

A Study on method deploying efficient Cloud Service Framework in the Public Sector

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Abstract— This study aims to contribute to efficient cloud service deployment in Korea's public sector, and utilizes in-depth analysis of foreign cases including current practices the U.S, U.K, and EU, which have been aggressively driving public sector cloud service in recent years, as well as domestic cases unique to the Korean environment as the basis for comparing and drawing out differences and implications. Existing literature are also used as basis to develop a frame that can be applied in the efficient deployment of government cloud service. At the same time, cloud service deployment guidelines for existing and new government service are formulated. In addition, such issues as governance system, service roadmap, cloud adoption method at the office, and cloud data center implementation, are also discussed.

Keywords— Cloud Computing, service, frame, governance

I. BACKGROUND

The world is watching cloud computing with interest because of IT resource saving and service quality enhancement. The cloud computing market is rapidly emerging as a new growth engine in the smart society. All the countries of the world are paying attention to the possibility and growth trend of the cloud computing industry, and are actively taking part in the new market. The Korean government regards the cloud service as a new growth engine of the country, and is preparing comprehensive and mid-to-long term plans to introduce cloud services to the government with a view to developing the private market in Korea by actively introducing cloud computing to governmental services.

II. TRENDS AT HOME AND ABROAD

A. Overseas trends

As the establishment of the governance system, which defines the roles and functions of governmental agencies, is required to maximize the effects of cloud service introduction in the public sector and promote policies efficiently, major overseas governments are setting up and implementing pan-governmental policies and governance systems to effectively introduce cloud throughout the public sector. [2]

TABLE 1. CLOUD GOVERNANCE SYSTEM STATUS OF MAJOR COUNTRIES

Country	contents
U.S.	The federal government's cloud governance system in the U.S. is composed of 7 organizations, which are mainly driven by the Federal CIO Council.
Japan	The Ministry of Internal Affairs and Communications is leading private industry promotion and cloud introduction in the public sector. Composed of the Ministry of the Economy, Trade and Industry, the Japan Cloud Consortium (JCC), cloud promotion headquarters of local autonomous bodies, and the Local Authorities Systems Development Center (LASDEC). × JCC: Private, public, academic, and research center council LASDEC: An affiliated agency of the Ministry of Internal Affairs and Communications
U.K.	The Director of Digital Engagement comprehensively manages cloud government ICT. Implementing a "G-Cloud" plan and integration of the government data center.

Countries around the world are adopting cloud computing for the purpose of saving on the cost of information system development and operation, and efficient resource management. The following table 2. show the cloud policy promotion status of major countries.

TABLE 2. CLOUD POLICY PROMOTION STATUS OF MAJOR COUNTRIES

Country	contents
U.S.	· (Cloud First Strategy) - The OMB (Office of Management and Budget) mandated that each federal agency should convert more than three services into cloud by June 2012 for efficient operation and cost savings by removing old systems. - The GAO (General Accounting Office) reported the progress status of switching to cloud service by each agency on June 2012.
Japan	· (Kasumigaseki Strategy) - Single cloud infrastructure: The government information system of 13 central ministries and offices will be switched to a single cloud infrastructure to implement a common platform. · (Introduction of the local government cloud center) - 1,800 information systems in local government will be integrated in the cloud-based data center for shared use by 2015.

U.K.	· (G-Cloud Strategy) - The Cabinet Office in the U.K. announced a plan to provide the government's computing resources based on cloud computing.
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B. Domestic trends

The foundation of domestic cloud governance was laid by the “comprehensive plan to promote pan-governmental cloud computing,” which was announced jointly by the Ministry of Public Administration and Security, the Ministry of Knowledge and Economy, and the Korea Communications Commission on December 30, 2009. This plan aims for the, “strongest cloud computing country in the world by 2014. It implements ten detailed tasks in four areas, such as the first cloud computing introduction in the public sector, laying the foundation of the cloud computing service in the private sector, and R&D on key cloud technologies; and by creating favorable conditions for cloud computing.” Afterwards, the government announced the, “strategy for cloud computing diffusion and competitiveness improvement” On May 2011, and identified new policy tasks in line with the changes in the cloud computing market. Based on these activities, the Ministry of Public Administration and Security, the Ministry of Knowledge and Economy, and the Korea Communications Commission defined their promotion areas in the cloud computing area, and established and implemented the promotion plan internally. The “Pan-Governmental Cloud Computing Policy Council” resolves all pending issues among government departments.

The “Pan-Governmental Cloud Computing Policy Council” was established to create an integrated center, which is based on the cooperation among government departments, at the national level, and to create conditions that reflect the various requirements of the industries in government policies. Council members are composed of the managers in charge of cloud at the Ministry of Public Administration and Security, the Ministry of Knowledge and Economy, the Korea Communications Commission, and the experts in the academic, research, and industrial circles. The council has been held regularly once every quarter since March 2010.

The Ministry of Public Administration and Security focuses on the promotion strategy related to the introduction of cloud computing in the public sector, cloud introduction by administrative agencies, and information resource integration and efficient utilization. Whereas, the Ministry of Knowledge and Economy develops technologies and standards to secure the technical competitiveness of cloud computing, and the Korea Communications Commission improves laws and policies to promote private cloud industries and to foster cloud service providers in Korea. [3]

III. GAP ANALYSIS AND FINDING IMPLICATIONS

A. Analysis of the gap between domestic and overseas policies

The U.S. government also has been implementing the policy of switching to cloud computing since 2010. Since

December 2010, based on the “Cloud First” policy, the U.S. OMB (Office of Management and Budget) has requested all federal agencies to switch or develop at least three services to cloud computing by June 2012. The GAO (General Accounting Office) recently pointed out the absence of detailed guidelines by reviewing the implementation status.

In particular, they also pointed out that according to the results of reviewing the cloud service implementation status by organization there was a declarative request from the government regarding switching to cloud computing but that no guidelines are available that take the entire public sector into account. [4]

B. Implications

It was found that the integration of distributed information resources are promoted in overseas countries and that government guidelines are required to solve the problems that have occurred while switching to or developing cloud services. In particular, support is needed to drive organizational and cultural changes in each organization to introduce cloud services.

In Korea, initial integration work is carried out, and switching to cloud services is under way. This includes the integrated management of 40 government departments' information resources in the integrated government computing center. In addition, switching or service provision using private cloud (as opposed to the overseas case where public cloud is used for switching) is required, as the proportion of the online service is large (ranking top in an e-Government evaluation by the UN) and the importance of security is emphasized due to national circumstances.

In particular, demand on the virtualization technology, such as creating an efficient office working environment with programs like smart work and VDI for improved administration efficiency, is higher than in overseas countries, as the working environment is expected to change due to the offices relocation to Sejong City. In addition, a need for advance verification regarding general key review items such as performance, cost-effectiveness, and security when introducing a clouding office environment for central administrative agencies has been recognized. Recently, some cloud-related project plans are dependent on a specific solution when they are placing an order, which causes problems that must be solved.

According to the consistent strategy at the national level, to introduce cloud computing, the implementation of things such as laws and policies, project promotion, technology development, personnel nurturing, and PR are all required at the pan-governmental level. As a result, the establishment of the governance system is required in Korea to implement cloud services effectively in the public sector.

C. Governance System in the Public Sector

To establish the governance system for the effective implementation of cloud service in the public sector, the scope of the “Pan-Governmental Cloud Computing Policy Council” should be expanded to include the Ministry of Strategy and Finance and the National Intelligence Service, besides the

current members (the Ministry of Public Administration and Security, the Ministry of Knowledge and Economy, and the Korea Communications Commission). Also, the mid-to-long term cloud implementation strategy needs to be established at the national level, and the roles of each participating organization need to be defined. In addition, the detailed guidelines in each cloud promotion phase should be prepared to introduce cloud services in the public sector. This encompasses the entire phase—from planning to operation and termination, as has been done in the U.S. and the U.K.

IV. CLOUD SERVICE INTRODUCTION METHOD IN THE PUBLIC SECTOR IN KOREA

A. DEVELOPING A SYSTEM OF INTRODUCING CLOUD-BASED PUBLIC SERVICES

Up until now, cloud computing has been mainly utilized for simple information resource integration to achieve cost savings and efficient resource use based on the economy of scale. However, the demand on public service identification and development is increasing. This can increase effectiveness and value by making use of several cloud computing characteristics (flexibility, distributed operation, etc.). On the other hand, according to the results of reviewing the cloud service implementation status by organization, the U.S. GAO pointed out that there was a declarative request from the government regarding switching to cloud computing but that no guidelines that take the entire public sector into account are available. Therefore, the cloud service introduction system was developed for this paper, which presents the direction from the perspective of policies and technologies and can be referred by public agency staffs when identifying cloud based public services. To develop the system, the cloud-based public service needs to be defined. The cloud-based public service is designed to provide public services for people using cloud-based services, internal administrative services for the government and public agencies, and the service that is commonly used by people and internal administrative agencies. Depending on the service content, three models (IaaS, PaaS, SaaS) are used to provide the service.

Figure 1 shows the procedure of developing an introduction system that provides policy and technology factors, which should be considered when identifying the service, and presents the development guidelines for each area. The service introduction system is configured in such a way that cloud services can be classified from various viewpoints, and the procedures and guidelines needed for the implementation of the service in question can be provided.

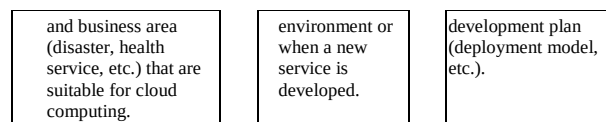
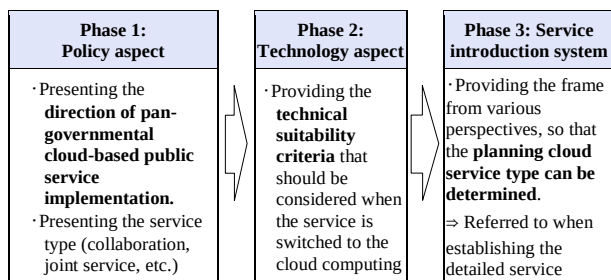


Figure 1. Public service identification and introduction procedure in the cloud environment

To provide the cloud service guidelines at the pan-governmental level, which should be considered when developing or operating the cloud service plan, the three-dimensional cube model was devised. It reflects various service type classification models from various viewpoints that allows for the distinction of service characteristics.

As shown in Figure 2, the three-dimensional axis is composed of control, channels and types.

The control axis is divided into the new/switching axis, depending on whether the cloud service is newly developed or switched from the existing service. It is designed in such a way that the public agency staff can receive help from the entire area of the IT life cycle by sub-cell.

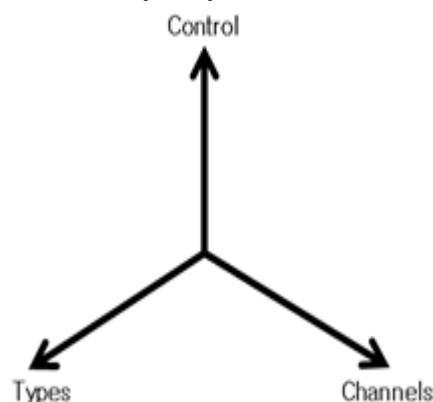


Figure 2. Basic axis of introducing cloud-based public services

The activity to perform in the IT lifecycle can be different, depending on the service introduction type. Service switching takes the IT cycle of, “identify → select → approve → utilize,” whereas the new service takes the it cycle of, “plan → develop → verify → share.”

According to the EA SRM 2.2 public service classification, the channel axis is divided into the civil service and support service within the government. The NIST’s cloud model (private, community, hybrid and public) was considered for the channel axis but security was additionally considered due to the characteristics of cloud services in the public sector in Korea. As a result, the axis is designed to give the guidelines that can include the future development model, while considering the private model in the short term. For the “types” axis, the model by cloud characteristics is first classified into IaaS, Paas, and SaaS, using the NIST’s definition. In addition, the IaaS category is need to reflect DaaS(Desktop as a service) in Korea, as the demand on the cloud office environment is increasing due to the special circumstances in Korea (e.g., smart work).

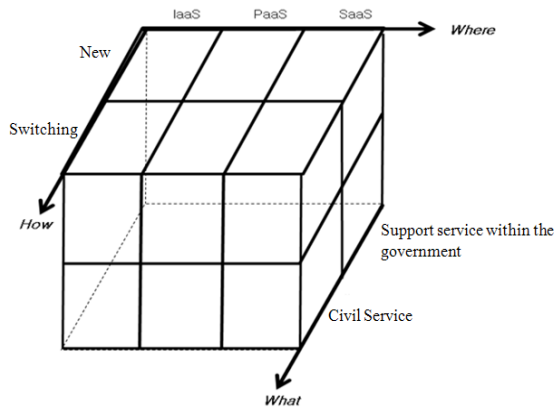


Figure 3. Cloud-based public service introduction system

The type and characteristics of the cloud service corresponding to each cell in the cube model need to be defined. The Australian government defined the strengths of cloud computing and characteristics by service from the viewpoint of the service introducer, as shown below. [5], [6]

TABLE 3. CLOUD COMPUTING CHARACTERISTICS

Strengths	Contents
Scalability	Service implementation and expansion are fast, and implementation and maintenance costs are low.
Efficiency	The introducer can focus on service innovation, instead of ICT-related technologies.
Cost Containment	ICT-related development and operation cost saving, when developing a service.
Flexibility	The latest technology is automatically updated. Quick development. Remote purchase is possible.
Availability	The service is available at any time and in any place, if the Internet is connected.
Resiliency	Failure at one place doesn't affect service provision.

In addition, the government guidelines and instructions need to be provided when implementing the service by cell, and Table 4 shows the example of government guidelines. However, it is necessary to present the approach by phases, based on the service type, depending on technical difficulties and preparation of the guidelines for cloud service development.

TABLE 4. CLOUD COMPUTING GUIDELINES

Item	Contents
Technology and standards	· Establishing the architecture reference model for cloud computing in the public sector.
	· Interface standard guide to secure interoperability among cloud services.
	· Open S/W utilization guidelines to save on costs and promote small and medium sized business.
Implement -ation	· Technology guidelines to prove the possibility of introducing cloud services when developing a new information system.

	· Guidelines to introduce the cloud office environment in the public sector.
	· Evaluation and certification criteria about cloud-related solutions.
Switching	· Criteria of selecting the business that can be switched to the cloud service.
	· Technology guidelines to switch the existing information system to the cloud service.
Planning	· Economic feasibility analysis of the cloud service.
	· Analysis of the current system.
Operation	· Standard SLA guidelines for the cloud service.
	· Establishing the criteria of cloud service quality evaluation.
	· Developing a metering system for the use of cloud services.
	· Developing the standard development model for the cloud data centre.
Security	· Security guidelines for each element for the cloud service, such as the data, system, and communication network.
Governance	· Defining pan-governmental governance systems, organizations, functions, and roles to introduce and implement the cloud service.

B.case1 describes the examples of applying the cloud service to the office environment, based on the cloud based public service introduction system that was developed in this paper.

B. CASE 1 : CLOUD OFFICE DEVELOPMENT GUIDELINES FOR SMART WORK

Among the introduction guidelines described above, the smart office environment has the strengths of efficiency and availability, because it can provide a working environment at any time and in any place. However, the model that fits into the specific organization needs to be selected. This needs to be done by comparing the strengths and shortcomings of the detailed technology model. [1]

The cloud office environment refers to the working environment where workers can save their information resources for business in a central data centre, and use them via remote connection, instead of installing or storing all or part of the information resources in the office.

The guidelines for cloud office development classify the components of the existing PC environment into the terminal, the operating system, application, and business data. Depending on the centralization of components, the cloud office environment model is grouped into the following: 1) desktop virtualization, 2) application virtualization, and 3) cloud storage.

1) **Desktop virtualization:** only the terminal with the monitor and keyboard is left in the office, and the OS, application, and business data are centralized.

2) **Application virtualization:** only the terminal and OS are left in the office, and the application and business data are centralized.

3) **Cloud storage:** only the terminal and OS are left in the office, and the application and business data are centralized.

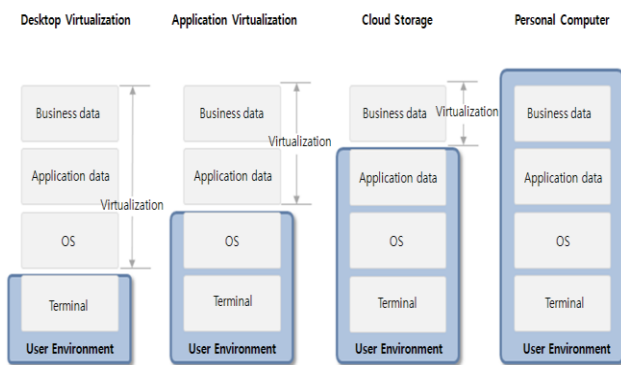


Figure 4. Technology model definition for cloud office

The guidelines present the criteria that can be compared and referred to when introducing the model. Desktop virtualization is suitable for the realization of the low CO2 environment and management automation. Whereas, application virtualization is appropriate for some job groups that repetitively use a certain function, and cloud storage has the strength of safe and systematic management of the business data. The following table shows the comparison results among cloud office environment models.

TABLE 5. COMPARISON BETWEEN CLOUD OFFICE ENVIRONMENT MODEL

(◎ > ○ > △)

Type	Desktop virtualization	Application virtualization	Cloud storage
Smart work implementation	◎	◎	◎
Information leak prevention	◎	◎	◎
I/O response speed	△	△	○
Business S/W support	○	△	○
Efficiency of the development cost	△	△	○
Systematic data management	○	○	◎
Automating office environment management	◎	◎	○
Realization of the low CO2 environment	◎	◎	○

D. Case 2 : Cloud data center construction

The integrated government computing center pushes ahead with switching to cloud services for existing central agencies. The center has been integrating the central agencies' business system since 2008. As a result, costs were saved by 30% as compared with individual development, and quick response and system availability were improved. The cloud infrastructure is then gradually expanded to the new and aged system in the integrated government computing center. The current status of information resource integration in central ministries and offices is in the middle phase of equipment,

software, and service integration. The cloud data center in the public center provides the service for public agencies and provincial administrative agencies, excluding central administrative agencies. The service target includes common business, unique business, and emergency business, which can be switched to the cloud service. The term, "common business," refers to the general administrative business that is common to all agencies regardless of the characteristics (e.g., civil service, document management, request approval, archive management, etc.), whereas "unique business" refers to the duties given to the agency according to the agency's unique characteristics (e.g., weather information service by the Korean Meteorological Administration, military service resource management system by the Military Manpower Administration). The term, "emergency business," refers to the unique business processed by the administrative/public agency that can occur unexpectedly or on a large scale (e.g., duties required by disaster occurrence).

V. CONCLUSIONS

In this study, the overseas case and status of cloud services in the U.S., U.K., and Japan, which have been actively promoted over the recent few years, were closely analysed to introduce efficient cloud service in the public sector in Korea. The characteristics of the domestic circumstances were also analysed to identify differences and implications. Also, based on the related studies, the introduction system was developed, along with the policy and technical items that can be applied when introducing efficient cloud services for the government. Then, the cloud service introduction guidelines were presented to switch existing services or to promote new services. The governance system of the Korean government, the cloud-based service roadmap, cloud office environment introduction guidelines, and construction of the cloud data center were also described. As the countries of the world are actively participating in the cloud computing market by paying attention to the possibility of the cloud computing industry, it is expected that this paper could be used as reference data when cloud service is introduced in the public sector in Korea.

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She has worked for NIA since 2001. The second paragraph uses the pronoun of the person (he or she) and not the author's last name. Internet Quality Measurement System is developed by NIA at 2001. Now her interest area is making Government policy for Cloud Computing



He has worked for NIA since 1997. The third paragraph uses the pronoun of the person (he or she) and not the author's last name. He worked for information system audit policy, government project management in NIA. Now His interest area is making Government policy for Cloud Computing.