Online Code Compilation using Cloud Computing

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Abstract - *Computer Program that Software Developers use to create, debug, maintain, or otherwise support other programs and applications are Programming Tools, Which if produces accurate, meticulous and swift results can lead to Good Quality Error Free Code. This paper proposed the Online Code Editor that was created for Beginners, Programmers Designers or Developers who want to code programs On the Go without use of a Dedicated Software Installed having Full Portability and Transferability. It based on web application running on the Private cloud computing. Editor Features are built on programming languages like, e.g. HTML, PHP, CSS, and JavaScript. The editor isolate's programming languages by highlighting syntax of programs. Users are able to create new files, import/export files. Moreover, Save On Site and Dropbox (Dropbox Api), Clear etc. are the additional functions of the editor. In this research of the text editor development, the open source software called, "Ace Cloud9 Editor" was used for some functions such as Clear 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 and other Cloud Available Services like Ideone, Brackets, Compiler, PasteBin, Codepad, Codeanywhere and others like Notepad++ and Sublime which running on personal computers, were summarized*

Key Words: Sphere Engine; Online Editor; Private Cloud Computing; Ace Editor; IDE

1.INTRODUCTION

Now Days Computer based Software –Editors and Cloud based compilers are very Popular . Even though, the ability of software is less capable than the Integrated Development Environments (IDE), Many programmers who want to edit code might prefer to install an application on there systems or pay online for accessing an Online Editor. Text editors are good tools for programmers to use within small resources as they have many limitations. Nevertheless, they also need to be installed on the computers before using. Therefore, programmers have to have at least one Computer to access their respective codes. In case of scarce need of a PC editing of 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. [4] 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. Program can be saved and complied via web browser and the code will be done at server-side. Then, the output of the compilation is displayed on the same page through Sphere Engine API running in Client Side. Portability is one of the key assets of this editor as programmers can access their code ,edit it and simultaneously execute it on the go with just a pc/tablet or even on a an handset having a working internet connection .This paper also focuses on reducing and saving expenses on buying new personal Computers As it solves the problem of installation and storage. 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

2. CLOUD COMPUTING AND TEXT EDITOR

2.1 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[10]:

"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. This cloud model promotes availability and 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 2.2 and 2.3 below [2-5].

2.2 Cloud Service Model Architectures

There are 3 basic types of Cloud computing architectures:

1) Cloud Software as a Service (SaaS)

The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through a thin client interface such as a web browser (e.g., web-based email). The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings. 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.

2) Cloud Platform as a Service (PaaS)

The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly application hosting environment configurations

3) Cloud Infrastructure as a Service (IaaS)

The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, deployed applications, and possibly limited control of select networking components (e.g., host firewalls).

2.3 Cloud Computing 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:
The cloud infrastructure is made available to the general public or a large industry group and is owned by an organization selling cloud services. 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:
The cloud infrastructure is operated solely for an organization. It may be managed by the organization or a third party and may exist on premise or off premise. 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 :
The cloud infrastructure is a composition of two or more clouds (private, community, or public) that remain unique entities but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load-balancing between clouds).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.

4) Community Cloud:
The cloud infrastructure is shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be managed by the organizations or a third party and may exist on premise or off premise

2.4 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 Brackets, Complilr, PasteBin, Codepad, Codeanywhere and Cloud9 IDE. Some open source code editors are described below:

1) Ace

Ace is an open source software using JavaScript language. 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.

2) Ideone and Sphere Engine

Ideone is a free online IDE and debugging tool which enables users to share and run code online with own input data with 40+ programming languages. It can be used for specific needs, for instance e-learning, recruitment services, programming contests, unit testing of code snippets, web applications testing, mobile applications, malicious software testing. Sphere Engine is open source platform for cloud based development Which has API and CMS Support. Others such as Tutorials Point, W3School, Code Academy, etc. are also used as code editors.

Among others, Ace is an embeddable code editor written in JavaScript. Ace is a good front-end editor because it supports programmers in syntax highlighting, and customizable markers. It matches the features and performance of native editors such as Sublime, Vim and TextMate. It can be easily embedded in any web page and JavaScript application. Ace is maintained as the primary editor for Cloud9 IDE [6]. Therefore, Ace was chosen in developing the editor on Private cloud in this research.

3. ONLINE CODE EDITOR ARCHITECHTURE

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

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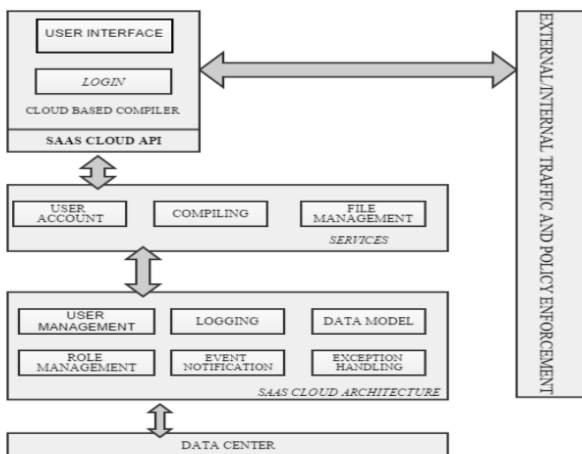
The layer of Online Code Editor is shown in Fig. 1.

Fig -1: Layers 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.
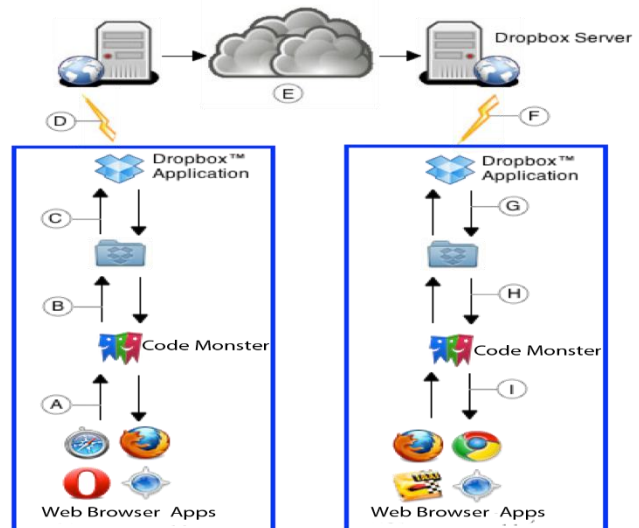

Fig-2 : Architecture of Online Code Editor

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

3.2 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. 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 over 40+ Languages.

4. USE OF ONLINE CODE EDITOR

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

4.1 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.

After the project was created, the user can then create files. 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 as per supported compiler type.
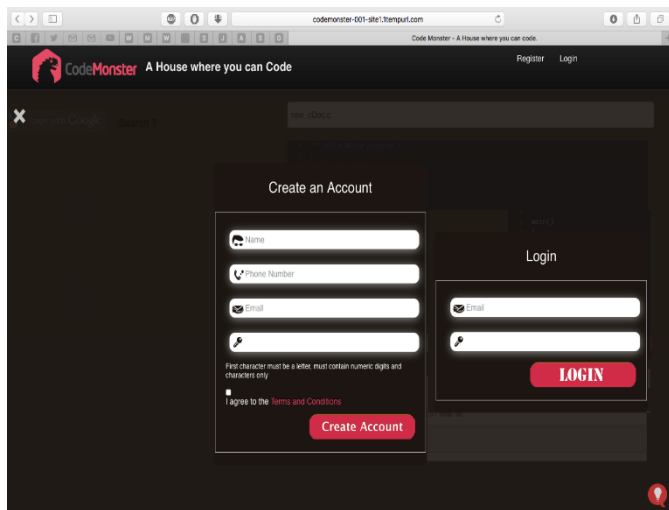
Fig -3: Registration and Login Page

2) Creating a new file by clicking on dropbox tab. the user then chooses a file type as shown in Fig. 4.
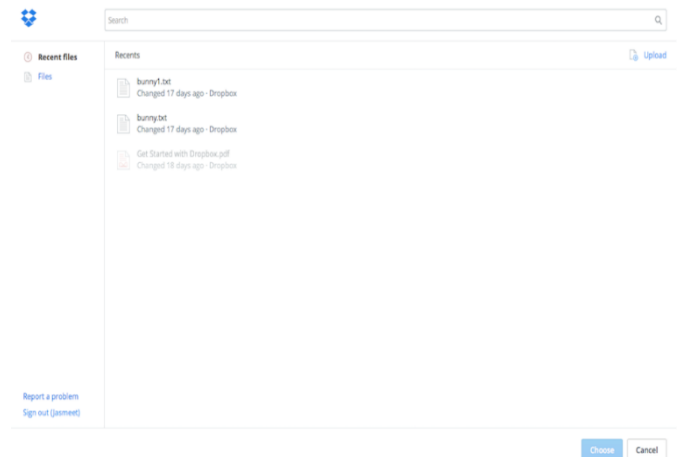

Fig -4: File Creation

4.2 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 over 40+ languages (10 implemented)
- Open file, Close file, Create file, Delete files and save them .
- 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 [3].
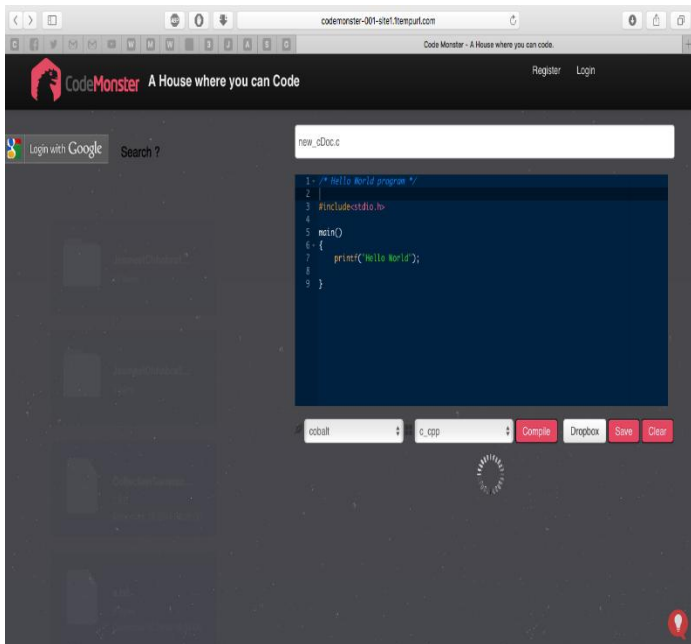

Fig -5: Coding area in Online Code Editor

Table-2: the Comparison of Fuctions wuth other Cloud Editors

Table-1: The comparisons of Functions in the Online Code Editor with other Editor.

4.3 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.
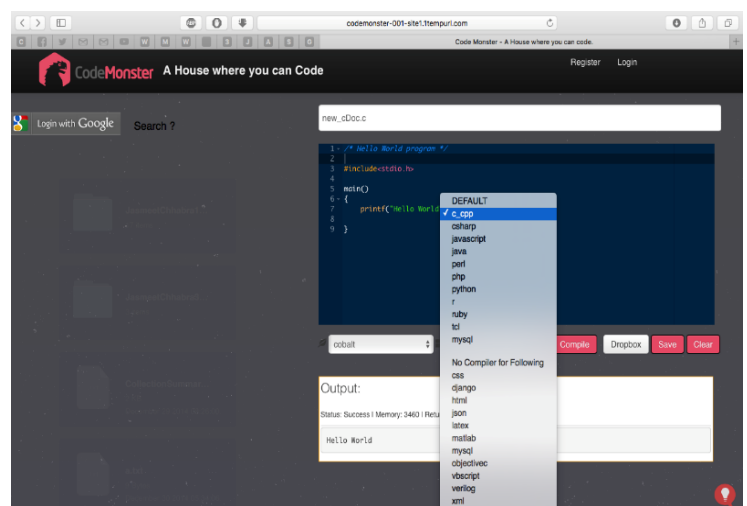

Fig-6: Testing Result of "Hello World"

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. [8]

5. 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, Delete file, Delete ,Compile 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. Over 40+ computer languages; can be written within this editor using the Online Code Editor which is the best one stop solution for all online IDE's and on system built software alternatives.

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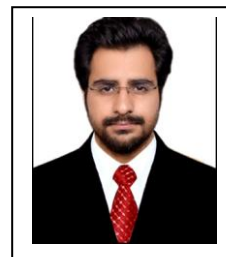
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