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A Case Study on the Establishment of Cloud Management System in Data Centers: Focusing onG-Cloud Application Case

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데이터센터 클라우드관리시스템 구축 사례 연구 : G-Cloud 적용사례 중심으로

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Abstract According to the enforcement of the Cloud Computing Development and User Protection Act, a new paradigm called as Cloud Computing is coming to the fore among public and private domestic enterprises. Therefore, domestic companies should develop SaaS products specialized for the domestic market and try to preempt the IaaS market ahead of global companies. Now we are facing a necessity to combine all the cloud systems in Korean government to operate seamlessly in a harmony. In this paper, we will look at the prospect of future development of related industry through cloud computing concept and G-cloud's cloud management system (G-CMS). G-CMS can be seen as the first system to comprehensively manage heterogeneous Unix virtualization systems. G-CMS can also save costs by managing heterogeneous virtualization systems in data centers.

Key Words : Cloud Computing, G-Cloud(Government Cloud), G-CMS(Government Cloud Management System), IaaS, PaaS, SaaS,

요 약 본 '클라우드컴퓨팅 발전 및 이용자 보호에 관한 법률'이 시행됨에 따라 이에 맞추어 국내 공공 및 민간기업에서 클라우드 컴퓨팅이라는 새로운 패러다임에 대한 관심이 고조되고 있다. 국내 클라우드 시장 선점을 위해서는 국내 통신사, SI 및 SW업체 등이 시장에 진출하고 있으나 글로벌 기업에 비해 경쟁력이 낮다. 따라서 국내기업은 국내시장에 특화된 SaaS 제품 개발을 하고 글로벌 기업에 앞선 IaaS 시장 선점을 위해 노력해야 할 것이다. 본 논문에서는 클라우드 컴퓨팅 개념과 G-클라우드의 클라우드관리시스템(G-CMS) 구축사례를 통해 향후 관련 산업의 발전방향 전망에 대해 알아본다. G-CMS는 이기종 Unix 가상화 시스템을 종합적으로 관리하는 최초의 시스템으로 볼 수 있습니다. 또한 G-CMS는 데이터센터에서 이기종 가상화 시스템을 관리함으로써 비용을 절감할 수 있습니다.

주제어 : 클라우드 컴퓨팅, G-클라우드, G-CMS, IaaS, PaaS, SaaS

1. Introduction

On September 28, 2015, the Cloud Computing Development and User Protection Act (the Cloud Development Act) was enforced.[1] As the one and only act in the world that regards Cloud, it's requires public institutes such as the branches of the central government, the local governments, state-owned firms, and schools to spearhead the

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introduction of Cloud. Thus the market for Cloud will grow around the public market.

Cloud Computing(Cloud) has evolved from it original method that requires inconvenient installation of ICT resources, to a new method that charges users for their service. As the central infrastructure to accomplish the key values of Government 3.0 - openness, sharing, communication and cooperation - Cloud is expected to promote information sharing across institutions.

Meanwhile, on November 10, 2015, the Ministry of Science, ICT and Future Planning pronounced the K-ICT Cloud Promotion Plan in a bid to establish an infrastructural foundation for Government 3.0 and fast-track the innovation of the national and social ICT infrastructure. [2] As elaborated in Fig. 1, the plan will step up the utilization rate of Cloud to 30% (about a tenfold of the current rate) by 2018, giving a boost to nationwide innovation. At the same time, the private market will be fueled with a 2 trillion won worth revenue generated in the Cloud market. The public sector will also benefit from budget saving by 320 million dollar for three years from 2016 to 2018 and operational innovation.

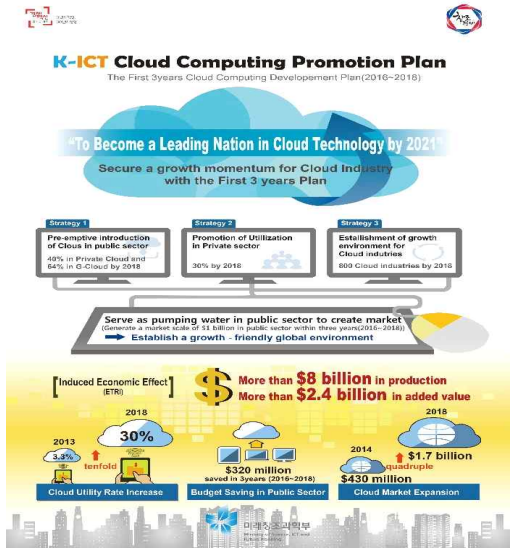

Fig. 1. A Blueprint of K-ICT Cloud Promotion Plan

2. The Concept of Cloud Computing

2.1 The Technological Trend of Cloud

According to Gartner, the market research agency, the annual average growth rate of cloud computing is over 35%. Furthermore, as the market for Private Cloud enters a maturing stage, the demand to utilize the flexibility of Public Clouding is projected to increase.

Table 1 demonstrates the latest technological trend from 2011 to 2015 selected by Gartner[3].

Table 1. Gartner's Top 10 Strategic Technology

	2011	2012	2013	2014	2015
1	Video	Media tablets and beyond	Mobile devices battle	Mobile device diversity/management	Computing everywhere
2	Mobile App and Media Tablet	Mobile-centric applications/interfaces	Mobile Application and HTML5	Mobile App and Applications	Content-rich systems
3	Social communications and collaboration	IoT	IoT	IoT	IoT
4	Context-aware computing	Contextual/social user experience	Hybrid IT & Cloud Computing	Hybrid Cloud & IT as a service broker	Risk-based security/self-protection
5	Cloud computing	Cloud computing	Personal Cloud	Era of the Personal Cloud	Cloud / Client Computing
6	Next generation analytics	Next generation analytics	Actionable analytics	Cloud / Client architecture	Advanced pervasive/invisible analytics
7	Social analysis	Big data	Strategic big data	Software-defined anything	Software-defined applications and infrastructure
8	Storage class memory	In-memory computing	In-memory computing	Smart machines	Smart machines
9	Fabric-based computing and infrastructure	Extreme low-energy servers	Integrated ecosystem	Web-scale IT	Web-scale IT
10	Ubiquitous computing	App stores and marketplaces	Enterprise app stores	3D Printing	3D Printing

The cloud computing market is relatively small, at 0.7% of the global market. In the case of SaaS, small and medium business and midsize companies operate within 0.5% of the global market.

Since high value-added businesses can be promoted with relatively small capital using IaaS and PaaS services, small and medium business and mid-sized companies can also do business relatively.

PaaS accounts for less than 1.9% of the global market and is dominated by global and domestic companies. IaaS is also within 0.9% of the global market[4].

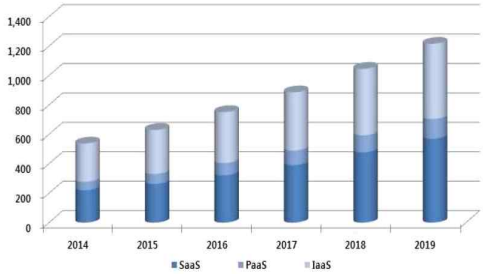

Fig. 2. Domestic cloud computing market size and outlook

2.2 The Definition of Cloud Computing

Different organizations and institutions define Cloud Computing differently[5].

• Gartner : A form of computing that utilizes internet technologies to offer highly expansive resources to a wide range of clients.

• Wikipedia : An internet-based computing technology or a web-based software service that basically keeps its programs in utility data servers on internet and loads the data into computers or smartphones on demand.

• Google : The technology that enables the utilization of ample computing resources, a task that cannot be performed by a computer alone, by connecting hundreds or thousands of user-oriented and task-oriented computers.

Sorted by service type, Cloud is composed of IaaS, PaaS and SaaS. If sorted by service operation mode, it is composed of Public Cloud, Private Cloud and Hybrid Cloud. The main definition of each type and operation mode is as explained Table 2[6].

Table 2. Service Types and Operation Modes of Cloud

Category		Main Definition
Service Type	IaaS (Infrastructure as a Service)	• A type of service that rents or provides hardware resources such as server or storage
	PaaS (Platform as a Service)	• A type of service that rents or provides platform necessary for developing software
	SaaS (Software as a Service)	• A type of service that rents or provides the software that users demand
Service Operation Mode	Public Cloud	• A form of service opened for the public to use its many services
	Private Cloud	•A form of service that establishes a cloud service environment exclusively for the insiders of an enterprise or an institute
	Hybrid Cloud	• A combined form of Public Cloud and Private Cloud • Imposes selective privacy policies on specific data or service that should be kept in privacy.

3. An Overview of G-Cloud

G-Cloud(Government Cloud) is an electronic government Cloud Service established and run by the National Computing and Information Service(NCIS). Before the introduction of G-Cloud, each government branch had to establish information resources according to each task. This, in turn, widened the gap in the utilization of software and hardware resources among tasks and systems. Thus, the government resources were exploited inefficiently and rarely shared across organizations. Also, the huge number of computing equipment filing into NCIS brought about the overall depletion of infrastructure such as the upper surface area of computing rooms, electricity, and heating and air-conditioning equipment. [6] In order to overcome these inefficiency, G-Cloud was created in response to the demand for sharing and speedy distribution of various resources, as well as cost-saving.

4. An Overview of G-CMS

4.1 An introduction of G-CMS

G-CMS is a G-Cloud management system, created with POLESTAR XEUS, a domestic cloud management solution by Nkia, co., ltd. POLESTAR XEUS is a service operation tool that provides a wide range of convenient functions for users and control and management functions for Cloud managers[8].

Covering almost all of the current heterogeneous solutions, G-CMS is the only platform in the world that can control RHEV(Red Hat Enterprise Virtualization), IBM PowerVM, and HP IntegrityVM. It has proven its excellence by acquiring GS (Good Software) Certificate, 2012 and National Software Presidential Award, 2013.

4.2 Main functions and expected utility of G-CMS

The main functions of G-CMS are as Table 3.

Table 3. Main functions of G-CMS

Item	Function
User Portal	• User Log-in page • Dashboard information each for users and managers • My Page information
Manager Portal	
Management of Resource Provisioning	• Creating new HP/IBM virtual machine • Altering spec of virtual machine • Retrieving resources from CPU, memory or storage (Deleting virtual machine, retrieving disk, etc.)
Connecting with G-CMS	• Altering constituting information of virtual server • Automatic updating of agent • Consistency of garnered data
Management for Resources	• Management of resources status dashboard controlled respectively according to net, government branch, resources pool, and physical server. • Management of IP, storage and events • Management of service catalog and template
Management of Usability	• Online Migration management of virtual machine • HA(High Availability) management function • Automatic backup management function

As Shown in Fig. 2, G-CMS allows more than 120 physical servers including IBM Unix, HP Unix to be managed via Cloud. It also provides an environment in which users and managers can more conveniently perform management operations such as altering virtual server qualification and adding storage. It also provides a holistic view of a situation by presenting summarized resource status data on dashboard. Thus, NCIS has been able to fully exploit the resources rapidly, while at the same time cutting down the cost. The Table 4 shows the effectiveness of the system by comparing the previous environment with the Cloud environment[9].

In this paper, G-CMS was introduced with the concept of its architecture.

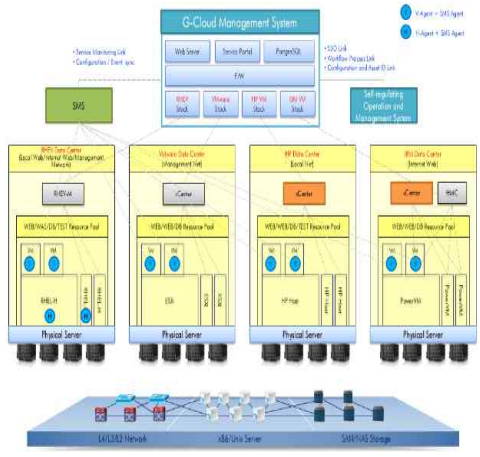

Fig. 3. G-CMS architecture

Table 4. The comparison between the former environment and cloud

Category	Former Environment	Cloud Environment	Note
Resource Allocation Period	A week	An hour	7 times
Usability	HA composition	HA composition	Same
Performance	1Gbps	10Gbps	10 times
Expandability	Difficult	Accessible	-
Complexity	Normal	High	-

5. Conclusion

G-Cloud was the first implemented base on a Unix server. The expected utility of constructing G-Cloud is as follows: First, it expands the service that can be shared and used by government agencies and institutions. Second, it facilitates the operation of a world-class smart government and the informatization of low-carbon green growth. Third, by promptly reacting to the demands for globalization projects of each government branches, such as various requirements and service demands from client organizations, it can increase satisfaction in terms of nationwide administration service and client organizations.

Thus, G-CMS can be seen as the first system to comprehensively manage heterogeneous Unix virtualization systems. This helped domestic enterprises to acquire a world-class technological dominance in the field of Cloud management system. The integrated management can also save costs by managing heterogeneous virtualization systems in data centers[10].

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