Online Code Editor on Private Cloud Computing

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***Abstract*—Programming tools are important for programmers to develop software. If the developers have a good tool, it can help them develop system faster and more accurate. This paper proposed the Online Code Editor that was created for programmers or developers who want to write programs without any platform requirements or without any specific physical computers. It bases on web application running on the Private cloud computing. The features of the editor are performed on web programming languages, e.g. HTML, PHP, CSS, and JavaScript. The editor is able to isolate programming languages by highlighting syntax of programs. Users can create new projects and files, import and export files that they want on a server. Moreover, Save, Auto save, Delete, and etc. are the additional functions of the editor. In this research of the text editor development, the open source software called, "Ace" was used for some functions such as Undo, Redo, and Syntax highlight.**

The experimental results indicated that the proposed editor can be practically used on Private cloud computing. Moreover, the comparison of the features among the proposed editor running on Private cloud, Notepad++, and EditPlus which running on personal computers, was summarized.

Keywords— Online Editor; Private Cloud Computing; Ace

I. INTRODUCTION

Recently, computer software in writing computer program source code is very popular. Even though, the ability of software is less capable than the Integrated Development Environments (IDE), many programmers who want to edit the source code urgently might not access convenient resource without installing any application on the computer or notebook. Text editors are good tools for programmers to use within small resources. Nevertheless, text editors also need to be installed on the computers before using. Therefore, programmers need to have at least one computer in order to edit program source code. If one does not own any computer, to urgently modify any source code is impossible. Thus, Online Code Editor was proposed to solve this problem. It helps programmers to write or modify their source code at any place and any time they want. The online text editor was built and run on Private cloud computing based on web-based application. Open source software called Ace was used to highlight the text. Programmers can compile and run source code via web browser and the code will be done at server-side. Then, the output from the compilation will be displayed at the browser of client-side. Programmers can use any computer or even tablet PC to write the computer program, without having to install software they just use only internet and browser. It helps the organization to reduce the expense in purchasing many personal computers. The structure of the paper is as follows: Section II, the theory of Cloud computing and text editor are mentioned. In Section III, architecture of the Online Code Editor is proposed. The use of Online Code Editor and its functions are mentioned in Section IV. Finally, conclusions are presented in Section V.

II. CLOUD COMPUTING AND TEXT EDITOR

A. Cloud Computing Definition

The definition of Cloud computing was identified by many researchers. National Institute of Standards and Technology (NIST) introduced Cloud computing as the following:

"Cloud computing is a model for enabling ubiquitous, 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. This cloud model is composed of five essential characteristics, three service models, and four deployment models." [1]

Basically, Cloud computing has 3 services, 3 deployment models as described in part B and C below [2-5].

B. Cloud Service Model Architectures

There are 3 basic types of Cloud computing architectures:

1) Infrastructure as a Service (IaaS)

IaaS provides the infrastructure for information system. The hardware service will be provided by cloud providers. By using this service, the users can own just only computer without any operating software. This service

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provides the most flexibility in using resources. The users need to manage installing platform and software on it. IaaS provides flexible coding management and deploys programs to be used in cloud without the restriction in program development. It also provides scalability which is one of the essential features in Cloud computing and it can be done by the users. The server rental service is one example of IaaS. The billing can cost monthly or per processor or per storage.

2) Platform as a Service (PaaS)

PaaS provides hardware, software platform and framework for distributed application development. Providers can create Application Programming Interface (API) for users to use and run on the providers' platform service and deploy to Cloud. The advantage is, API was guaranteed to be ready to use and up-to-date. In contrast, if programmers used complicated structure of API from one of PaaS providers, it might be difficult to move to other platform of different providers.

3) Software as a Service (SaaS)

SaaS provides application software for every user. The users can ignore the location of software and the resources which is the responsibility of the providers. The users only need to pay the bill for the services. The SaaS service is higher level than PaaS because its infrastructure, platform, and software will be provided from the providers. In order to use this service, the users only need the internet connection without the requirement of hardware or platform technical knowledge.

Normally, users of IaaS and PaaS are developers or application software providers but not end-users. The application software providers develop the software to deploy in Cloud computing for end-users.

C. Cloud Deploying Models

In Cloud computing technology, many types of services are classified by many researchers. In this paper, 3 basic models of deployment: Public cloud, Private cloud, and Hybrid cloud are described as the following [2-5]:

1) Public Cloud : It is available for all users in general public. Customers can access the Public cloud via the internet from third-party providers. They can use IaaS, PaaS, or SaaS in pay-as-you-go model. Amazon, Microsoft and Google are examples of Public cloud vendors.

2) Private Cloud : It is for business or organization or internal use only. The organization provides the services based on its resources such as servers, networks or data centers via intranet within the firewall. Government organizations or large companies prefer to use Private cloud due to secured environment data and ease of data controlling. Nonetheless, the development or maintenance requires in-house hardware investment.

3) Hybrid Cloud : It is the combination of Public cloud and Private cloud. Whenever, the capacity of Private cloud in business or organization is insufficient, external hardware or other resources can be requested from Public cloud providers. By using this model, the organization can protect some critical data to a certain extent within the firewall. Both intranet and internet will be used in Hybrid cloud model.

D. Development Tool for Editor

Text editor is a tool in writing computer programs such as Java, C, HTML, PHP, and etc. It has the capability to distinguish text in the program code with the difference of color highlight. The programmers can easily recognize the language structure and modify the code by using the highlight feature. Notepad[1], EditPlus[2], and Dev-C++[3] are the examples of text editors. Other important features for the editor are to compile and run the program to execute the output which provided in Integrated Development Environment (IDE) (or Interactive Development Environment) such as NetBeans[4], JCreator[5], or Eclipse[6], and Cloud9 IDE[7]. Some open source code editors are described below:

1) Ace

Ace is an open source software using JavaScript language [6]. It provides the basic characteristics for creating text editor such as Undo, Redo, and Syntax highlight which can be adjusted depending on the language that programmers prefer. Moreover, Ace can implement its own keyboard handler. Ace is used in many kinds of production applications because it provides many features[8].

2) CodeMirror and Orion

CodeMirror[9] is a JavaScript component. In order to customize it, a rich programming API and a CSS are available. Orion[10] is open source platform for cloud based development. Others such as CodePress, CodeTextArea, EditArea, etc.[11] are also used as code editors.

Among others, Ace is a good front-end editor because it supports programmers in syntax highlighting, and customizable markers [6-7]. Therefore, Ace was chosen in developing the editor on Private cloud in this research.

[1]http://notepad-plus-plus.org/
[2]http://www.editplus.com/
[3]http://www.bloodshed.net/
[4]https://netbeans.org/
[5]http://www.jcreator.com/
[6]http://www.eclipse.org/
[7]https://c9.io/
[8]http://ace.c9.io/
[9]http://codemirror.net/
[10]http://www.eclipse.org/orion/
[11]http://en.wikipedia.org/wiki/Comparison_of_JavaScript-based_source_code_editors

III. Online Code Editor Architecture

Online Code Editor is deployed on Private cloud computing in SaaS layer, which can be accessed with many platforms such as desktop computers, notebooks, or tablet PCs via organization intranet.

A. Component of the Editor

The layer of Online Code Editor is shown in Fig. 1.

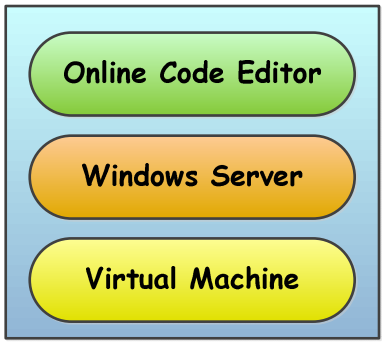

Figure 1. Layer of Online Code Editor.

In Private cloud computing, ESXi which is Hypervisor will be installed as the first layer. It manages the server resources to create Virtual Machine (VM). Therefore, Hypervisor then becomes a VM which is a virtual hardware creating from ESXi in IaaS layer. The users can use it to install an Operating system or software in PaaS and SaaS, and the last layer is VM [8]. In this experiment, VMware vCenter Server (vCenter) was used. It is the management software to create VM on Private cloud computing.

According to Fig. 1, Windows Server is installed in PaaS layer. It is used for managing the resources from VM in IaaS layer. The editor is installed in SaaS layer after Windows Server has been installed. In order to support the Online Code Editor, Appserv which consists of PHP, Apache, MySQL, and phpMyAdmin, including FileZilla server are installed.

Fig. 2 shows the architecture of Online Code Editor. It consists of the main component which is used to compile and run program source code. The main component consists of 2 parts: Server Side Engine and Client Side Engine which use HTTP(s) in communication. Ace will be used as a Front-End to support the editor. Since, the Online Code Editor is Web-based application, therefore; the users can access it via Web browser by using the account on Private cloud.

B. Functions of the Editor

In this paper, the Online Code Editor was developed using JavaScript. It called some functions in Ace which is Front-End editor, such as Undo, Redo, and Syntax Highlight. For users, there are 4 steps in using the editor. First, the users need to login after registration. Second, the users create a project which means that a folder is created in order to store files in it.

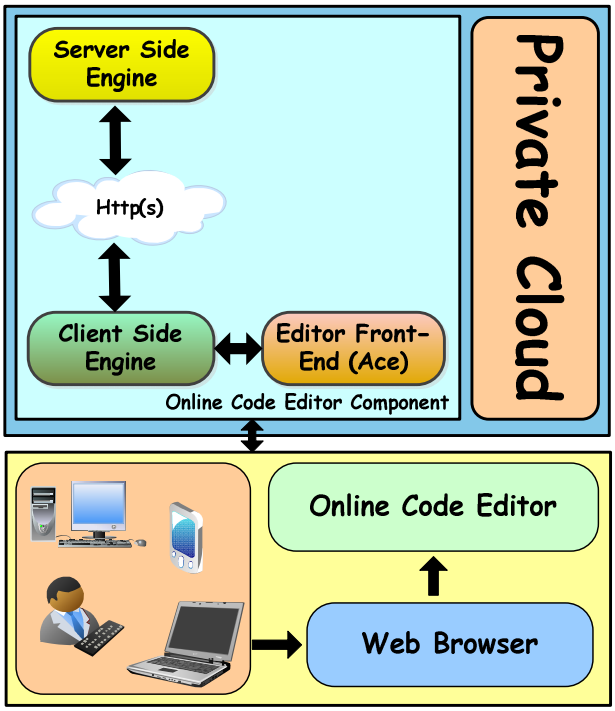

Figure 2. Architecture of Online Code Editor.

Third, the users can create files under the created folder. With this Editor, the users can Import, Export, Undo, Redo, Save, and Run projects or files, etc. The editor supports HTML, PHP, CSS, and JavaScript.

IV. The Use of Online Code Editor

The use of Online Code Editor and its functions can be described as shown below.

A. Create Folders and Save Files

After the user's registration as shown in Fig. 3, the system will create a folder by using the user's registration name. All files that created by the user later will be stored in this folder. After the user creates a project, e.g. Project A, the system will store the detail of the "Project A" such as creating date and time and modification date and time of each folder. Moreover, the editor has ability to automatically change the project name when the user accidentally creates the same name, the editor will automatically save as "Project A (1)".

After the project was created, the user can then create files such as HTML, PHP, CSS, and JavaScript. The file creation is classified into 2 steps as the followings:

1) Filling a name of a file into "Filename" should not be redundancy. Then, in the drop down list, the user can choose a file type.

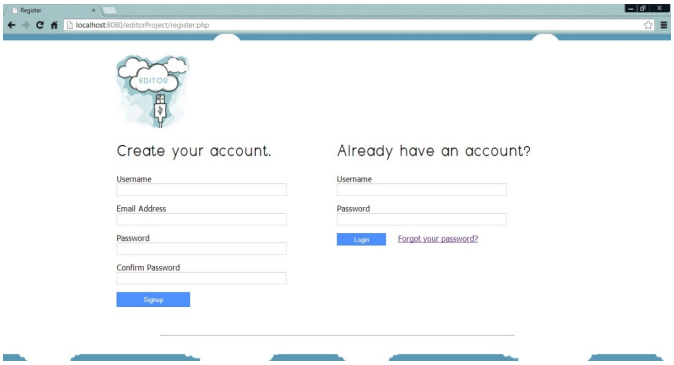

Figure 3. Registration and Login Page.

2) Creating a new file by clicking on menu tab. "File > New File… > " the user then chooses a file type as shown in Fig. 4. The system can manage a file name in case of duplication.

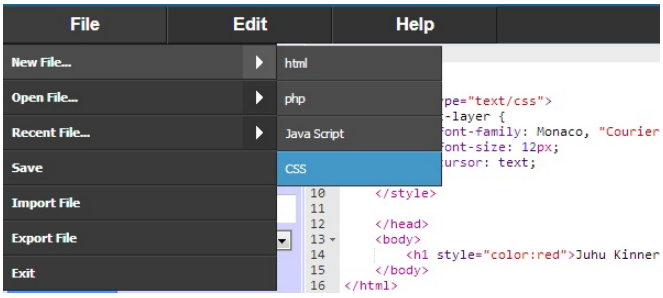

Figure 4. File Creation.

B. File Creation

After creating the file, the user can write program source code in the right space on the web page, as shown in Fig. 5. The system will create essential basic syntax of each language and then store the file within the project folder.

Online Code Editor used Ace to highlight syntax in each language. The editor also used Undo and Redo libraries source code. More functions were added in this editor as described in the followings:

- Import and Export files in HTML, PHP, CSS, and JavaScript.
- Open file, Close file, Create file, and Delete file and project.
- Compile and Run program in only the edited file or within the project.
- Auto save written code in every 5 seconds.

Online Code Editor was deployed on Private cloud, however, it based on Web application. AJAX was used to send and retrieve data in back-end process to make it smooth interconnection. The files and the projects can be created as many as the users' require since there is no limit in using space (but it may depend on the storage of Private cloud in an organization). If there is any update file process, a timestamp will be stored in the database.

When starting to write a source code, the system provides the helpful features derived from Ace such as, when writing HTML file after typing open tag of <html>, the editor will automatically create close tag of </html>, as well as when the user types Single Quote (') or Double Quote ("). The features of Online Code Editor are compared to other text editors features as shown in Table I.

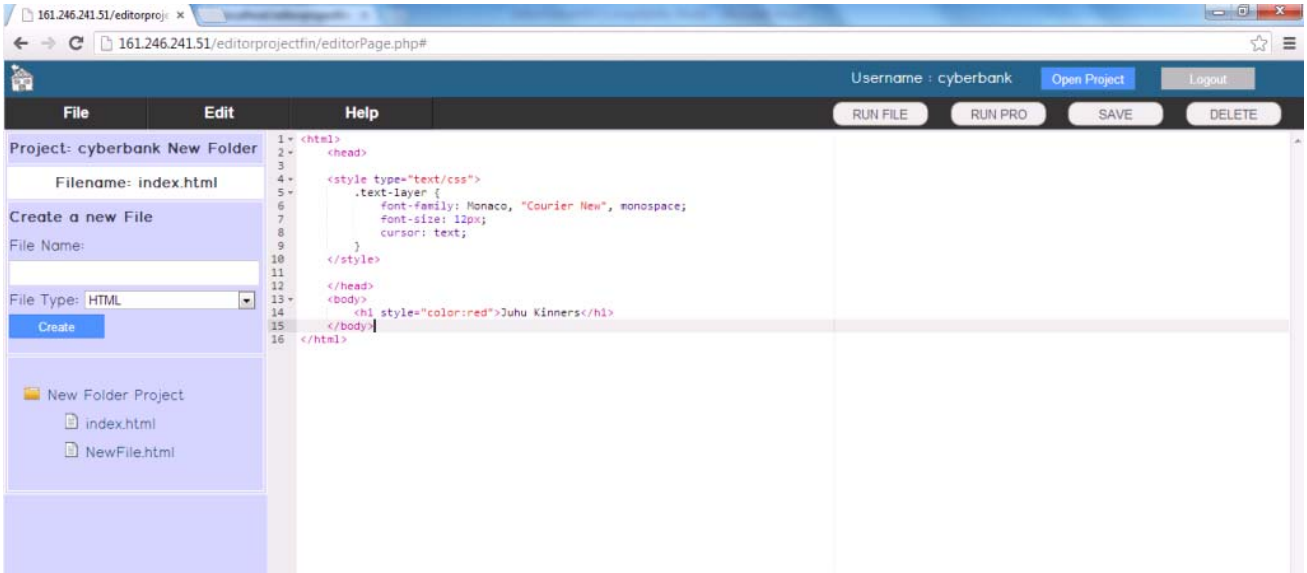

Figure 5. Coding Area in Online Code Editor.

TABLE I. THE COMPARISONS OF FUNCTIONS IN THE ONLINE CODE EDITOR WITH OTHER SOFTWARE.

Function	Notepad++	EditPlus	Online Code Editor
1. Save File	✓	✓	✓
2. Import File	×	×	✓
3. Export File	×	×	✓
4. Redo Code	✓	✓	✓
5. Undo Code	✓	✓	✓
6. Open File	✓	✓	✓
7. Open Project	×	×	✓
8. Run File	×	×	✓
9. Run Project	×	×	✓
10. Syntax Highlight	✓	✓	HTML, CSS, PHP, JavaScript
11. Create File	✓	✓	✓
12. Create Project	×	×	✓
13. Delete File	×	×	✓
14. Delete Project	×	×	✓
15. Close File	✓	✓	✓

C. *Running Code on the Online Code Editor*

The simple source code of "Hello World.html" was run to test the Online Code Editor as shown in Fig. 6. Then the result of running it will be shown in Fig.7.

```
<html>
    <head>

    <style type="text/css">
        .text-layer {
            font-family: Monaco, "Courier New", monospace;
            font-size: 12px;
            cursor: text;
        }
    </style>

    </head>
    <body>
        <h1 style="color:red">Hello World</h1>
    </body>
</html>
```

Figure 6. Testing Program of "Hello World.html".

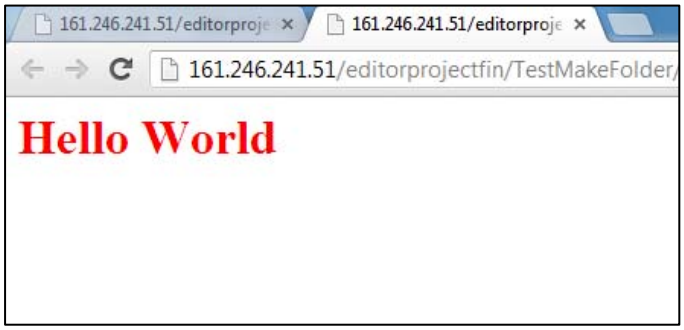

Figure 7. Testing Result of "Hello World.html".

Moreover, the use of hardware resources of Private cloud computing was also examined in this research and 2 cores of CPU, 2 GB. of RAM were used. In order to examine the case when multi-users are trying to execute the code in HTML, PHP, and JavaScript, we found that if no user runs any code, 1.19 GB. of VM memory is used. Then after 10 users coding at the same times, VM memory increases to 1.20 GB., that means the memory of server will be used only 0.01 GB. or 10 MB. Nevertheless, it also depends on the size and the complexity of codes that are going to be written.

V. CONCLUSION

In this paper, the Online Code Editor was created and deployed on in Private cloud computing in SaaS layer. Ace open source software was used to create Undo, Redo, and Syntax highlight. In addition, the functions which are Import/Export files, Save file, Open file, Open project, Create file, Create project, Delete file, Delete project, Close file, Compile, Run file, and Run project were created to make this editor complete.

In addition, the advantage of deploying on Private cloud computing is the programmers in the business or organization can urgently write or modify program source code without any specific physical computers or without installing the editor program. Only 4 computer languages; HTML, PHP, CSS, and JavaScript can be written within this editor. In the future, other computer languages such as C++, C# can be written using the Online Code Editor.

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