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Comparison of Open Source Cloud System for Small and Medium Sized Enterprises

Yasuo Uchida[1], Seigo Matsuno[1], Makoto Sakamoto[2]

[1] Ube National College of Technology, Ube 755-8555, Japan
{uchida, matsuno}@ube-k.ac.jp
[2] University of Miyazaki, Miyazaki 889-2192, Japan
sakamoto@cs.miyazaki-u.ac.jp

Abstract. Today's information systems need stable operative restoration so that, in the event of a crisis (such as the 2011 earthquake in Japan), stable operation can be resumed as quickly as possible. Clouds in small and medium sized enterprises are still underused, and research and development, along with technological assistance, for small and medium sized enterprises has become an urgent problem. Currently, however, the relationship between the cloud and the information infrastructure for small and medium sized enterprise remains unexplored—not to mention a severe lack of scientific studies on future directionality. Therefore, we examined the framework of a suitable cloud system for small and medium sized enterprises, and we designed and built a prototype model, evaluating its ease of implementation. In addition, we compared our prototype model with a representative open-source cloud platform.

Keywords: Open Source, Cloud, Eucalyptus, OpenStack, Small and Medium Sized Enterprise

1 Introduction

Today's information systems should be able to maintain stable operation even during crises such as the 2011 Great East Japan Earthquake. Barring that, these systems must have the capacity for quickly restoring operations. This is true even for information infrastructures in small and medium sized enterprises (SMEs). This means that for ICT departments, a business continuity plan (BCP), designed to sustain operations in the midst of disasters and emergencies is essential to ensure preventative measures are available to minimize the impact and to quickly restore the most important and essential operations.

The "Survey on the State of Cloud Usage by Small and Medium Sized Enterprise" (2011) [1], showed that about 10% of SMEs use cloud computing, highlighting an urgent demand for R&D and technological support for SMEs. Further, there have been almost no academic studies on the relationship between cloud computing and SME information infrastructures, or on future directions relating to this relationship.

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Previously, we presented a research project called “Open Source Information System Research and Development for Supporting the IT Strategy of Small and Medium Sized Enterprise” [Foundational Research (C)] (2008-2010). In that study, we proposed a model open-source information system to support the IT strategy for SMEs, together with developing a prototype, and we considered usage-related problems. In the present study, based on our findings from our previous research, we consider and design a cloud system framework appropriate for SMEs, and investigate and consider the issues related to its operation and administration.

2 Cloud systems

2.1 Cloud computing

The United States National Institute of Standards and Technology (NIST) defines “cloud” as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources, that can be rapidly provisioned and released with minimal management effort or service provider interaction. ”

Cloud computing includes the following five characteristics:

- On Demand and Self Services
- Broad Network Access
- Resource Pooling
- Rapid Elasticity
- Measured Services

The fifth characteristic can be categorized into the following three service types:

- SaaS (Software as a Service: Functionality is delivered over the network)
- PaaS (Platform as a Service : Application development environment and customization features are delivered over the network)
- IaaS (Infrastructure as a Service: Even virtual machines and operating systems are delivered over the network)

2.2 Cloud research trends

“Above the Clouds: A Berkeley View on Cloud Computing,” a report from the Reliable Adaptive Distributed Systems Laboratory (RAD Lab) in the United States, highlighted ten obstacles facing cloud computing, including the availability of service, data lock-in, and data confidentiality and auditability.

In a Gartner report titled “Survey of 2,014 global CIOs” [2] senior executives were asked to predict the time when more than half of the information processing on their company’s computers will be moved to the cloud. “By 2015” was the answer given by 53% of global respondents. Only 25% of Japan respondents, however, gave the same response. Further, whereas only 19% percent of global respondents replied “after 2021” or “not possible to migrate,” those answers were given by 43% of

Japanese respondents. These results show that Japan is considerably late in terms of cloud research and cloud implementation.
On the subject of research trends in Japan, other than a cloud and public infrastructure study conducted by the Information-technology Promotion Agency [3], most studies are related exclusively to security [4].

2.3 Cloud systems

Cloud systems can be categorized as shown in Figure 1. In particular, depending on the cloud system service architecture, they are configured according to the following three subsystems: SaaS (functions are provided over the network), PaaS (the application development environment and customization functions are provided over the network), and IaaS (even virtual machines and operating systems are provided over the network). For open-source cloud system implementation, OpenStack [5] Compute (Nova) is an example of a resource toolset, whereas OpenStack Object Storage (Swift) is an example of a cloud storage toolset. Even SMEs can easily use these open-source projects to develop tools that provide functionality similar to (i.e., with functional compatibility for) Google Apps or Amazon EC.

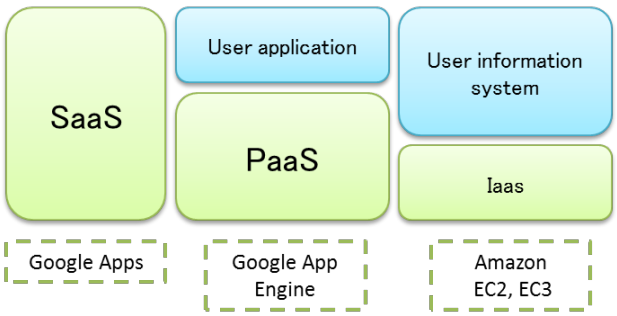

Fig. 1. Cloud systems

2.4 Amazon EC2

Amazon EC2 [6] is a good example of an IaaS subsystem. Amazon EC2 refers to “Amazon Elastic Compute Cloud.” It is a web service that presents computing capabilities in the cloud that are easily scalable [7]. It can be used for the following processes:

- Immediately launch and execute by selecting a preconfigured template image. Alternatively, create an Amazon Machine Image (AMI) that includes applications, libraries, data, and related settings.
- Configure security and network access on Amazon EC2.

- Select the desired instance type and operating system, and—using web service APIs, or the various administration tools that are provided, start, stop and monitor the AMI instance as much or as little as needed.
- For each instance, decide whether to run from multiple locations, use a fixed IP end point, or add robust block storage.
- Pricing is based on actual resources consumed, such as the total time the instance was run or the amount of data transferred.

Of these processes, the AMI selection process is shown in Figure 2.

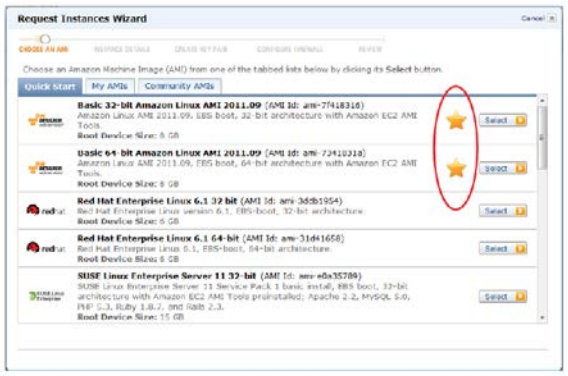

Fig. 2. AMI selection

2.5 EC2 clone

Services equivalent to Amazon EC2 that are delivered using different technologies are called EC2 clones.

Eucalyptus [8] is a typical open-source toolset for presenting IaaS-type cloud services. Eucalyptus (Elastic Utility Computing Architecture Linking your Programs to Useful Systems) was originally a research project from the Computer Science Department at the University of California-Santa Barbara. Support is currently provided by a company called Eucalyptus Systems, Inc.

As shown in Figure 3, the Eucalyptus IaaS web service is presented through IT infrastructures such as servers, networks, and storage.

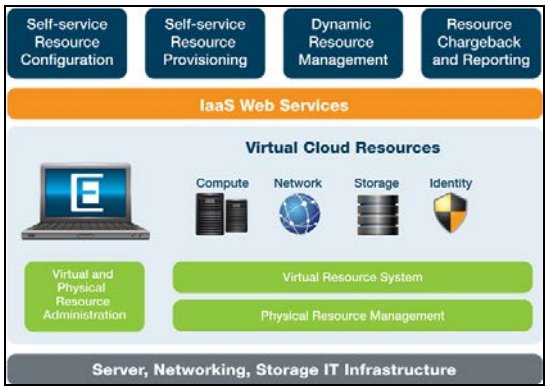

Fig. 3. Eucalyptus Framework

3 Prototype system

3.1 Linux virtualization technologies

There are two main virtualization types: paravirtualization and full virtualization. With paravirtualization, rather than fully emulating the actual hardware, virtual hardware is provided as the environment for a virtual machine. In full virtualization, a CPU with built-in virtualization support fully emulates the actual hardware.

Xen is compatible with both paravirtualization and full virtualization technology. KVM is a typical full virtualization infrastructure that is included in the Linux kernel as a standard feature, from 2.6.20 onward.

3.2 Prototype system specifications

Table 1 shows the specifications for the prototype system tested in this study.

Table 1. Prototype system specifications

Form factor	Space saving desktop
CPU	Intel ® Core™ i3 processor (with virtualization support)
Memory	4GB
Hard disk	200GB
OS	CentOS 6.4（x86_64）
Linux kernel	2.6.32
Virtualization technology	KVM
Cloud platform software	Eucalyptus 3.2.2 FastStart

3.3 Installing Eucalyptus

By installing Eucalyptus 3.2.2 FastStart, the cloud environment is used as follows.

Show list of registered images
euca-describe-images

Create key pairs
euca-add-keypair euca-demo > euca-demo.private
chmod 0600 euca-demo.private

Launch instances
euca-run-instances -k euca-demo emi-B3C23724

Verify instances
euca-describe-instances

Connect to an instance
# ssh -i euca-demo.private ec2-user@172.23.2.100
$ sudo su
Install Apache
yum install httpd

Configure Apache
vi /etc/httpd/conf/httpd.conf
Set to “ServerName local host”.

Launch Apache
service httpd start

Configure security rules
euca-authorize default -p 80

The above steps enable the availability of web services.

4 Conclusion

In this study, we considered and designed a cloud system framework suitable for SMEs. Furthermore, we performed implementation testing and tested the operation of the system. In the future, it will be necessary to run the prototype system to investigate and consider further issues related to its operation and administration.

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References

1. Information-technology Promotion Agency: Factual Investigation on Cloud Usage by Small to Medium Enterprise (in Japanese) (2011)
2. Gartner: Worldwide Survey of 2,014 CIOs, press release (2011)
3. Information-technology Promotion Agency: Report – Research on Cloud Computing and Public Infrastructure (in Japanese) (2010)
4. Hori et al.: Cloud Computing Security Research Trends (in Japanese), Information Processing Society of Japan Report CSEC "Computer Security" (2009)
5. OpenStack, http://www.openstack.org/
6. Amazon : Amazon Elastic Compute Cloud （ Amazon EC2 ） , http://aws.amazon.com/jp/ec2/
7. Ishida, A.: <A Cloud Case Study> Amazon EC2 (in Japanese), Information Processing 50(11), pp. 1068-1073 (2009)
8. Eucalyptus Community, http://open.eucalyptus.com/

