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DEVELOPMENT OF PRIVATE DATA CENTER BASED ON CLOUD COMPUTING

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ABSTRACT

The data center into one of the critical components in a business environment that exists today. As the core of business services, the data center is expected to provide the best service possible, even in a disaster situation, so that the company business survive and profit will continue to flow. Support for data center reliability of new technologies has brought cloud computing. Cloud computing technology is a combination of the two technology, they are grid computing and virtualization. This cloud computing technology is expected to reduce the weaknesses caused by the conventional data center system. The study discusses the development of a data center based on cloud computing technology. First, build private cloud infrastructure using open stack software. Then, develop a web application to upload and download files by registered user. And finally, develop a desktop application for synchronizing files process from the cloud server to the user's PC/Laptop. The web application is placed on a web server above the cloud infrastructure layer. Research on the amount of main memory is also carried out to determine how much memory is good enough to run the web application. This study provides a solution for data management systems using the data center systems based on cloud computing technology. The aims of this study, the user will more convenience to upload or download data.

Keywords: data management system, data center, virtualization, cloud computing, virtual machine

I. INTRODUCTION

Data centers have become popular in the variable domains such as web hosting, enterprise applications, and e-commerce sites. Modern data centers are increasingly employing a virtualized architecture where applications run inside virtual servers

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mapped onto each physical server in the data center1,2,3,4. These virtual machines (VMs) run on top of a hypervisor, which is responsible for allocating physical resources such as memory and CPU to individual VMs. With virtualization, several virtual machines (VM) are consolidated to run on a single machine (called a host) with the aid of a Hypervisor or Virtual Machine Monitor (VMM) layer. The hypervisor has access to all the underlying hardware resources, and it multiplexes those across the VMs, in a way such that the guest OS running in VMs has the illusion of running on its own physical machine.

Today, most IT professionals still build redundant sites as a backup and manually manage data replication and failover to the secondary site when needed. So, they have their site sitting there inert as an insurance policy, but also as a nonperforming asset. By virtualizing data center resources at both sites, you can turn non-performing assets (with the exception of a disaster) into an ongoing available asset that will function in a distributed scenario to achieve maximum reliability and performance regardless of location. For example, in an active-active data center configuration, data replicated, upgraded, and being maintenance on a more-frequent basis. Overall, uptime and time-to-market for services increased.

Cloud computing is an emerging distributed computing paradigm that offers cost-effective, scalable on demand services to users, without large up-front infrastructure investments5,6. Through the use of virtualization, cloud computing provides a back-end infrastructure that can quickly scale up and down, depending on workload.

Migrating systems into the cloud is an emerging and accelerating trend. The cloud provides a standardized front end interface, which enables the execution of a wide variety of applications on the same hardware platform. Data centers are the backbone infrastructure to facilitate the development of cloud computing. Cloud performance hinges on the computation, storage and network capacity provisioned at the data centers. Consequently, cloud workload demands are well reflected by demands on resources at today's data centers.

This paper discusses the development of data center based on cloud computing. The purpose of this research is to develop a good infrastructure for the data management system at a data center, based on cloud computing technology.

Background

A data center (sometimes spelled datacenter) is a centralized repository, either physical or virtual, for the storage, management, and dissemination of data and information organized around a particular body of knowledge or pertaining to a particular business. Data centers are essentially very large devices that consume electrical power and produce heat. The data center's cooling system removes heat consuming additional energy in the process, whose heat must be

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removed as well. It is not surprising, then, that the bulk of the construction costs of a data center are proportional to the amount of power delivered and the amount of heat to be removed. In other words, most of the money is spent either on power conditioning and distribution or on cooling systems.

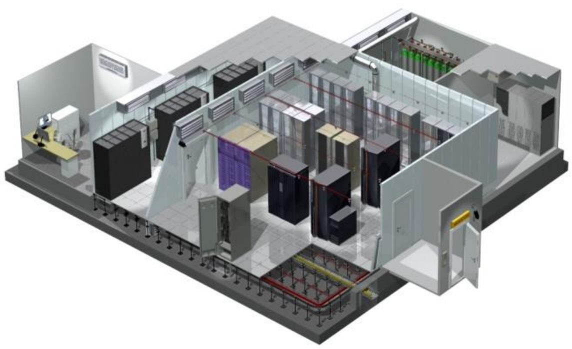

Figure 1 Data center room design[7].

The overall design of a data center is often classified as belonging to "Tier I–IV". As depicted in Figure 1.

- Tier I data centers have a single path for power and cooling distribution, without redundant components.
- Tier II adds redundant components to this design (N + 1), improving availability.
- Tier III data centers have multiple power and cooling distribution paths, but only one active path. They also have redundant components and are concurrently maintainable, that is, they provide redundancy even during maintenance, usually with an N + 2 setup.
- Tier IV data centers have two active power and cooling distribution paths, redundant components in each path, and are supposed to tolerate any single equipment failure without impacting the load.

Server virtualization consists of running multiple operating systems and applications on the same server at the same time. This eliminates the traditional, yet inefficient, model with its 1-to-1 correspondence between a dedicated server and a single operating system (OS). The current process of partitioning one physical server into several operating systems, or virtual machines (VMs), it lets simultaneously deploy, operate, and manage these multiple operating system instances on that single physical server. This offers enormous expansion opportunities for accommodating increased numbers of applications and unique users.

Virtualization increases application availability and can dramatically shorten disaster recovery time to significantly improve business continuity preparedness. For enterprises, virtualization offers levels of efficiency in security, management, automation, and VM deployment as well as the ability to provide increased resources to more users. Across the board, virtualization allows enterprises and SMBs to reduce the number of physical machines in their data centers while maximizing the number of underlying applications.

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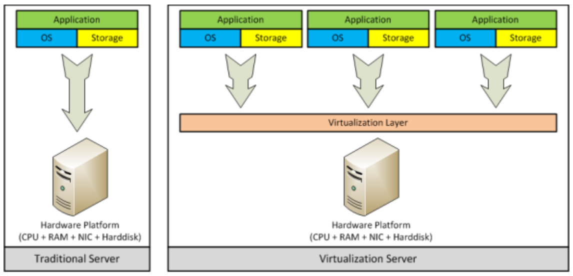

Figure 2 Traditional VS Virtualization Architecture.

Cloud Computing is often described as a stack, as a response to the broad range of services built on top of one another under the moniker "Cloud." The generally accepted definition of Cloud Computing comes from the National Institute of Standards and Technology (NIST). The NIST definition runs to several hundred words, but essentially says that: *"Cloud Computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."* [8].

Cloud computing can be viewed as a collection of services, which can be presented as a layered cloud computing architecture, as shown in Figure 2. The services offered through cloud computing usually include IT services referred as to SaaS (Software-as-a-Service), which is shown on top of the stack. SaaS allows users to run applications remotely from the cloud.

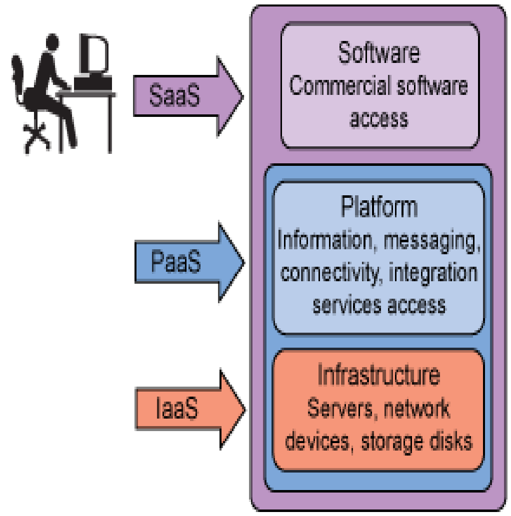

Figure 3 Cloud layers.

Infrastructure-as-a-service (IaaS) refers to computing resources as a service. This includes virtualized computers with guaranteed processing power and reserved bandwidth for storage and Internet access. Platform-as-a-Service (PaaS) is similar to IaaS, but also includes operating systems and required services for a particular application. In other words, PaaS is IaaS with a custom software stack for the given application. As depicted in figure 3.

Clouds can be classified in terms of who owns and manages the cloud; a common distinction is Public Clouds, Private Clouds, Hybrid Clouds and Community Clouds. As depicted in Figure 4.

A public cloud, or external cloud, is the most common form of cloud computing, in which services are made available to the general public in a pay-as-you-go manner. A Private Cloud, or internal cloud, is used when the cloud infrastructure, proprietary network or data center, is operated solely for a business or organization, and serves customers within the business fire-wall. A composition of the two types (private and public) is called a Hybrid Cloud, where a private cloud is able to maintain high services availability by scaling up their system with externally provisioned resources from a public cloud when there are rapid workload fluctuations or hardware failures. In the Hybrid cloud, an enterprise can keep their critical data and applications within their firewall, while hosting the less critical ones on a public cloud.

The idea of a Community Cloud is derived from the Grid Computing and Volunteer Computing paradigms. In a community cloud, several enterprises with similar requirement can share their infrastructures, thus increasing their scale while sharing the cost. Another form of community cloud may be established by creating a virtual data center from virtual machines instances deployed on underutilized users machines.

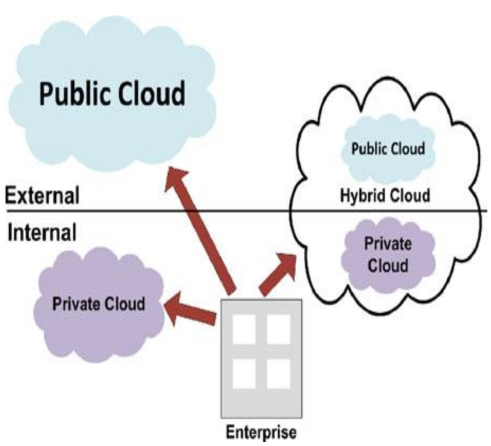

Figure 4 Cloud types.

II. METHODS

Design system requires systematic steps to produce a good application and accordance with the purposes and intent. Starting early stages of analysis application need to be built, discuss the general description, system requirements and use cases. As depicted in figure 5.

The basic requirements are an absolute must have to try this system as follows.

- Computer server which supports virtualization.
- Cloud software.
- Host domain and guest domain Operating System.
- Web server applications .
- Desktop software for build in desktop application.
- Internet provider

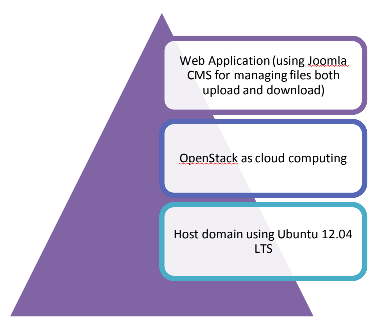

Figure 5 Build data center for cloud computing.

The following steps are taken to build a data center using cloud computing.

1) Install domain host. This uses the operating system Ubuntu 12.04 LTS.

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There are a few settings such as hard drive partitions using LVM technology.

2) The next step is installing OpenStack as cloud computing software.
3) Next, install the guest domain as the web application, also uses the operating system Ubuntu 12.04 LTS.
4) Furthermore, install some additional software for build web server such as SSH, Apache, PHP, MySQL, FTP, and webmin.
5) Finally, develop desktop application using visual studio 2008 to folder/files synchronization.

Functional requirements are requirements relating to the function or process transformation that can be done by software. This is followed functional requirement for this system.

1) Cloud software should be able to create a new admin user and user project.
2) Cloud software should be able to create an instance that can be used servers for web applications.
3) Cloud software should be able to define in terms of port security that must be opened and should be closed.
4) Cloud software should be able to run the file transfer process using two methods: FTP and SSH.
5) Web application software should be able to add new users.
6) Web application software must be able to upload and download files.
7) Web application software must be able to make a report of the users' research results who have managed to download the file.
8) Desktop application software should be able to add the configuration FTP users.
9) Desktop application software must be able to synchronize folders and files existing web applications.

This following Figure 6, Figure 7 and Figure 8 are flowchart diagrams the implementation of this system for backend, fronted and desktop applications.

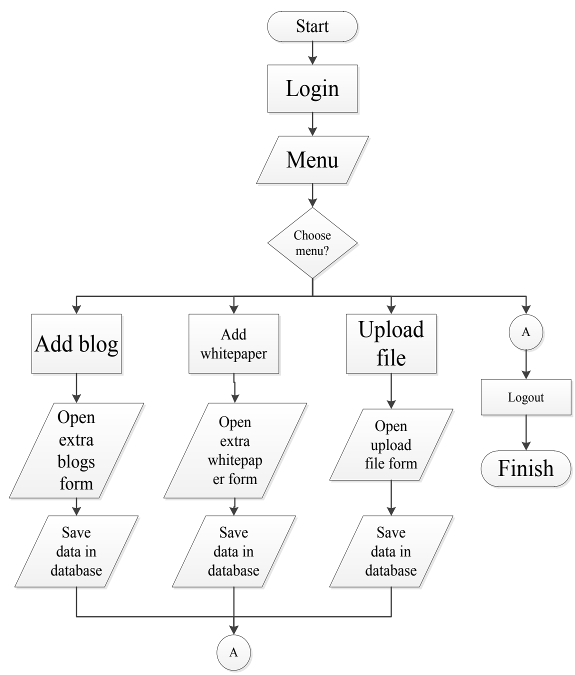

Figure 6 Web application flowcart for backend.

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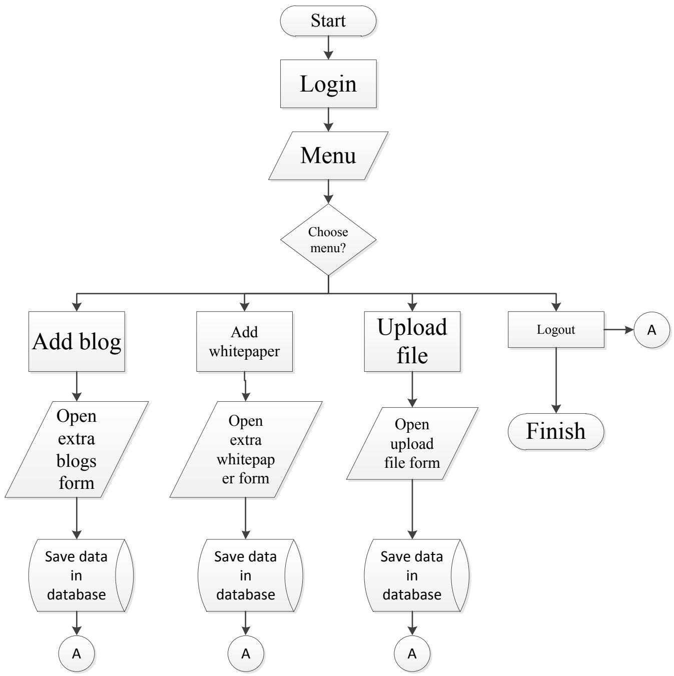

Figure 7 Web application flowcart for frontend.

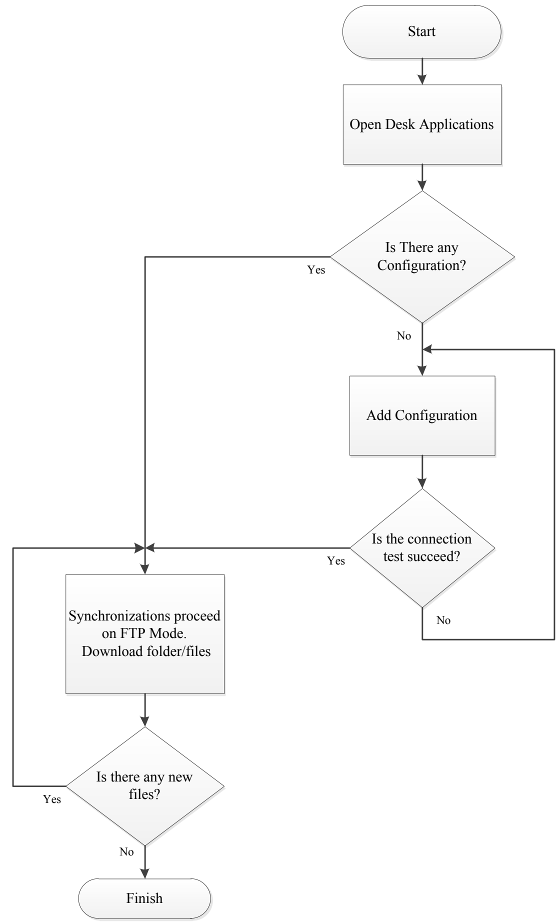

Figure 8 Desktop application flowcart.

III. RESULTS

This section will discuss how to implement the hardware and software so can be utilized in accordance with the desired goals. Implementation environment is divided into three major sections.

- OpenStack section
- web applications section, and
- desktop applications section.

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Implementation on the part of cloud computing is divided into two parts, implementation of the OpenStack admin management and OpenStack project management. OpenStack management is divided into two parts; admin section and project section. Admin regulate all matters relating to hardware and software, including setting function of cloud like flavor, images, users, and project. While the project is set up one or multiple instances running on OpenStack layer. Table 1 below shows the second part of the management of OpenStack.

The web application is divided into two parts, backend and front-end. Backend devoted for an admin to set a few things such as the menu and the submenu that appears on the front end, the layout of modules, components used, and etc. Not all web visitors are allowed to visit the admin page, therefore given the login form to enter into it. Front-end more general nature, therefore all visitors can see it, but in this application there is a menu that deliberately hidden or special purpose, so that visitors who wish to access the menu are required to login first. User data, the data, articles, white papers the data, upload the data files, and so forth are stored in a database. The database used is MySQL client version: 5.5.31, with PHP driver is MySQL.

Implementation of desktop applications using the programming language C-Sharp (C#) from Microsoft Visual Studio 2008. In this program added libraries for synchronizing files from the server to the local memory (laptop/PC) is Microsoft. Synchronization and Microsoft. Synchronization Files. Then made some of them are the support class and class Server Connect. csDBConnect.cs.

Software testing is an important element that must be performed to determine whether the application runs well or not. In this study, testing was conducted in two phases ie. server performance testing and application testing functions.

Performance testing aims to determine the amount of RAM memory required so the system can work well as needed. The test makes a few servers with RAM capacity varies, performed using 3 different scripts, where each script runs several times the experiment, then the average taken as a result. As depicted in Figure 9.

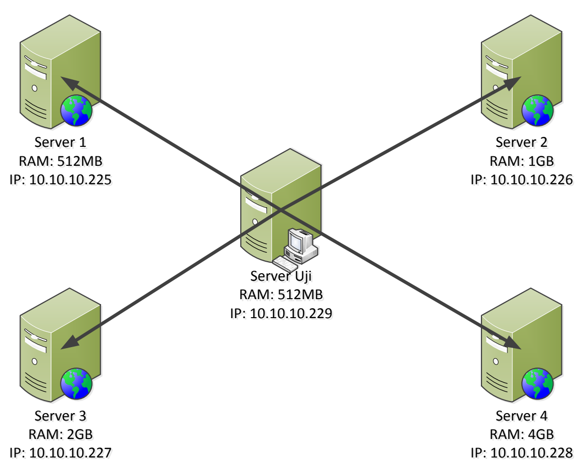

Figure 9. Design of performance testing 4 server with different of RAM

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Figure 10 shows the results of the study, which used Apache Benchmark tool. Using this results, we can know the approximate tiem of response time for persentage served (%).

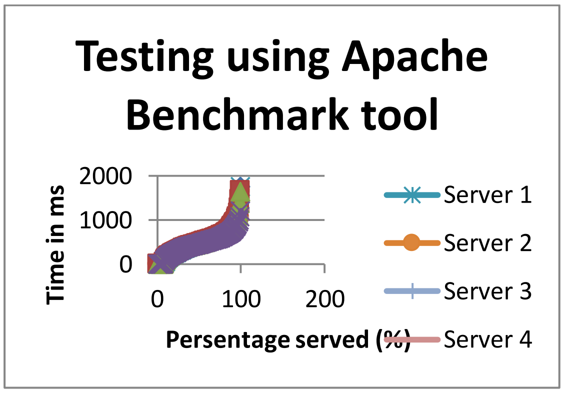

Figure 10 Stress test using apache benchmark tool

IV. DISCUSSION

Analysis of the test results from both applications and hardware used in the prototype data center in the cloud computing system has been running well. Function test on a few things in the application, both OpenStack applications, web applications, and desktop applications, has been successful. The results of performance testing for performance above a layer of OpenStack virtual server also has shown a good performance. The test results on the performance of RAM (Random Access Memory), namely performance testing, shows that a larger RAM capacity will function more quickly. It indicated by the time required to perform the test shorter.

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