Cloud Computing Approach for IT Cost Reducing in Indonesia Government's e-Procurement System

Case Study Jawa Barat e-Procurement System Unit (LPSE Jabar Indonesia)

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Abstract— **The development of "eSomething" takes place in almost all government sector, include Indonesia Government. One of electronic based system developed recently in Indonesia is e-procurement system. This condition bring much higher financial requirement and qualified Ihuman resources to build the IT infrastructure.**

We proposed cloud computing scheme architecture for e-procurement system in Indonesia (Jawa Barat) to reduc the IT cost for implementing the e-procurement system. The ROI analysis is carried out to select which cloud scheme is best to apply in Indonesia condition. We also propose the architecture of the new cloud based system based on the analysis conducted. The analysis result show that a significant cost reducing is achieved by implementing Infrastructure as a Service scheme cloud computing in e-procurement system at Jawa Barat Indonesia.

Keywords-cloud computing, e-procurement, IaaS

I. INTRODUCTION

Indonesia government spends nearly Rp. 10.811.661.220.662 or 3,87% of total government's spends (Rp 195.000.000.000) during year 2008-2009 on information technology[7]. In last 3 years, the growth of telecommunication and internet infrastructure in indonesia is developed aggresively. The development of "eSomething" takes place in almost all government sector. This condition bring much higher financial requirement and qualified Ihuman resources to build the IT infrastructure. Conventionally, IT services have been carried out by desktops, laptops, mobile devices or servers for storage and processing some applications with corresponding software needed. During preparation to build the IT infrastructure, the government take great effort with technology. Hardware buying/procurement process, vendor selection process and storage capacity problem raise severe bureaucratic obstacle for public administrators.

One of electronic based system developed recently in Indonesia is e-procurement system. Indonesia is an archipelago country with more than 13000 islands. The lack of Information Technology infrastructures and the the high cost of hardware infrastructure become a great obstacle for implementing electronic based government in Indonesia.

With the fast growth of processing and storage technology and the achievement of the internet, internet have become inexpensive, more powerful and more available everywhere (ubiquitous) than ever before. This technology trend has facilitated the emergence of a new computing model called cloud computing. In cloud computing model, the IT resources (e.g desktops, storages and servers) are delivered as general utilities that can be rent and released by users through the internet on demand. This would mean that an organization would contract with a provider to deliver applications, computing power and storage via web.

This paper proposed the cloud computing scheme architecture for e-procurement system and organized as follows: Section 2 introduces the cloud computing itself, section 3 describes current e-procurement system at Jawa Barat Indonesia, section 4 discuss cloud migration scheme for the reviewed system and section 5 finally concludes the paper.

II. WHAT IS CLOUD COMPUTING

A. Definition of Cloud Computing

The basic idea of cloud computing is that computing will become location – and device- independent- meaning that it doesn't mater where information is stored nor where computation/processing is taking place. [1]

The term "cloud computing" mean that computing services are delivered over the Internet, on demand, from a remote location, rather than residing on one's own desktop, laptop, mobile device, or even on an organization's servers. For an organization, this would mean that, it would contract with a provider to deliver applications, computing power, and storage via web.

B. Cloud Computing Delivery Model

Cloud Computing have three delivery models[2] :

- Software as a Service (SaaS): The consumer uses an application, but does not control the operating system,

hardware or network infrastructure on which it's running.

- Platform as a Service (PaaS): The consumer uses a hosting environment for their applications. The consumer controls the applications that run in the environment (and possibly has some control over the hosting environment), but does not control the operating system, hardware or network infrastructure on which they are running. The platform is typically an application framework.

- Infrastructure as a Service (IaaS): The consumer uses "fundamental computing resources" such as processing power, storage, networking

C. *Cloud Computing Benefits*

Cloud computing offers a number of benefits : [1]

- Rapid scalability and deployment capabilities • (providing just-in-time computing power and infrastructure)
- Decreased maintenance/upgrades•
- Improved resource utilization—elasticity, • flexibility, efficiencies
- Improved economies of scale •
- Improved collaboration capabilities•
- Ability to engage in usage-based pricing, mak• ing computing a variable expense, rather than a fixed capital cost with high overhead
- Reduced information technology (IT) infrastructure needs—both up-front and support costs
- Capacity for on-demand infrastructure and computational power Rapid scalability and deployment capabilities
- Green-friendly—reduced environmental • footprint
- Improved disaster recovery capabilities

D. *Cloud Computing for Government*

To implement Cloud computing in the government, it will require a meaningful shift in how government organization think of IT. Government organization that previously thought of IT as an investment in locally owned and operated applications, servers, and networks will now need to think of IT in terms of service. This new way of thinking will have a broad impact across the entire IT service lifecycle. [3]

Recent works on cloud computing implementation in US Federal Government [3] , transforms its Information Technology Infrastructure by virtualizing data centers, consolidating data centers and operations, and ultimately adopting a cloud-computing business model. Initial pilots conducted in collaboration with Federal agencies will serve as test beds to demonstrate capabilities, including appropriate security and privacy protection at or exceeding current best practices, developing standards, gathering data, and bench-marking costs and performance. The pilots will evolve into migrations of major agency capabilities from agency computing platforms to base agency ITprocesses and data in the cloud. Expected savings in the out years, as more agencies reduce their costs of hosting systems in their own data centers, should be many times the original investment in this area.

III. CURRENT E-PROCUREMENT SYSTEM AT WEST JAVA INDONESIA

This paper will focus in proposing cloud migrating the e-procurement system named LPSE (Layanan Pengadaan Secara Electronic) or Electronic Based Procurement Service at West Java Province. LPSE system is developed with free license based to implement to all government institution in Indonesia. Until 2010, there are 60 government institution have the LPSE system [6].

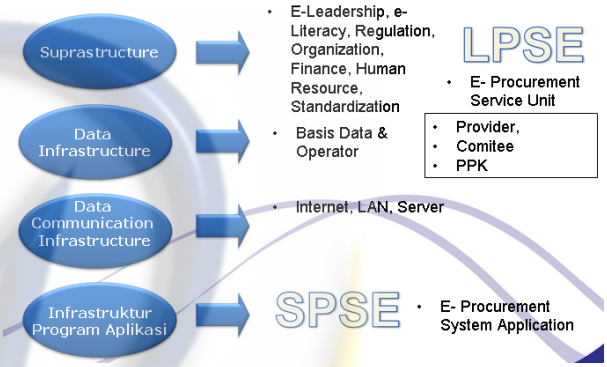
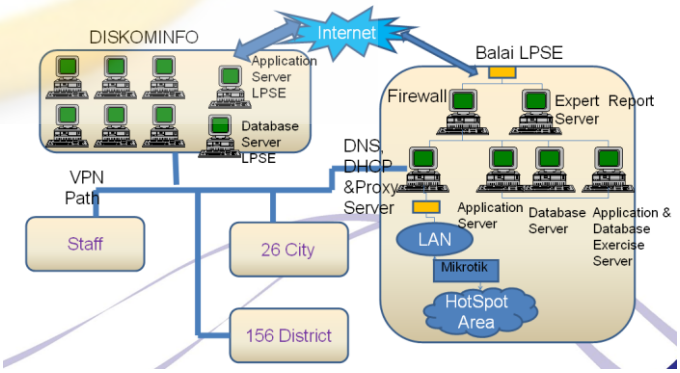


Figure 1. e-Procurement System Unit (LPSE) and IT Scope [6]

Current implementation of LPSE system is using spread server based scheme which require every office 0f 600 government institution all around Indonesia has their own server.

Below is the current architecture and the upgrading plan base on diskominfo Jabar (Province Communication and Information Agency) data. [6]



The National system of E-procurement , achieve 70 domain in september 2010 and below is the estimation of [8] of the overall requirement

TABLE I. INDONESIA NATIONAL SYSTEM OF E-PROCUREMENT REQUIREMENT

Server		
LPSE domain Number	72	URL
Server per Domain (average)	3	unit
Total Server	216	unit
Number of Server estimation for 300 institution	900	unit
Volume Data		
Total Packet	6.700	
Volume Data Per Packet	500	MB
Total Volume Data	3,2	TB
Total Budget Plaaform(rupiah)	13,7	Trilyun
Vol Data Per Trilyun Budget Platform	233,9	GB/Trilyun
Estimation Base on Budget Platform		
Asumsion of Total Budget Platform	300	Trilyun
Asumsi Vol Data	68,52	TB

The Indonesia national e-procurement system have 900 distinct servers. Since the geographics condition of Indonesia, it is difficult to use shared servers due to great distance for each corresponding organization. This condition resulted in the poor utilization of the servers. Moreover, high data volume for each procuremen packet require high amount of storage.

The e-procurement domain number keep on increasing , as a result, it will increase the system number to be maintained. Upgrade process also become a complex challenge, since it must carry on fastly and smoothly for hundreds servers

IV. CLOUD MIGRATION SCHEME FOR INDONESIA E-PROCUTEMENT SYSTEM (JAWA BARAT REGION)

There are some drawbacks when the government institutions own and operate their own servers, such as [4]:

- Running out of capacity : Sometimes government don't have the expansion capital when the time comes to buy new hardware. When the government manage their infrastructure, a lot of cash wil be needed for every storage or every new server they buy. Moreover, they will have a significant lead time during procurement process, to taking delivery, having system racked, installed and tested
- Server fail problem : When one of the drives in government's server array fails, they need to remove the old drive from the server abd put the new driver to the server. This condition takes time and skill and has to happen in timely fashion to prevenr a complete failure of the server.
- Disaster problem : In condition when disaster happens, the IT team needs to rush to address the situation, need to have solid backups in place and a strong disaster recovery plan.
- Some servers don't needed anymore : When it is time to decommissiom some servers, that servers need to given away or the government will expense for the machine that is not doing anything for their business.
- Electricity and place problem : When the government run their own infrastructure , they may be paying for place and electricity that are largely unused. This a huge waste of money.

To overcome the problem stated above, we propose to implement cloud computing as a model for enabling convenient, on demand network access to a shared configurable computing resources (e.g. networks,servers, storage, application and services) that can be released with minimal management effort. [3]

The set of principles and considerations for each of major migration steps can be applied to the Indonesia government cloud computing migration., as stated below:

A. *Selecting services to move to the cloud*

To conduct cloud migration of an IT system, like LPSE e-procurement system in Indonesia, they must carefully consider their broad IT portfolios and create roadmaps for cloud deployment and migration. These roadmaps will select which services that have high expected value and high readiness to achieve highest benefits and lowest delivery risk. Identifying exactly which cloud service to provide or utilize is a basic starting phase activity in developing an organization roadmap.

The chart below [federal cloud computing strategy] use two dimensions to support plan cloud migrations : *value* and *readiness.* The value dimension describes cloud benefits in efficiency, agility and innovation. The readiness dimension describes the ability for the IT service to move to the cloud in short time. Services with relatively high value and readiness are strong candidates to move to the clouds first.

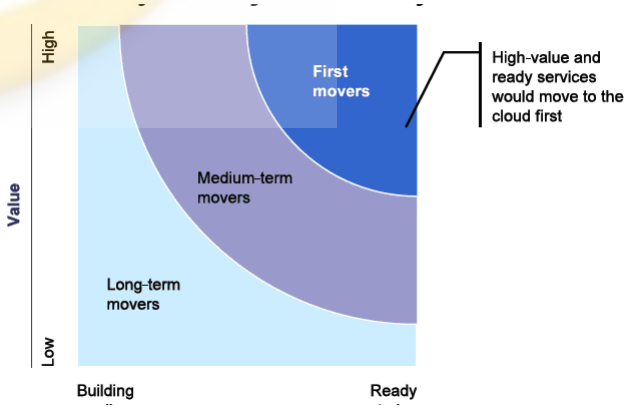


Figure 2. Selecting Services for Cloud Migration

As stated below we shall selecting services for cloud migration by identify sources of value and determine cloud readiness

1) Identify sources of value

We perform Cloud ROI analysis [cloud aplication architecture] on a specific infrastructure that compares internal building scheme with cloud scheme to identify sources of value .

In this analysis, although the diferrent organizations of LPSE in different regional state can have very different IT infrastructure profiles, we modeled an organization with a classic standard-based web application infrastructure, represent the type of IT infrastructure most suitable for a cloud computing migration. From the current condition data, we can see that the LPSE have 900 servers without virtualization is already being operated.

The model focus on the costs that likely directly being affected by a cloud migration; i. e., costs for server hardware and associated support hardware, such as server rack, router, access point, switches, cabling, etc., basic server software (OS software, backup management and security software), associated contractor labor for engineering and planning support during the transition phase, storage. It does not address other costs such as application software, that less vary significantly between cloud scenario.

We assume the organizations buy six solid servers, one rack, two good firewalls, one hardware load balancer, two good GB ethernet switches The depreciation schedule typically is three years, as the expected lifetime of the hardware

In addition, the organization will need application software and services.LPSE domain in 2010 is 72 units with total Rp 377.185.000 for developing application software, and services cost will consist of time to set up the environments, monitoring, services, support contracts, and labor for managing the environment. Table below shows all of the expected up-front and ongoing average cost per one LPSE organization in Indonesian Rupiahs.

TABLE II. COSTS ASSOCIATED WITH DIFFERENT INFRASTRUCTURES

	Internal (initial)	Cloud (Initial)	Internal (monthly)	Cloud SaaS (monthly)
Rack	**30.000.000**	**O**	**5.000.0000**	**0**
Switches	**20.000.000**	**O**	**0**	**0**
Load balancer	**200.000.000**	**0**	**0**	**730.000**
Servers	**240.000.000**	**O**	**0**	**12.060.000**
Firewalls	**30.000.000**	**O**	**0**	**0**
24/7 support	**0**	**O**	**0**	**4.000.000**
Management Software	**5.300.000**	**O**	**1.000.000**	**7.300.000**
Expected Labor	**12.000.000**	**12.000.000**	**12.000.000**	**6.000.000**
Degraded performance	**0**	**0**	**1.000.000**	**0**
Totals	**537.300.000**	**12.000.000**	**19.000.000**	**30.090.000**

To finalize the analysis, we must define the organization's depreciation schedule and cost of capital. We assume that the depreciation schedul is three years, defines from the expected lifetime of the hardware. The cost of capital represents what our money is worth to us if we invest it somewhere else. The number is lies in the 10% to 20% range. In this analysis it is assumed to be 10% and calculated monthly.

To compare whether cloud or internal scenario is more expensive, we must calculate the financial expression called *present value* (the value of those payments to us today if we were forced to pay for it all today). We calculate the present value (PV) with Microsoft Excel's PV function for each scenario :

$$Internal = \left(-PV\left(\frac{10\%}{12}, 36, 19.000.000 \right) \right) + 537.300.000$$

$$= Rp\ 1.126.133.476{,}12$$

$$Cloud_{SaaS} = \left(-PV\left(\frac{10\%}{12}, 36, 30.090.000 \right) \right) + 12.000.000$$

$$= Rp\ 944.526.278{,}76$$

That was calculation for SaaS Cloud Scheme. For IaaS Cloud scheme, the total monthly cost is substracted by Management Software cost , become Rp. 22.790.000 and Total Cloud cost become :

$$Cloud_{IaaS} = \left(-PV\left(\frac{10\%}{12}, 36, 22.790.000 \right) \right) + 12.000.000$$

$$= Rp\ 718.290.258{,}99$$

From this analysis we could see that the cloud scenario achieve cheaper payment than Internal scenario. Since the IaaS cloud achieve the lowest cost, we propose to select the IaaS Cloud scenario, i.e, hardware virtualization and Cloud storage.

2) Determine Cloud Readiness

Before migrating to the cloud, government must ensure that the network infrastructure can support the demand of higher bandwidth. Since the Indonesia government already employ WiMAX telecommunication system, the bandwidt readiness is set up.

In addition, government should consider whether or not the applicable organization is ready to migrate the service to the cloud. For IaaS scheme , required human resources for manager, negotiator should be prepared .

B. Define Cloud Architecture

Infrastructure as a Service (IaaS) is the delivery of hardware (server, storage and network), and associated software (operating systems virtualization technology, file system), as a sservice. The service provider owns the equipment and is responsible for housing, running and maintaining it. Amazon Web Services Elastic Compute Cloud (EC2) and Secure Storage Service (S3) are examples of IaaS offerings. [cloud computing study of]

The IaaS scheme we proposed is hardware virtualization and cloud storage.

1) Hardware Virtualization

Through virtualization, a single physical server can be partition into any number of virtual servers running their own operating systems in their alocated memory, CPU and disk footprints.

A number of virtualization technology provider take different methode. Xen, the popular open source virtualization from Amazon, provides a hypervisor layer on which one or more guest operating systems operate.[Cloud Application Architecture]

2) Cloud Storage

Cloud storage enables data to be "thrown" into the cloud and no need to worry about how it stored or backing it up. By the time we need it, we just access directly to the cloud and retrieved it.

There are a number of approaches to cloud storage on the market. The data stored at clouds, will be cut into small chunks and storing the data to the multiple servers with checksum.

Below is the new architecture proposed for LPSE e-Procurement system at Jawa Barat Indonesia,

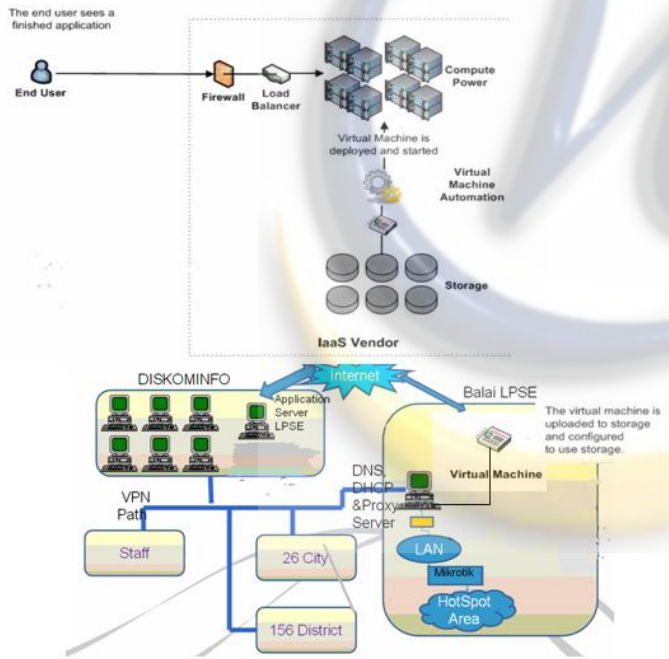


Figure 3. Cloud Computing Scheme for Jawa Barat e-Procurement System

Figure above, show that application server, database server, firewall, expert report server, exercise server at LPSE organizations and directorate of ministry communication and information are moved to IaaS vendor at clouds. LPSE organizations, as software owner has virtual machine that uploaded to storage and configured to use storage.

V. CONCLUSION

To summarized, based on our economics analysis on cloud migration scheme for e-procurement system at Jawa Barat, Indonesia , there are significant cost savings during initiation and monthly expense.

Infrastructure as a Service (IaaS) plan provide highest cost savings, since the most expense of e-procurement deployment , servers, power, storage and hardware infrastructure don't need to be purchased and maintained by the government.

As a field of Cloud Computing is rapidly progressing, there were many chances for researchers to explore further and socialize the research result to the corresponing users, such as government, factory and other organization.

The cloud computing e-government scenario also support disaster mitigation plan, since it will be automatically and simply backing up critical data in clouds.

ACKNOWLEDGMENT

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