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Design of Cloud Service Platform for eGovernment

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Abstract

The term, eGovernmen or e-Government, uses technology communications devices such as computers and the Internet to provide public services to citizens and others. The eGovernment or e-government provides citizens with new opportunities to access the government directly and conveniently, while the government provides citizens with direct services. Also, in these days, cloud computing is a feature that enables users to use computer system resources, especially data storage (cloud storage) and on-demand computing power, without having to manage themselves. The term is commonly used to describe data centers that are available to many users over the Internet. Today, the dominant Big Cloud is distributed across multiple central servers. You can designate it as an Edge server if it is relatively close to the user. However, despite the prevalence of e-government and cloud computing, each of these concepts has evolved. Research attempts to combine these two concepts were not being made properly. For this reason, in this work, we aim to produce independent and objective analysis results by separating progress steps for the analysis of e-government cloud service platforms. This work will be done through an analysis of the development process and architectural composition of the e-government development standard framework and the cloud platform PaaS-TA. In addition, this study is expected to derive implications from an analysis perspective on the direction and service composition of the e-government cloud service platform currently being pursued.

Keywords: *Bigdata, Cloud Computing, Cloud Service, eGovernment, Service Platform*

1. Introduction

The eGovernment or e-Government Standard Framework, promoted by the Korean government, is becoming the standard for development frameworks applied to public projects and includes all of the technologies of Bigdata[1-10], Artificial Intelligence[11-13] and Cloud Computing 14-16]. The framework aims to standardize application software, improve quality and reuse, achieve improved quality of e-government services, improve efficiency in information investment, and standardize the development environment to enable fair competition. The standard framework is not intended to replace the existing various platform environments (.NET, php, etc.) but to provide a development and operational standard environment that can be used to build java-based information systems. The development framework mentioned here supports efficient application building by pre-creating and providing the necessary features and architectures for

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information system development. These standard frameworks make up the following key characteristics: (1) This aims at national standardization. In other words, national standardization shall be carried out through an advisory council comprised of private, public, and academia. (2) It complies with open standards. Utilization of open source-based generalized and open-source technologies precludes dependencies on specific operators. (3) This links commercial solutions. By presenting standards that can be linked to commercial solutions, interoperability is guaranteed. (4) This ensures flexibility of change. It is easy to replace each service with modularity and minimizes the impact of changes between modules through interface-based interworking. (5) This fully supports the mobile environment. It supports mobile web (UX/UI) and hybrid apps for mobile environments. In addition, it provides not only a convenient and diverse environment, but also an Eclipse-based modeling (UML, ERD), editing, compilation, and debugging environment.

2. Related Works

Although each government around the world has been working on e-government, there have been no cases of applying cloud service platforms to eGovernment. Despite the development of the 4th Industrial Revolution component technologies such as the Internet of Things, Bigdata, and Cloud, these factors are only applied to private companies. Private companies are making great efforts to apply these component technologies to Enterprise Architecture, but governments are not. This study combines the concepts of e-government and cloud computing in order to design cloud service platform for eGovernment.

2.1 eGovernment

The term, eGovernment or E-Government, is an abbreviation for Electronic Government, which electronically organizes knowledge and information within and outside government organizations to efficiently manage government organizations and provide people with fast and efficient administrative services. In other words, the electronic government is the government of a knowledge and information society that innovates administrative affairs using information technology and provides quality administrative services to the people efficiently. E-government tasks include electronic processing of government services, electronic processing of government-to-people-to-business (G2C and G2B), electronic processing of government-to-government operations (G2G), and establishing a foundation for government information. E-government is a government that can network administrative information systems to increase productivity and efficiency of administrative affairs through computers and high-speed information and communication networks. However, the term "electronic government" has recently emerged, and the definition of the concept has not yet been established. Some define e-government as a 'government that performs business processing digitally' or 'government that provides government work or services through databases and networks', while others understand e-government as a 'government that uses information technology to share information between governments and private sectors'. In any case, the establishment of electronic government has already been carried out in advanced countries such as the United States, Japan, the United Kingdom, France, and Canada, and in Korea, the government entered the top e-government ranks in the world in 2002. The establishment of an electronic government led to administrative informatization within the organization, and electronic administrative services were realized through high-speed information and communication networks for administrative consumers. In other words, the computerization of records can significantly reduce various documents within administrative organizations, eliminating the so-called red tape's closure and facilitating communication between unit organizations. In addition, by sharing information between the upper and lower classes of the administrative organization, the participation of the lower management group in the decision-making process was expanded, increasing the efficiency and productivity of the administration. On the other

hand, it is possible for civil petitioners to apply for, inquire, and consult through the communication network without visiting the administrative agency, receive the results of civil complaints quickly and accurately, the so-called non-stop service is being realized.

In other words, e-government is a form of government that uses information and communication technology to provide existing government tasks through cyberspace. In other words, building an electronic government is not just about providing offline services online, but also accompanied by changes in government organizations and work processes accordingly. Because the information function applied to the electronic government is neutral, it can be identified the same as the so-called management information system (MIS) of the private sector. However, the electronic government is very different from the MIS. The e-government is involved in many stakeholders, and its evaluation criteria must also take into account various criteria such as efficiency, democracy, legitimacy, transparency, and narrowing the information gap, so it is very complex and dynamic.

This e-government has the following main goals. (1) Value-added-oriented e-government: Value-added-oriented e-government is defined as a network-based organizational paradigm that seeks to overcome the limitations of mechanical system-like organizations in the age of digital economy. In the digital age, where information is disclosed and exchanges between inside and outside the organization are frequent, government public organizations are required to be transformed into organic organizations based on more horizontal networks and open communication. New organizations and leadership styles such as professional-based authority and control, horizontal communication, and personal motivation are needed, and various forms of change are needed to support them. (2) Customer-oriented e-Government: The practical and final beneficiaries of e-Government are the general public and private organizations. Customer-oriented e-government can be defined as an activity that seeks to identify and accommodate the needs of the public in developing and policymaking of e-government tasks and extending the work processes within public sector organizations to end users. If a service development and delivery system is established with a priority in identifying and satisfying the needs of the people in the development and implementation of various tasks of the e-government, the effect of informatization will be greatly improved and the quality of administration can be achieved effectively. To achieve these, the customer-oriented e-government sets detailed goals such as electronic democracy, simplifying government service integration, high value-added enterprise support services, and upgrading information utilization. (3) Synchronizing e-Government: IT systems must be integrated and supplemented under consistent principles in order to increase the utilization of government public sector information systems built so far, and to be more effective in supporting organizational change and public services. If the existing information service was focused on improving work efficiency, future information service projects should be carried out to effectively integrate the already established system to meet more advanced requirements such as immediate work processing, high-quality policy decisions, and specialization of the task force. Given the rising expectations of the public, the direction of administrative reform, and the trend of IT development, this integration is key to information support for fast and accurate business handling and integration of related applications, which can be redoubled by customer need-based architecture design and IT.

The e-government construction project was largely aimed at three aspects: innovation in services to the public, promotion of internal information in administration, and composition of basic infrastructure for e-government. (1) Public service can be divided into four major projects: Civil Service Innovation (G4C), National Comprehensive Electronic Procurement System (G2B), Link 4 Social Insurance Information, and Establishment of Comprehensive National Tax Service System (HTS). Unlike previous projects that have not been successful, each project is making its own achievements. The public service preferentially introduced the

most necessary system in various structures, including the introduction of a national e-commerce-based system for domestic companies as well as citizens, and provides services for public welfare in addition to civil complaints and e-commerce. (2) The purpose of the internal informatization promotion service is to carry out key tasks such as personnel, finance, city, county, and district electronically and to realize a highly productive government. Detailed services such as the Electronic Personnel Management System (PPSS), the National Financial System (NAFIS), and the comprehensive administrative information of cities and counties will be implemented. (3) Next-generation e-government can be defined as "a governance structure that enables the real-time distribution and behavior of physical space and electronic space under ubiquitous technology and foundation to perform administrative tasks more intelligently and provide services to the people anytime, anywhere." To realize this next-generation electronic government, a technological foundation such as a shift from traditional narrow-band to broadband networks, a shift from wired networks to wireless and mobile networks, and the establishment of new sensor and chip networks are essential. The ubiquitous environment will break away from existing e-government concepts, expanding information access to e-government through non-PC access media, and creating new areas of e-government services that were not previously provided.

The e-government should also be electronicized based on ubiquitous computing and network technology to meet the next generation of national informatization, and in this respect, the concept of ubiquitous e-government could be presented in the direction of the next generation of e-government. Therefore, the next-generation e-government will be able to provide services even in the midst of customers' movements and access them at any time, thanks to rapid wired and wireless integration, terminal and network integration, or so-called convergence. In other words, as the next generation of e-government, e-government services in a ubiquitous environment are accessible anytime, anywhere, always aware of the situation, and intelligent, enabling them to provide or act on the services required at all times. This will have the effect of raising the level of public services, reducing the cost of public management, increasing the efficiency of public asset management, and doubling the productivity of human resource management.

2.2 Cloud Computing

Cloud computing is a technology that processes information from a computer to another computer that is connected to the Internet rather than from its own computer. The personal computer (PC) we use is equipped with software purchased as needed, and data such as videos and documents are stored. To create a document, you need to run a program such as image font writing that is stored on your computer. However, cloud computing is a way of storing programs and documents elsewhere and accessing them over the Internet from my computer. It is like renting a car or using public transportation when necessary without buying it. This eliminates the need for software to be installed on my computer and the need for periodic updates. In addition, you don't have to save the documents you were working on on your company computer and take them home. In addition, there is no fear of data corruption if one's computer fails. You can spend as much as you need and pay for it, so you don't have to buy low-frequency software at a high price, and you don't have to have ridiculously large storage devices. Prior to the introduction of the cloud, companies also built and operated on-premise systems that bought expensive hardware and applications and customized them for the company's situation, which took more than months and cost a lot of money. Such construction and operating costs have become possible to reduce with the advent of the cloud. It can contribute to energy savings as well as costs because it operates similar functions in society as a whole. However, if a server is hacked, personal information can be leaked, and if there is a problem with Internet access or a server failure, data cannot be used. The reason why it is named Cloud is because the Internet is expressed as a "cloud" when representing the computer network configuration as a picture. In other words, the Internet environment with a large number of computers

was regarded as an unknown existence like a cloud floating on the far side of the sky. The cloud approach is not a new concept. When computers first appeared, they were very expensive. When a user enters data into a terminal with only an input/output function called a dummy terminal, it is stored and processed on a large computer in the center. This approach, similar to cloud computing, gradually disappeared as personal computers emerged and performance improved. With the advent of the Internet, cloud computing will reappear. Furthermore, as the amount of data needed to be processed increases, it naturally borrows the power of high-performance computers outside rather than personal computers. The key technologies that enable the cloud are virtualization and distributed processing. Virtualization is a technology that divides only one server that processes information into several small servers, enabling multiple tasks at the same time. This can be used to increase server utilization rates. Distributed processing is a method of distributing tasks across multiple computers and re-collecting the results over the network. A distributed system can operate a system composed of multiple computers as if it were a single computer system, which can also handle large-scale tasks quickly.

In other words, cloud computing is a computing environment in which IT-related services such as data storage, network, and content usage can be used at once through servers on the Internet. This refers to a computer environment in which information is permanently stored on a server on the Internet and temporarily stored on clients such as desktops, tablet computers, laptops, netbooks, and smartphones. The concept is that all user information can be stored on a server on the Internet and used anytime, anywhere through various IT devices. It is a computing service that borrows and pays for computing resources such as hardware and software that exist in an intangible form, such as cloud, as much as they need, and integrates computing resources from different physical locations into virtualization technologies. Cloud computing, an innovative computing technology that provides IT-related services such as data storage, processing, networking, and content usage in servers on the Internet, is sometimes defined as 'on-demand outsourcing services of IT resources over the Internet'.

With cloud computing, companies or individuals can reduce the cost of maintaining, repairing, and managing computer systems, the cost of purchasing and installing servers, the cost of updating, and the cost of purchasing software, and contribute to energy savings. In addition, data can be lost due to hard disk failure, but in a cloud computing environment, data can be stored safely on external servers, storage space restrictions can be overcome, and documents that one has worked on can be read and modified anytime, anywhere. However, if a server is hacked, personal information can be leaked, and if a server fails, data cannot be used. Through the cloud computing environment established by portals such as Google, Daum, and Naver, various services can be easily used with portable IT devices such as tablet computers and smartphones. Cloud computing, which is drawing attention as a next-generation Internet service due to its high ease of use and high industrial ripple effects, emerged as a new IT integrated management model in the late 2000s.

3. Design of E-Government Cloud Service Platform Analysis Framework

3.1 Steps for Framework

Figure 1 shows design of e-government cloud service platform analysis framework. There are three major steps for the frame as follows; (1) Step 1: E-Government Standard Framework Analysis, (2) Step 2: Cloud Platform PaaS-TA Analysis, and (3) Step 3: E-Government Cloud Service Platform Analysis.

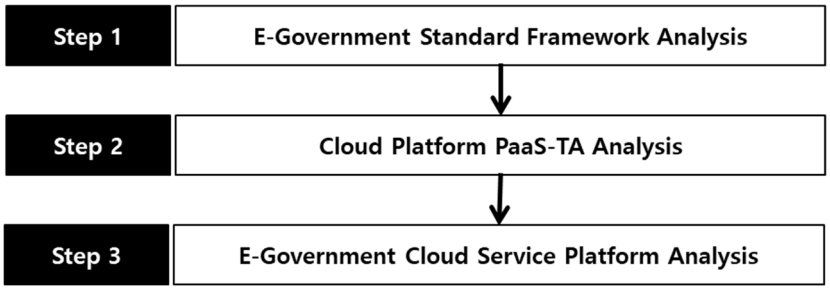

Figure 1. E-Government Cloud Service Platform Analysis Framework

Step 1 is a step in analyzing the standard framework of e-government. Here we define an overview of the e-government standard framework, analyze the Spring Framework techniques, and organize the e-government standard development framework. Step 2 is a step in analyzing the PaaS-TA of cloud platforms. Here, we construct PaaS-TA, including PaaS-TA technology status, PaaS-TA propulsion status, and PaaS-TA architecture. It also constructs PaaS-TA services, including PaaS-TA service items. Step 3 is a step in analyzing the e-government cloud service platform, which investigates the status of e-government cloud initiatives and constructs an architecture.

The E-Government Standard Framework is a pre-implementation of the basic functions required to develop or operate an information system and can complete the entire information system by developing and assembling additional functions based on it. Prior to the application of the standard framework, there were many overlapping developments of the same functions for each informatization project. In addition, technology dependencies also led to higher reliance on leading providers. In the end, companies and governments that did not have the framework had to bear the disadvantage of competition, and it took a lot of time and manpower to interconnect between information systems. This led to a lack of development standards, which made maintenance difficult. However, applying the standard framework can reduce redundant budgets due to common component reuse. The standardized development period can also resolve business dependencies. Since the framework is provided free of charge, it improves the competitiveness of small and medium-sized enterprises and improves interoperability due to the utilization of standardized linked modules. Modularity by development standards facilitates maintenance as well.

This e-government standard framework follows the Apache 2.0 licensing policy, and the execution environment architecture can consist of an open-source program centered on a spring framework. Open source by execution environment service consists of various layers(Presentation layer, Business Logic layer, Persistent layer, Integration layer, Batch layer, Foundation layer, Mobile Presentation / Device API layer). The e-government standard framework follows the Apache 2.0 licensing policy and the development environment architecture consists of open-source programs such as editing, testing, distribution, and setup tools. The configuration of open source services by development environment service includes the Implementation Tool, Test Tool, Test Tool, Deployment Tool, Configuration and Change Management Tool.

3.2 Standard Framework for eGovernment

The e-government standard framework is a standard framework that provides the application architecture, basic functions, and common components needed to build a web-based information system, consisting of a common component with a running environment, development environment, operating environment, and management environment. (1) Execution environment refers to an application environment that facilitates standardization of screen, server program, data development, and batch processing functions when developing business programs such as common modules for implementing e-government projects. (2) The development

environment provides the environment necessary for the development of e-government work programs. data development tools, test automation tools, code inspection tools, template project creation tools, common component assembly tools, customized development environment configuration tools, server environment management tools, standard source code creation tools for mobile, custom development environment configuration tools for mobile (Windows, Unix) installation tools, batch project creation tools, deployment tools. (3) The operating environment provides an environment (monitoring, distribution, management system) for operating services in the execution environment and an environment (batch execution, scheduling, and monitoring results) for operating the deployment environment. (4) Management environment refers to a module for distributing and managing development frameworks and common services to each development project. (5) A common component of e-government refers to various API-provided guide applications that can directly access and utilize mobile device resources in reusable mobile hybrid applications for common use in developing application software in e-government projects.

The e-government standard framework execution environment consists of seven service groups and provides 38 services, and distributes the batch and installed execution environment as a single file into essential and optional parts to form the optimal execution environment for each business. (1) The e-government standard framework provides a function to lighten the development environment by providing a light version of the development environment, to construct an optimized development environment by installing only necessary functions, and to quickly and easily. (2) The e-government standard framework operating environment provides monitoring tools for standard framework-based applications and communication tools for efficient operation of information systems. (3) The e-government standard framework management environment manages service request processing (SR) and support status for supporting informatization projects and provides systematic and efficient management functions for improving standard framework functions and upgrading versions. (4) The e-government standard framework common component is a set of components developed mainly for functions that can be reused in the establishment of information systems, and is designed and developed in compliance with the MVC architecture in the execution environment. (5) The E-Government Standard Framework Mobile Device API supports device hybrid application implementation over web resources consisting of HTML, CSS, and JavaScript on each platform (Android, iOS) specific implementation environment. (6) E-Government Standard Framework E-Government Device API Development Environment consists of Eclipse plug-ins for development in Android environments and framework projects in Xcode for development in iOS environments. (6) The E-Government Standard Framework Mobile Device API Guide Program provides an easy-to-access use example for developers when developing mobile hybrid applications for calling mobile device-specific features.

4. E-Government Cloud Service Platform Analysis

The e-government cloud platform construction project is carried out in connection with the Daegu Center Cloud Design (2nd) project and cloud conversion project, which is linked to the National Intelligence Service's pilot project for cloud infrastructure. The e-government is providing web technology-based e-government services through the administrative network and administrative computerization. From 2019 to 2020, intelligent and digital governments are designing and building a national cloud platform to have global competitiveness to provide innovative services that combine and combine advanced new technologies such as cloud, artificial intelligence, big-data, and the Internet of Things. It is to establish a common cloud-based foundation for the use of cloud-based pan-government information resources that can develop and operate e-government services, including intelligent information technology, efficiently, easily and quickly, without overlapping investments by institutions. It aims to establish a foundation for integrated management of cloud

platforms, develop core services, and introduce cloud platforms, increase efficiency of e-government information resources, and establish a foundation environment to support rapid implementation of intelligent e-government using AI and Big-Data.

The e-government cloud service platform is designed to benchmark the global public cloud platform and provide open source and commercial solutions through a service catalog based on standardization and interfaces. The target architecture establishes a cloud-based platform integrated management environment for e-government services. This constitutes a cloud engine that supports the PaaS platform, including a variety of open-source-based container environments and implementation environment support tools. In addition, cloud assist will be configured to provide intelligent technology services such as common support services AI and Big-Data as well as a variety of open source and commercial SWs through the service catalog. Open source software is also introduced for configuring e-government cloud platforms, along with building gateway portal functions for users and administrators and standard API-based connectivity functions.

5. Conclusions

Through an analysis of the development process and architectural composition of the e-government development standard framework and cloud platform PaaS-TA, we derive implications for the analysis of the direction and service composition of the e-government cloud service platform currently being pursued. The E-Government Standards Framework established technical standards for development and maintenance as a result of standardizing the Spring Framework-based development framework to improve the quality of services and enable fair competition. In particular, Spring Framework has been used as an e-government standard framework as an open source application platform based on Java, but as technology advances require a variety of development environments, expansion of non-Spring development platforms is needed.

PaaS-TA is an open-source cloud platform consisting of Apache licenses, and has evolved into a domestic open-source PaaS platform developed in public-private partnership since 2014. However, due to the lack of social technology advancement and proliferation, it is difficult to find cases of deployment due to the lack of opportunities for distribution of PaaS-TA platforms, and the expansion of the platform has continued to be promoted by the government and public institutions. Although PaaS-TA manages the infrastructure operating environment and development life cycle, it is a development-oriented platform that does not have all the functions to accommodate new technologies such as infrastructure virtualization, big data, artificial intelligence, and IoT.

In connection with the National Intelligence Service's intelligent cloud infrastructure pilot project, Samsung SDS has been implementing a cloud service platform as a main operator since October 2019, and is designed to provide a service catalog by referring to services and technologies owned by global cloud operators. The e-government cloud service platform is encouraging in terms of government-led projects, but it is very worrisome that private companies, regardless of popularity, are not leading. The cloud service platform is the most efficient means of designing and operating our IT resources and it is time to quickly shift the perception of business executives who can only see the visible without noticing its value, even though it has become a tool of business decision tools.

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