Analysis and Development of Software as A Service-Based Private Cloud Computing System at State Senior High School 1 Metro

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Abstract: This research discussed the analysis and development of the software as a service-based (SAAS) private cloud computing system at State Senior High School 1 Metro. The objective of this study was providing both theoretical and practical benefits especially for State Senior High School 1 Metro so that it presented an integrated data center for the future. The SaaS-based private cloud computing system was discussed only through the prototype model. The objective of this study was developing the SaaS-based private cloud computing system for sharing data or files (e.g., student data, teacher data, academic files, and learning files) at The State Senior High School 1 Metro. The data collecting technique used in this study were through observations and interviews. The result of the data analysis was that The State Senior High School 1 Metro needed a software-based private cloud computing application that was able to be accessed by students, teachers, and academic staff. The result of this study was that the software-based private cloud computing application was able to facilitate The State Senior High School 1 Metro to access the data and files because the data and files needed to be integrated.

Keywords: Private Cloud Computing, Software as a Service (SaaS), Prototype

1.   INTRODUCTION

The development of technology was currently based on the easy and fast internet system. The current information technology system had very limited resources. The resources needed the data storage and required much costs.

The concept of cloud computing technology developed today. Companies that used IT were utilizing cloud computing technology to overcome the obstacles e.g., limited resources and network infrastructure that caused the computing process to stop. Cloud computing was the best combination of the computer technology (computing) to help the development team and stakeholders understood unclear requirements specifications (Pressman, 2010). Stakeholders discussed the developer during the system development so that the system and application evolutionalized very quickly based on the stakeholder wishes.

The State Senior High School 1 Metro still used personal devices and social media services (e.g., Facebook and Whatsapp) in exchanging the data or files (student data, teacher data, academic files, and learning files) so that it allowed repeated data transmission because the data was not centralized on a server and. Based on the existing problems, an application that handled this existing problem should be developed. The private cloud computing was the application that was used to help solve problems at The State Senior High School 1 Metro to centralize the data exchange.

Based on the problems above, the authors planned to design the private cloud computing by using one of the cloud computing services, e.g., Software as a Service (SaaS) implemented in The State Senior High School 1 Metro.

2. LITERATURE REVIEW

a. Cloud Computing

According to Peter Mell and Timothy Grance (2012: 2), Cloud Computing was the model that allowed ubiquitous, convenient, on-demand network access to computing resources (for example networks, servers, storage, applications, and services) which was quickly released or added. The Cloud Computing was the information technology service that was utilized by users through network/internet. The resource, software, information, and applications were provided by the other computers. Cloud computing had two words "cloud" and "computing" – Cloud meant the internet itself and Computing as a computational process.

The concept of cloud computing was usually thought of as the internet. Ihe internet was described as a large cloud (the internet was denoted as a cloud) which contained a collection of interconnected computers. Cloud computing was regarded as an evolutionary invention referred to the convergence of technology and dynamic applications. There were major changes that had implications that touched almost every aspect of computing. The cloud computing provided the tools to scale up new services or to allocate computing resources faster based on the business needs. An overview of cloud computing was shown on Figure 1
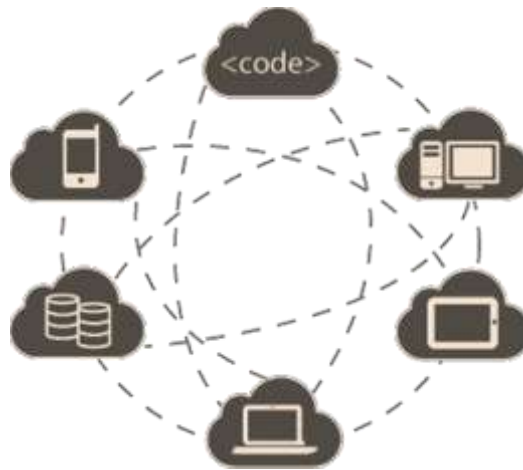
Figure 1. An overview of cloud computing
(Image Source: DataART, Four Models of cloud development)

b. Cloud Computing Service Model

Based on the type of cloud computing service, it was divided into 3 service models:

Figure 2. Cloud computing model
(Image Source: Microsoft Cloud Computing)

1. Software As A Service

   Software As A Service (SaaS) provided services in the form of applications used by the customers. SaaS was run on cloud infrastructure. The examples of SaaS service providers were Gmail, google docs, office 365, and SalesForce.
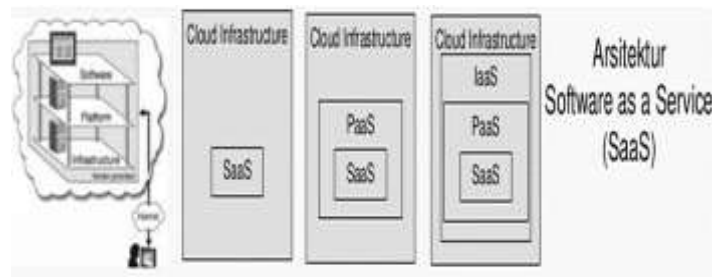

Figure 3. SaaS service model architecture
(Image Source: Slideshare.com)

2. Platform As A Service

   Platform As A Service (PaaS) provided a platform (programming language, tools, Web server, database) that was useful for developing applications run on cloud infrastructure The result of PaaS was used for the customers. The examples of PaaS service providers were OpenShift, PHPCloud, AppFog, Heroku, and GoogleApp Engine
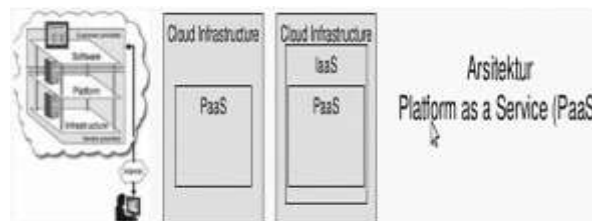

Figure 4. PaaS service model architecture
(Image Source: Slideshare.com)

3. Infrastructure As A Service

   Infrastructure As A Service (IaaS) provided the processing resources, storage, network capacity, and other computing resources. The examples of IaaS were Amazon EC2 and TelkomCloud service providers.

Figure 5. IAAS service model architecture
(Image Source: Slideshare.com)

c. Supporting Software

   Supporting software was software used to create and design applications.

1. PHP

   PHP (PHP Hypertext Preprocessor) was a type of scripted language (programming language), which was designed to develop dynamic web applications and embedded HTML code. PHP was the first developer to develop a type of scripting language and PHP was run on the webserver side.

2. JavaScript

   JavaScript was a popular scripted language on the internet and was able to work in most of the popular web browsers e.g., Internet Explorer (IE), Mozilla Firefox, Netscape, and Opera. Javascript code was able to be used on web pages using script tags.

3. Cascading Style Sheet

   Cascading Style Sheet (CSS) was one of the web programming language for controlling several components in a web so that it was more structured and uniform. The styles in word processing applications was in the form of Microsoft Word that was able to set several styles e.g., headings, sections, body text, footers, images, and the other styles used together in multiple files. In general, CSS was used to format the web page appearance created in HTML and XHTML languages.

4. Git Version Control System

   Git Version Control system was the system that recorded any changes into a file or collection of files. It was seen on the software source code regarded as the file that was carried out by version control. This system was able to restore files to their condition or previous state, to restore the entire project to its previous state, to compare changes every time, to see whoever made the latest changes to an object that potentially caused problems, to see whoever published the issue, and the others. The Version Control System (VCS) was able to restore easily if the files were messed up or lost.

3.   METHOD

Several stages were carried out to process the data of this study so that the data was appropriate and run well.

a. Research Methodology

   The research methodology was the method used in obtaining various data. It was processed into more accurate information according to the problem. The research methodology was used as a guide in a study so that the result of this study was achieved and did not deviate from the objective of this study.. The research methodology consisted of several stages that formed a systematic flow.

b. Research Subject

   The location of this research was conducted at The State Senior High School 1 Metro to discuss the analysis and development of Software as a Service (SaaS)-based Private Cloud Computing.

c. Research Stages

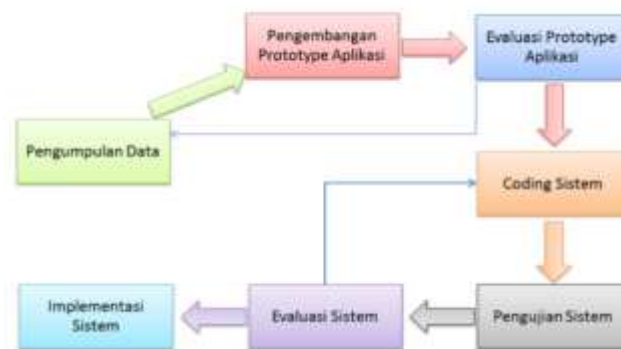   There were several stages in this study as they were shown on Figure 1.

Figure 6. System Development Method

d.   Data Collecting Technique

     The data collecting technique had a very important role because it was able to determine the quality and accuracy of the data. The authors used the following methods as follows:

     1.   Interview

         Interview was conducted through direct questions and answer about about the ongoing data distribution. The interview was carried out to to the academic section, teachers, and staffs of The State Senior High School 1 Metro. The interview technique used in this study was an unstructured interview so that the authors were free to explore as complete and deep information as possible in a relaxed atmosphere.

     2.   Library Research Method

         It was a type of the data collecting technique related to search theories related to this study by reading books or browsing the internet.

e.   Indicators

     An indicator was an indirect measure of a condition. The indicator was the variables used to measure the changes that occurred either directly or indirectly

     This indicator was the initial variables of whether the development of the Software as a Service (SaaS)-based Private Cloud Computing in the form of an application. It provided effectiveness and efficiency in sharing data or files (student data, teacher data, academic files, and learning files).

4.   RESULTS AND DISCUSSION

a.   Developing Prototype

     This Software service as a service (SAAS)-based private cloud computing software required the developing stages. They were used to make the details of the system from the indicators into a design form so that the users were able to understand them

     1. Designing the Architecture of the Application

         The architecture of this application was designed as follows:

1.1.1.1.   1.1.1.2.   1.1.1.3 1.1.1.4.   1.1.1.5.   1.1.1.6.

1.1.1.7.   1.1.1.8.   1.1.1.9   1.1.1.11.   1.1.1.12.

1.1.1.13   1.1.1.1

1.1.1.14.

Server

1.1.1.10.

1.1.1.16.

1.1.1.17   1.1.1.18.   1.1.1.1

1.1.1.21   1.1.1.22.   1.1.1.2

1.1.1.24.   1.1.1.20.
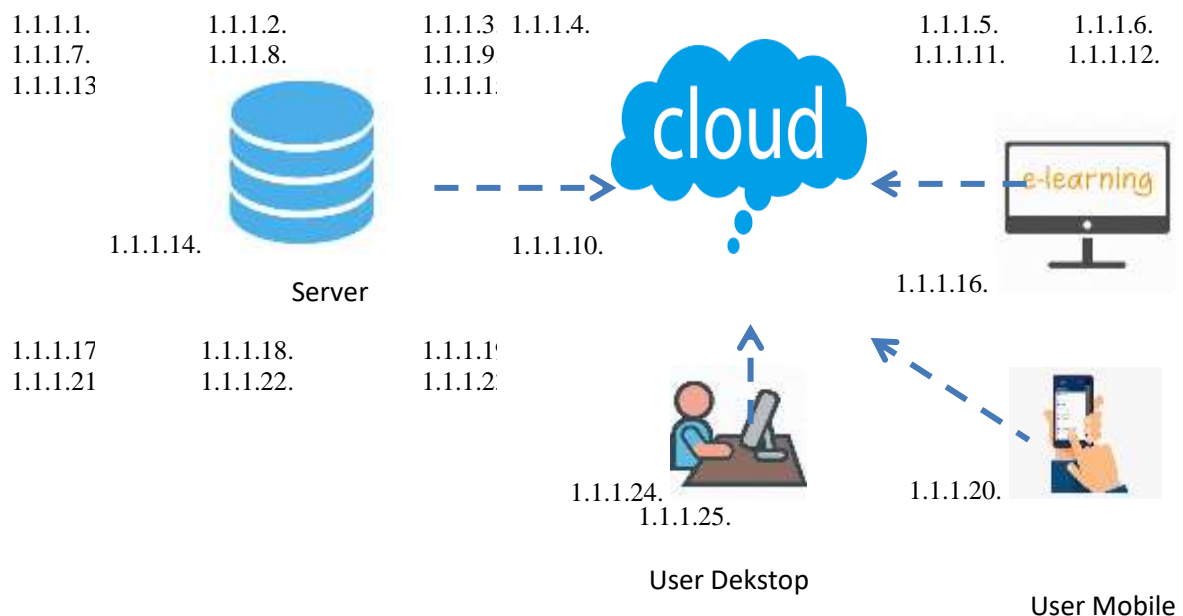
1.1.1.25.

User Dekstop

User Mobile

Figure 7. Application Architecture Design of the State Senior High School 1 Metro

From the picture above, there was a server that became the data center for The State Senior High School 1 Metro. The centralized data were the student data, teacher data, teacher files, academic files, and learning files. These files were accessed together with certain access rights through a client device using a PC or a mobile.

2. Designing System

This stage included needs analysis, system analysis, use case diagrams, sequence diagrams, activity diagrams, and class diagrams

3. Designing Database

Database was a storage for all entered data. The database design consisted of several tables that were interrelated between one and another table. Each of the tables had fields and data types that were adjusted to the function of each field.

4. Conducting Data Management Subsystem

The data management subsystem was the component of applications in the form of a database containing the collected data based on the needs for this application development. The database was in the form of data about training data and testing data that had been determined.

5. Designing Interface (Interface)

In this study, the following applications were made. This was the application designs for Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro e.g., Login Form Design, Student Form Design, Teacher Form Design.

6. Analysing the Application

Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro was able to be accessed by students, teachers, and academic staffs. In this application development, the needs analysis on the software and hardware was carried out.

7. Implementing Application

Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro was developed through PHP and MySQL. Each of this applications was explained below:

- Index file

    The index file described the main appearance of a private cloud computing application based on Software as a Service (saas) at The State Senior High School 1 Metro. its appearance was displayed on Figure 8:

Picture 8. Index file of Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro

- **Main Menu File**

    The Main Menu file described the items accessed by the users after inputting the username and password correctly. The appearance was seen on Figures 9. and 10.

Figure 9. Main Menu Files for students

Figure 10. Main Menu File for Application Academic Staff

- Subject Group Files
  Subject group files were designed to view, add, modify, and delete course group data
- Subject Files
  Subject files were designed to view, add, modify, and delete course data
- Class Master Files
  Class master files were designed to view, add, modify, and delete class master data
- Class Assignment File
  Class assignment files were designed to view, add, modify, and delete class assignment data
- File making of online exam questions
  Online exam question creation files were designed to view, add, modify, and delete data on online exam question creation.
- Questionnaire files for teachers and libraries
  Questionnaire files for teachers and library files were designed to view, add, modify, and delete questionnaire data for teachers

8. Implementation of Applications and Testing of Soft Devices

Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro was made through HP and MySQL. Furthermore, Black-Box and White-Box testing were carried out to ensure that an event or input was run properly and the output was generated appropriately.

- Black-Box Testing
  The Black-Box testing was carried out to ensure that an event or input was carried out properly and the output was generated appropriately according to the design. Table 4.4 described the tested form through the Black Box method:

Table 1. Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro

Form	Input	Process	Output	Test Result
Index File	Username & Password	In this process, Username & Password input with the login table was checked. If the	Go to the main menu file	corresponding

Table 1. Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro (Continue)

Form	Input	Process	Output	Test Result
		Username & Password was wrong, it would sent an incorrect Username & Password.		
Student Index File	Level user	This file was the main menu for students	File access File, test of online examination	corresponding
Subject group files	Id, subject group	This form was for accessing subject group data	Id, subject group	corresponding
Subject file	Id, subject group, subject code, subject name, major, weight	This form was for accessing subject data	Id, subject group, subject code, subject name, major, weight	corresponding

- **White-Box Testing**
   White-Box testing was carried out to ensure that an event or input was run properly and the output was generated according to the design.
   Table 2 described the form in order to be tested through the white-box method.

Table 2. White-Box Testing form accessed by Staff, Teachers, and Students at SMAN 1 Metro

File	Syntax	Analysis	Test Result
Index.php	```<?php error_reporting(0); session_start(); include_once("library/koneksi.php"); if(@$_POST["login"]){ //jika tombol Login diklik $user = $_POST["user"]; $pass = md5($_POST["pass"]); //$pass = $_POST["pass"]; if($user!="" && $pass!=""){ include_once("library/koneksi.php"); $em = mysql_query("select * from login where password = '$pass' AND username = '$user'"); $data = mysql_fetch_assoc($em); $r =mysql_fetch_array($em); $levell=$r[level]; echo"$levell"; if(($data["username"] == $user) && ($data["password"] == $pass) && ($data["level"]=="rs")){ echo "<div class='alert alert-success alert-dismissable'> <button type='button' class='close' data-dismiss='alert' aria-hidden='true'>×</button>```	This file displayed the password form, once the submit button was clicked, the syntax accented the log-admin.php file (bold green color)	**Corresponding**

```
                                              Data Telah
Ditemukan!!.
</div>";
                              $_SESSION["user"] =
$data["username"];
                              $_SESSION["pass"] =
$data["password"];


     echo '<script
type="text/javascript">window.location.href="admin/index.php";<
/script>';
}else if(($data["username"] == $user) && ($data["password"] ==
$pass) && ($data["level"]=="Akademik") ){
                              echo "<div class='alert alert-success
alert-dismissable'>
<button type='button' class='close' data-dismiss='alert' aria-
hidden='true'>&times;</button>
                                              Data Telah
Ditemukan!!.
</div>";
                              $_SESSION["user"] =
$data["username"];
                              $_SESSION["pass"] =
$data["password"];


     echo '<script
type="text/javascript">window.location.href="Akademik/index.php
";</script>';
                }else{
                              echo "<center><div class='alert alert-
warning alert-dismissable'>
<button type='button' class='close' data-dismiss='alert' aria-
hidden='true'>&times;</button>
                                              <b>Data Tidak
Ditemukan!!</b>
</div><center>";
                       }
          }

}
?>
```

5. CONCLUSION

The results of this Software as a Service (SaaS)-based Private Cloud Computing at The State Senior High School 1 Metro were as follow:

a. The Software as a Service (SaaS)-based Private Cloud Computing facilities The State Senior High School 1 Metro to access data and files because data and files are integrated.
b. The Software as a Service (SaaS)-based Private Cloud Computing is a bootstrap-based system so that it can be accessed using any media and platform.

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