologies in homes and the automatic control of them.
ITS [Intelligent Transport Systems]	19	An advanced road traffic system for use in resolving road traffic issues, including traffic jams, traffic accidents, and environmental degradation, through establishing an integrated system of people, roads, and vehicles via utilization of information and communications technologies, etc.
Multi-tenant	40	Sharing resources, including servers and database, etc. between multiple users.
OECD [Organization for Economic Co-operation	42	An international organization that aims to contribute to economic growth, trade liberalization, and developing nation support through the free exchange of opinions and

and Development]		information between developed countries.
Open source	34	Refers to publishing source code and design specifications of software over the internet, etc. and allowing anyone to modify and redistribute the software.
QoS [Quality of Service]	39	Technology for use in securing a certain level of communication quality (transmission delay, operating rate, etc.) via bandwidth control and priority control for specific communications over networks. Important technology for services that do not allow any delay or suspension in communications, including real-time distribution of voice and video pictures (radio/television-type services) and IP telephones over the internet where various communication data types coexist.
SLA [Service Level Agreement]	6	A system for service providers to guarantee users of a service quality by including in the contract service quality guaranteed items and provisions concerning reduction of usage fees in case they are not achieved , etc.
Space code	19	An identifier for determining place and location with optional precision. It is the basis for managing the variety of information related to place and location (spatial information).
Storage	7	Devices used to record data and programs in information systems and which include hard disk devices, CD-R devices, and magnetic tape devices. Storage functions may be installed in enclosures other than those the information systems are installed in and shared by multiple information systems.
Stream data	5	Data produced consistently and in large volume from devices, including sensors, terminal devices, and servers, etc.
Virtualization technology	2	Technology that virtually partitions/integrates components of computer systems, including CPUs, memory, storage, OS, and networks, etc.