Implementation Strategy for a Public Service Based on Cloud Computing at the Government

Jung-hyun Seo[1], Jun-Sik Min[2] and HyeongOk Lee[3*]

¹Dept. of Computer Eng., National Univ. of Sunchon, Sunchon, Chonnam, 540-950, Republic of Korea
²Dept. of Computer Eng., Kyungdong University, Goseong, Gangwon, 219-705, Republic of Korea
³Dept. of Computer Edu., National Univ. of Sunchon, jungang-ro 255, Sunchon, Chonnam, 540-950, Republic of Korea,
¹jhseo@scnu.ac.kr, ²jsmin@k1.ac.kr, ³oklee@scnu.ac.kr

Abstract

The present study analyzes policies on cloud computing (CC) in five countries (USA, UK, Japan, Australia, and Singapore) and deduces their implications. It also suggests and analyzes a list of 15 guidelines, 20 check lists, and a service analysis model to implement a public service based on cloud computing (PSBCC). The outline of the necessary procedure for the implementation of a PSBCC is proposed. The analysis model of the service to be implemented is proposed to select the PSBCC that is to be implement according to the promoted policies. The checklist to determine the PSBCC implementation is proposed, which can also be used as data to examine the validity of the implementation. These suggestions provide a systematic method to establish high-quality PSBCC, and the established PSBCC is expected to reduce Information Communication Technology (ICT) operation costs and promote service innovation from the business perspective.

Keywords: Cloud computing, Public service, guideline, check list, PSBCC

1. Introduction

Computer performance is usually evaluated in terms of the processing speed of the CPU and the storage capacity of the memory. Despite the development of operating system methods for improving the processing speed of the CPU and the storage capacity of the memory, enhancement of computer performance is gradually slowing down due to limitations of physical electronic materials that have electrical properties. To solve this problem, high-performance computing (HPC) that connects several computers was studied as an alternative. According to the connection method between a memory and a processor, the communication method between processors, and the method of supplying computing resources, multiprocessors, multi-computers, grid computing, peer-to-peer (P2P), and CC were developed. CC is a computing structure that has received the greatest attention in decade, emerging as a new paradigm beyond a simple system [1].

CC is a large-scale distributed computing paradigm in which a pool of computing resources is available to cloud consumers via the Internet Computing resources, *e.g.,* processing power, storage, software, and network bandwidth, are represented to cloud

---

* Corresponding Author

consumers as the accessible public utility services [2]. CC has been rapidly developed and widely studied because of its many significant benefits such as connection through wired and wireless Internet, limitless usage as required, development of wireless Internet, fast services, and reduced initial construction costs. As part of the expansion of the information technology market and the exit strategy in response to economic recession, developed countries are promoting CC policies and global companies are investing in CC on a large scale. On the other hand, developing countries are politically encouraging CC at the government level against developed countries and global IT companies, concerned about global companies encroaching on their IT markets. The United States of America (USA), the United Kingdom (UK), Japan, Australia, China, the European Union (EU), South Korea, Thailand, Vietnam, and New Zealand are swiftly taking actions with regard to policies and services on CC [3].

The USA established the Federal Cloud Computing Initiative (FCCI) in March 2009, which is the initial policy of the Obama government on IT-based integration of federal governments and public institutions and the implementation of CC services. In December 2010, the federal government examined the detailed tasks performed by the FCCI and announced its new promotion plan, "25 Point Implementation Plan to Reform Federal Information Technology Management" [4]. In 2011, it also announced the "Federal cloud computing strategy" [5]. In June 2009, as part of the Digital Britain [6] strategy, the UK announced the "G-Cloud" that aimed to convert governmental IT resources into CC-based resources by 2012. The G-Cloud that consisted of 10 detailed strategies focused on cost reduction through a conversion of common tasks into software as a service (SaaS), integrated purchasing of infrastructure, integration of information resources of public data centers, and establishment of markets that sell CC services to governments.

Japan is promoting the "Kasumigaseki project" for central government departments, aiming to be completed by 2015 and the "local government cloud" for local governments [3]. The Japanese government established a goal to execute new CC-based administrative reforms by integrating governmental IT systems and data through the Kasmikasseki project by 2015. In January 2011, Australia announced the "Cloud Computing Strategic Direction Paper" [7]. This study identified the importance of CC, and the benefits, risks, and issues that might be caused by this opportunity when migration public data to CC, and then, proposed the relevant policies. The proposed policies consist of three streams including the CC execution plan, the adoption of the public cloud, and government-wide integration. Singapore is conducting a project for the construction of the "Data Center Park in Singapore" [8], focusing on attracting the data centers of global companies.

This study examines policies of major developed countries on CC implementation that have been announced and promotion processes, and proposes various issues that should be considered by countries that are preparing CC implementation. In Section 2, the basic concept of CC and IT and the business characteristics of PSBCC are introduced, and the range of public services is determined. In Section 3, first, the CC policies of the US, the UK, Japan, Australia, and Singapore are analyzed and relevant implications are derived. Second, the outline of the necessary procedure for the implementation of a PSBCC is proposed. Third, the analysis model of the service to be implemented is proposed to select the PSBCC that is to be implemented according to the promoted policies. Fourth, a list of guidelines for PSBCC implementation is proposed. Fifth, the checklist to determine the PSBCC implementation is proposed,

which can also be used as data to examine the validity of the implementation. Finally, the conclusion is derived.

2. Related Works

2.1. Cloud Computing

The definition of CC varies slightly according to the position and perspective of an institution on CC. In general, CC can be defined as "the large-scale distributed computing service environment in which as much of the massive IT resources including computing power, storage, platform, and services as required are provided for users through the Internet." The NIST (National Institute of Standards and Technology) defines it as follows:

"Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (*e.g.*, networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."[9]

CC service models can be widely defined according to the targeted services. The models that have been proposed include AaaS (Architecture as a Service), BaaS (Business as a Service), PaaS (Platform as a Service), DaaS (Data-center as a Service), SaaS (Software as a Service), FaaS (Framework as a Service), HaaS (Hardware as a Service), IaaS (Infrastructure as a Service), IDaaS (Identity as a Service), and CaaS (Communications as a Service). As a unified classification standard for service models is not established as yet, [9] is used for the definition of AaaS, PaaS, and SaaS models in this study.

As described above, CC can be widely classified on the basis of the targeted service and the perspective on CC such as the users of the service, and the range and degree of resource sharing. The NIST defines a deployment model as Private, Public, Hybrid, and Community according to users of services and the range of resource sharing [9].

Characteristics of CC include virtualization, reusability, integration, flexibility, rapid elasticity, measureable, resource pooling, scalability, availability, utilization, cooperation, and mobility. These various characteristics include both IT and business properties. The NIST defines the basic characteristics of CC services as On-demand self-service, broad network access, Resource pooling, rapid elasticity, and measured service from the IT perspective [9]. Potential benefits through CC implementation from the business perspective include scalability, efficiency, cost containment, flexibility, availability, and resiliency [7].

2.2. Range of Public Services

Public services generally refer to "all services produced and supplied by the government and public institutions to satisfy the benefits of social communities and the public needs" [10]. This definition emphasizes public goals and the public among all the service beneficiaries. Indeed, the services of the public sector consist of nationwide services, internal-governmental support services that are required to perform nationwide services, and common technology support services that facilitate the establishment of the two services based on IT. As this study focuses on public services performed in the CC environment, public services are divided into nationwide services, internal-governmental support services, and common technology services. Nationwide services support the tasks and services of institutions that focus on the public. Internal-

governmental support services are commonly used in several institutions and can be provided and managed in the integrated environment. Common technology services are components necessary to realize nationwide services and internal-governmental services.

3. Analysis of PSBCC Policies of Major Countries

3.1. Current Status of Implementation Policies by country

In March 2009, the US Chief Information Officer (CIO) council announced the FCCI, the initial policy of the Obama government on cloud implementation as the strategy for the IT-based integration of the federal government and public institutions and CC implementation. This plan focused on administrative management, procurement, CC technology innovation, cost-efficient IT establishment, and promotion of the role of the government as the service provider. The council also proposed the execution plan that was divided into three stages including the public cloud, the private cloud, and the hybrid cloud from August 2009 to June 2010. In addition, this plan implements SaaS, PaaS, and IaaS in phases. In December 2010, as part of the promotion procedures, the "25 Point Implementation Plan to Reform Federal Information Technology Management" was announced. The plan comprises several detailed execution plans including reduction of federal data centers to approximately 800 by 2015, implementation of the Cloud First policy and the IaaS solution, implementation of a SaaS-based e-mail service in institutions of the federal government, and strategy preparation for the development of sharing services among institutions of the federal government.

In the case of implementing a public cloud, institutions could not appropriately perform security evaluation and authorization on CC by themselves. To solve this problem, the CIO council installed the FedRAMP Joint Authorization Board (JAB) that consists of experts of the GSA, the Department of Defense (DOD), the Department of Homeland Security (DHS), the NIST, the National Security Agency (NSA), and the OMB. The FedRAMP JAB established the Federal Risk and Authorization Management Program (FedRAMP) [12] as a program for the common evaluation of and authorization for CC.

In June 2009, The UK announced the "G-cloud" plan that converts governmental IT resources into CC-based resources by 2012 in its future strategy plan, the Digital Britain Report [6]. To achieve this goal, the position of the Director of Digital Engagement was introduced in the Office of the Prime Minister to manage CC-based governmental ICT. The main contents of this plan focus on cost reduction through a conversion of common governmental tasks into SaaS, integrated purchase of infrastructure, consolidation of information resources of public data centers, and establishment of the market for CC service sales that targets governments. In October 2010, the UK also announced its plan to integrate approximately 130 governmental data centers into approximately 10 cloud data centers by investing $370 million (USD). Ten promotion strategies of the G-cloud include the simplification and standardization of desktops, standardization and rationalization of duplicated or highly concentrated networks, rationalization of data centers, open source and open standard, green ICT, information security and guarantee, and sharing of services.

In January 2011, the Department of Finance and Deregulation of Australia announced the Cloud Computing Strategic Direction Paper [7]. According to this paper,

the Australian government and public institutions are planning to adopt CC-based services if cloud services have capital values and ensure appropriate security. Moreover, a governmental ICT ecosystem will be established to satisfy the business requirements of institutions using the optimum method from the perspective of costs, security, flexibility, and safety and solidity of management. In terms of CC strategies, this paper is composed of three streams: the possibility of CC implementation, adoption of the public cloud, and government-wide integration (private, public, and community clouds). Since the beginning of Stream 1 in the first half-year of 2011, Stream 2 has been completed, and Stream 3 that applies private and community clouds to the public cloud is currently underway.

The Japanese Ministry of Internal Affairs and Communications is promoting the "Kasumigaseki project" that will target central government departments and the "local government cloud" that will target local governments by 2015. It is planning to establish a common governmental platform by 2013 and execute administrative innovation by 2015 through the "Kasumigaseki project." Through the "local government cloud," 1,800 information systems of local governments will be established as integrated data centers based on the cloud and promoted to be used commonly by 2015. In December 2010, the ministry established the Japan Cloud Consortium (JCC) in which approximately 50 public institutions and approximately 250 private IT companies participated for the integration of and convergence with conventional industries and the implementation and expansion of the omnidirectional cloud. The JCC has six workgroups including cloud migration review, business cooperation cloud review, the education cloud, next-generation cloud service review, the agricultural cloud, and the medical cloud.

The Information Development Authority (IDA) in Singapore executed a project for the construction of "the Data Center Park in Singapore" in order to establish the largest data center in the Asia-Pacific region. Through this project, companies such as the Tata group, Fujitsu, AT&T, BT, Verizon Business, and SingTel were attracted. The IDA also provides CC resources free of charge for promising small and medium-sized venture companies by establishing a cloud innovation center. As a result of the active promotion for investment attraction by the Singapore government, Salesforce.com, Amazon Web Service, Fujitsu, IBM, Microsoft Azure, Savvis, and Tata Communications established their branch offices in Singapore.

3.2. Characteristics of Policies of Major Countries

In this section, the CC implementation policies of countries that were mentioned earlier were analyzed. In addition, by analyzing 41 cases of the USA for CC establishment in the public sector (including 20 GAO (Government Accountability Office) reports) and 5 cases of Japan, Spain, Mexico, and Australia, we identified certain political characteristics.

The USA is gradually promoting the implementation of public, private, and community clouds. As the cloud system is established outside public institutions in the case of implementing the public cloud, security has emerged as one of the main issues. Giant multinational IT companies located in the USA are the cloud service providers for the public cloud that the USA is planning to implement, and the USA government is expecting the companies to boost the IT industry and economy in the country. The federal government is concentrating on ICT efficiency, scalability, and cost reduction factors as part of the cloud promotion goals of the government organizations. The main characteristic is that IaaS and PaaS be established at the government level and public

tasks be performed through the cloud system on the basis of SaaS. Furthermore, a powerful hybrid cloud model of the public and private sectors is being established by actively connecting the private cloud system to the public area. By implementing the private CC system, the USA is attempting to lead the global CC market. Although most of the CC-based services promoted by the government are simple services including nationwide web pages, e-mail, and customer relationship management (CRM), benefits such as reduction of ICT maintenance costs can be obtained because of a significantly large number of users.

The UK is constructing the cloud infrastructure at the government level by establishing and providing various services, which are the greatest advantage of CC, on a single platform in order to maximize system integration. The establishment and supply of services on the single platform ease concerns on security that can arise while using the public cloud and facilitate the development of public services on the same infrastructure and platform. As such, there is no difference between services, and the service connection is convenient. Moreover, a procurement system is being built for each institution to procure applications on the established cloud infrastructure by itself. Hence, service development has been more convenient for small and medium-sized IT companies that have insufficient funds, and the standardized procurement process facilitates as environment in which cloud services of each institution can be easily implemented.

Japan could establish and provide various services on the same platform by building the common governmental platform. As a result, concerns on the security of the public cloud were relieved. As all the services are established on the same infrastructure and platform, there is no difference between services and the service connection is convenient. Japan is paying special attention to the USA-led cloud system, and establishing its unique cloud system by being aware of the influence of the USA. Australia selected the cloud as the base system to realize an electronic government. Analyzing that it is inefficient to establish the unique cloud system using its current IT technology, this country is interested in applying cloud systems of multinational companies including Amazon, Dell, IBM, and Google. As the domestic ICT market is small, Singapore is concentrating on the establishment of a cloud infrastructure that targets all the Asian countries as its customers on the basis of the data centers of multinational companies.

The most active countries for government-led implementation and establishment of the cloud system are Japan, Singapore, and Australia. Each country is focusing on CC as the solution for the efficiency of the electronic government, business innovation, ICT efficiency, and cost reduction. Through cloud implementation in the public sector, these countries are expecting positive effects such as enhanced IT infrastructure, development of IT, qualitative improvement and increased efficiency of services, and budget reduction. Business innovation is frequently occurring in service areas that target the public. The USA that has an active private cloud market is establishing public services using the public cloud, the solution of multinational companies, to help the US companies preoccupy the global market and improve public services. Most countries are worried about a leakage of critical governmental and private information such as national and industrial confidentiality and personal information when the entire cloud industry becomes completely dependent on foreign multinational companies. In particular, Japan and the UK are constructing government-wide private cloud centers led by the government rather than implementing solutions of multinational companies in a bid to domestically prevent the market expansion and dominance of foreign

multinational companies and develop the domestic cloud industry. Singapore and Australia that have a weak foundation for IT and cloud industries have selected the strategy to promote multinational companies to install CC infrastructure in the countries by using solutions of the companies in order to develop domestic IT industries.

3.3. Strategy, Check List, and Analysis Model for PSBCC Implementation

3.3.1 Implementation Strategy

In this section, strategies to implement PSBCC, a list of guidelines for the implementation stage, and the analysis model to analyze the implemented services are proposed. First, the two prerequisites for the implementation of PSBCC are as follows:

First, the cloud-based common infrastructure and platform in which the PSBCC is to be constructed should be established.

Second, governmental guidelines on the implementation of cloud services should be proposed. Public service planners should design services according to these guidelines and conduct a final inspection using the checklist to confirm whether the designed service is appropriate for the cloud foundation. When the cloud implementation is determined, detailed construction plans should be established and then, the development should be begun. The procedure mentioned above is illustrated in Figure 1.
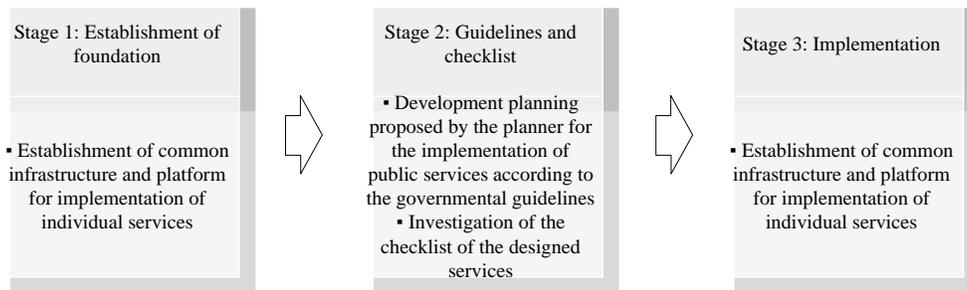

Figure 1. Procedures for PSBCC Establishment

The strategy for the implementation of PSBCC is the process to find answers for the three questions given below.

First, which service will be implemented?

Second, how will the service be implemented?

Third, does the service implementation cause any problem?

The detailed checkpoints for the first question are as follows:

• Whether the service to be implemented is consistent with the governmental policy or vision should be confirmed.

• Whether the service to be implemented is consistent with the cloud-related policies should be judged.

• Whether the service to be implemented is appropriate from the technological perspective should be confirmed.

The detailed checkpoint for the second question is as follows:

• The governmental guidelines on the implementation of cloud services should be obeyed.

The detailed checkpoint for the third question is as follows:

• People in charge of the cloud implementation should perform the inspection process using the checklist. In this process, the risks and benefits of CC implementation identified by the planners can be examined when issues on policies, technology, and security are enumerated.

Proposing guidelines and the checklist for CC implementation can resolve the three questions given above. In this study, only a list of necessary guidelines rather than all the guidelines is proposed, and the checklist is suggested in Appendix 1. When people in charge of the IT policies and services in public institutions decide on the implementation of PSBCC, the check list is used and the three items are reviewed.

First, the necessary items from the political, technological, and service perspectives should be examined.

Second, the necessity of service implementation (migration or new) should be reviewed.

Third, the appropriate period for service implementation should be investigated.

The guidelines and the standard list of 6 items required for PSBCC implementation are as follows:

Table 1. List of Guidelines Required for PSBCC Implementation

Division	Guideline
Governance	- Determination of the system, organization, and function of government-wide governance for service implementation
Platform and common technology	-Government-wide CC architecture reference model -Standard model for the construction of cloud data centers -Connection standard for mutual management between PSBCC -Guideline for the use of open software that can be commonly used
Security	- Security guidelines for each factor such as the data (information), system, and network

Implementation	-Technology guideline to confirm possibility of implementation in the case of new CC establishment -Guideline on the implementation of the cloud work environment in the public sector -Evaluation and authorization standards of cloud-related solutions
Migration	-Standards for selection of convertible services -Technology guideline on the conversion of the legacy system into the cloud system -Guideline for economic feasibility analysis
Management	-Guideline of standard service level agreements (SLA) for services -Standard for service quality evaluation -Metering system on the service use

3.3.2. Analysis Model of Public Services for Implementation of Cloud Services

The analysis model analyzes candidates that are reviewed for implementation in the initial stage of CC implementation planning in order to facilitate balanced execution. As shown in Figure 2, the service model and the deployment model were used as the analysis models, and three axes were set to be the standard according to the standard of the public service classification. The contents of each axis according to the classification are as follows:

• X-axis (classification of public services): nationwide services, internal-governmental support services, and common technology services

• Y-axis (Deployment Model): Private, Public, Hybrid

• Z-axis (Service Model): IaaS, SaaS, PaaS, DaaS

The three axes are the most widely used standard to classify the PSBCC, but it is acceptable to adjust the standard according to the needs of each country. For example, the service implementation method (new or migration), the service implementation period (year), and the physical location can be considered alternative standards. If the service implementation period (year) is used as the standard, the medium- and long-term road map can be created for the PSBCC implementation. Further, if the physical location is used as the standard, it ensures safety of the CC system from natural disasters such as earthquakes and tsunamis. In this case, the location of candidates that are reviewed for the PSBCC implementation is marked in the analysis model and the distribution of marked candidates is analyzed. It is required to observe the space that is the most concentrated or the emptiest. Unequal distribution is not always considered wrong, as the area can be concentrated or empty according to the relevant governmental policy.

Figure 2 shows the example in which 20 PSBCCs mentioned in the GAO report [13] and being promoted by the US federal government are analyzed. Numbers from 1 to 20 were assigned to 20 services, and their locations were marked on a cube. The list of services with assigned numbers is displayed in Appendix 2. The proportion of public

services of 75% is higher than that of the private service (20%) or that of the hybrid services (5%). The proportion of internal-governmental services (70%) is greater than that of nationwide services (25%) or that of common technology services (5%). Most of the 20 services mentioned in the GAO report are public internal-governmental services.
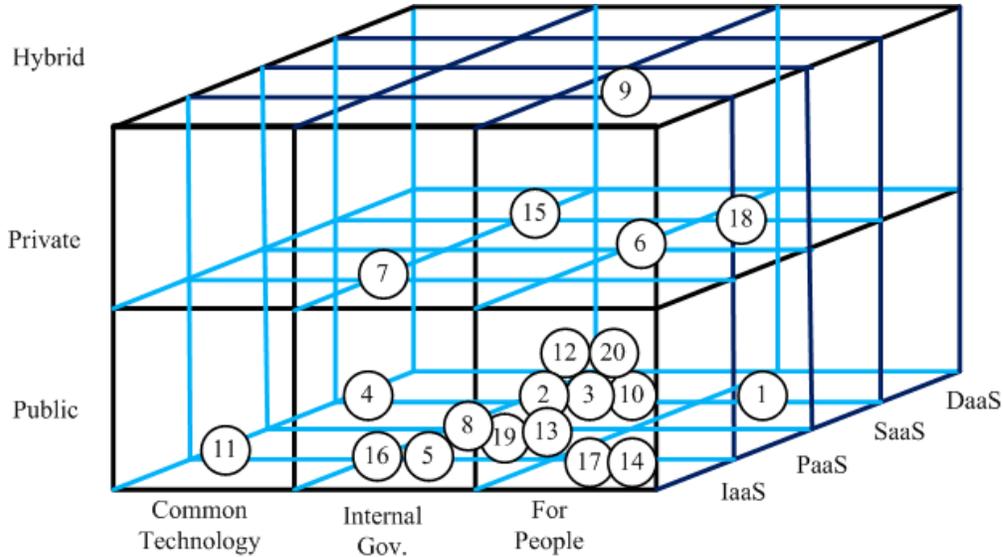

Figure 2. Floating the 20 Services Mentioned in the GAO Report

If the implementation period (year) is used as the standard instead of the deployment model, the long-term CC road map of the US can be examined through the analysis model. The short-term goal can be also verified by setting the year to be a short term.

4. Conclusion

We hope that this study can be effectively used by the government that is considering various methods to implement the PSBCC. Governments all over the world may attempt to inject new vibrancy into their economy through CC promotion, or become a leading IT country by developing domestic IT companies, or protect their industries that are being encroached by foreign capital. Alternatively, they may establish high-quality services by integrating nationwide public services or reduce ITC operation costs by improving efficiency of the IT system. We expect a government to establish a better policy for the implementation of CC services and execute the PSBCC more systematically through this study.

References

[1] D. Ergu, G. Kou, Y. Peng, Y. Shi, "The analytic hierarchy process: Task scheduling and resource allocation in cloud computing environment," J Supercomputer, 64, 3, 835-848 **(2013)**.
[2] S. Chaisiri, Bu-sung Lee, "Optimization of Resource Provisioning Cost in Cloud Computing," IEEE Transactions on Services Computing, 5, 2, 164-177 **(2012)**.
[3] David C. Wyld, "The cloudy future of government it: cloud computing and the public sector around the world," Internal Journal of Web & Semantic Technology, 1, 1, 1-20 **(2010)**.
[4] Vivek Kundra, "25 point implementation plan to reform federal information technology management," U.S. chief Information Officer, THE WHITE HOUSE, Dec. **(2010)**.
[5] Vivek Kundra, "Federal cloud computing strategy," U.S. chief Information Officer, THE WHITE HOUSE, Feb. **(2011)**.

[6] Digital Britain, http://www.official-documents.gov.uk/document/cm76/7650/7650.pdf.
[7] Department of Finance and Deregulation, "Cloud computing strategic direction paper," Australian Government, Jan. **(2011)**.
[8] Singapore Data Centre Park, http://www.ida.gov.sg/Infocomm-Landscape/Infrastructure/Data-Centre-Park
[9] Peter Mell, T. Grance, "The NIST Definition of Cloud Computing," Special Publication 800-145, pp. 1-3, National Institute Standard and Technology, Sep. **(2011)**.
[10] E. S. Savas, "Privatization and Public-Private Partnership," Chatham House Publishers, **(2000)**.
[11] E. A. Fischer, P. M. figliola, "Overview and Issues for Implementation of the Federal Cloud Computing Initiative: Implications for Federal Information Technology Reform Management," CRS report for congress, 7-5700, Apr. **(2013)**.
[12] FedRAMP, www.Fedramp.gov
[13] David A. Powner, "Information technology reform: Progress Made but future cloud computing Efforts Should be Better Planned," United States Government Accountability Office, GAO-12-756, 1-38, Jul. **(2012)**

Appendix 1

Migration services refer to services that are to be converted from conventional IT services to cloud-based services. New services refer to primitive services without IT that are not provided as primitive services but are to be implemented as cloud-based services. Necessary items target all services, and if one of them is checked, implementation should be seriously considered. Selective items can be widely checked according to services, and the effects of implementation can be identified according to the marking level, namely excellent, average, and poor, which also serves as the basis for the implementation.

The checklist for an innovator of cloud-based public services is as follows:

- Necessary items

Division	Sub division	Item	Selection
Common	Legal system	○ Can it be implemented without violation of present laws or legislation and revision?	☐
		○ Are there physical access restrictions on the cloud system? (access restrictions on data centers and servers)	☐
		○ Are there logical access restrictions on the cloud service? (online access restrictions on service programs and data that are to be implemented)	☐
	Security	○ When the security of cloud suppliers is threatened, are policies on invasion notification, backup, risk factor elimination, and damage compensation prepared for public institutions and the public?	☐
		○ Is the cloud provider prepared to supply audit records?	☐
		○ Did the cloud provider sign a supply contract with a third party? If so, can the third party satisfy all the articles above?	☐

- Selective items

Division	Sub division	Item	Excellent	Average	Poor
Common	Policy	○ Is the service consistent with medium- and long-term policies of the government on the cloud?	□	□	□
		○ Is the service directly or indirectly useful for long-term policies of the government?	□	□	□
		○ Does the service contribute to ensuring technical skills of the domestic cloud industry and promoting the industry?	□	□	□
		○ Are there foreign cases of successful establishment?	□	□	□
		○ Does the service include tasks that can be commonly used between institutions? (Should the service that is to be implemented be used by other institutions?)	□	□	□
		○ Is the service established by one institution and distributed to other institutions?	□	□	□
	Service type	○ Should the user use various terminal units irrespective of time and location?	□	□	□
		○ Is the service be used anytime and anywhere?	□	□	□
		○ Should the desktops of the users be regularly replaced with the most recent technology?	□	□	□
		○ Should availability be ensured without restrictions on use time? (System down/up functions due to system failure or performance issues are not required.)	□	□	□
		○ Does the service require common tasks to proceed tasks (projects) between institutions?	□	□	□
Migration	Service type	○ Are costs of establishment and management of the service that is to be implemented lower than those of a conventional service from the medium- and long-term perspectives?	□	□	□
		○ The conventional system of the service to be migrated is planned to be removed or used?	□	□	□
New		○ Is the service temporarily provided and removed? (whether it is a website that is established for one-time events such as the	□	□	□

		Olympics, Asian Games, and exhibitions)			

Appendix 2

Agency	No.	Service	Service model	Deployment model	C/I/P
DHS		Data Center Services	-	Private	-
	1	Employment Verification	SaaS	Public	P
	2	Website Hosting	SaaS	Public	I
GSA	3	Correspondence Tracking	SaaS	Public	I
	4	E-mail and Collaboration Solution	SaaS	Public	C
	5	IT Power Management Services	SaaS	Public	I
HHS	6	Medwatch+	PaaS	Private	P
	7	Grants Solutions	IaaS	Private	I
	8	Audit Resolution Tracking Management System	PaaS	Public	I
SBA	9	Collaboration Services (Management and Technical Assistance Line of Business)	IaaS	Hybrid	P
	10	Human Resources	SaaS	Private	I
	11	LAN/WAN, Offsite Vaulting	IaaS	Public	C
State	12	Electronic Library	SaaS	Public	I
	13	Program Management	PaaS	Public	I
	14	Website Hosting	IaaS	Public	P
Treasury	15	Business Process Management	SaaS	Private	I
	16	Document Management and FOIA Case Management	IaaS	Public	I
	17	Website Hosting	IaaS	Public	P
USDA	18	Collaboration Services (USDA Connect)	SaaS	Private	P
	19	Document Management and	PaaS	Public	I

		Correspondence Tracking			
	20	E-mail	SaaS	Public	I

※ Data Center Services by the DHS that refer to eight integrated services are excluded as all eight service models are different. C/I/P are classified by the research team as follows: C (common support services), I (internal governmental support services), P (nationwide services).