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Cloud Compiler Based on Android

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Abstract: ***Compilers are used to compile programs and convert them from written program to executable binaries. To install a compiler manually on each and every system requires a lot of system memory and time to configure each of them. And we also need to install a different compiler for each language on which we wish to work. Even after installation of the system it becomes difficult to update the compiler on each and every system whenever required. Nearly every student uses an Android device. Thus, we planned to use this as a base for helping the students to code and compile on the go using an Android device. We are also implementing an Android IDE application and Web-based UI which would provide the users of the application with a text editor and a terminal with an option to compile the program by auto-detecting the language of the source code. The Android application would auto-detect the language of the source code and then upload it to the cloud with the language details, the cloud system would feed the source code to the cloud system would feed the source code to the appropriate compiler and will return error/output, which will be displayed in the terminal. Developing a Cloud based Compiler would provide the ease of availability of the service from all over the Internet. And the Advantages of Android application is that it will be a very light-weight application to use. Compilers are not needed to be installed on the system hence saves the users device memory and the processing power.***

Keywords: Android, Cloud, Computing, Compiler, Multiple Language, Online, Web based

1. Introduction

Every time it is not possible to carry a programming kit with us. To enable programmers, to code on the go, it will be very helpful if the programmers can program their code on phone/tablet, which is always with them. Program, Compile and Run the code without the need of compiler in his device with the use of the concept of Cloud Computing. The compiler would be deployed in the cloud and the developer would use this cloud for his convenience. Cloud compiler can serve for many clients at one time. No need to install and maintain different compilers on individual clients. Only the cloud compiler, we have embedded in the cloud needs to be upgraded and thus whole system gets updated. Majority of population in this world uses an Android device nowadays. Android Operating System provides lot of functionalities to the user. This operating system is not restricted to be used on a particular device, it can be modified and made to run on various devices from televisions, mobile phones, computers, refrigerators, cameras, etc. One of the most widely used mobile OS these days is Android. Android is a software bunch comprises not only operating system but also middle-ware and key applications. Android is a powerful operating system supporting a large number of applications in smart-phones.

This project is intended for making use of today's popular technologies of Cloud Computing and Android for Integrated Development Environment. Currently, there are lots of IDE's, both open-source and commercial, in the market. Usually they provide lots of extensive features to developers to ease application developers life. However, there are two simple but substantial problems with today's IDE's. First is they require intensive CPU and memory usage which is not available all the time and since these applications are installed on specific system, it prevents portability. By combining Cloud Computing and Android technologies, this project will remove the requirement for powerful systems and provide portability to developer. The Android application provides much better functionality than other heavy programming kits for the Android.

2. System Description

The compiler will be embedded in cloud and used as, Software-as-a-Service (SaaS). The compiler will respond by providing the output of program if successfully compiled else will return errors and warnings. Using cloud as a service also reduces architecture costs of the organisation or the users. This will help the organisation to control the flow for the system.

A. Cloud Computing

Cloud is an idea of providing a computing service to the user instead of providing a product to use. The NIST (National Institute of Standards and Technology) definition of Cloud Computing states that "Cloud computing is a model for sanctioning convenient, on demand network access to a shared pool of configurable computing resources that can be provisioned immediately as required and released with minimal management effort". Explaining cloud can vary from different perspective because it can be used for various purposes. In short, cloud computing means accessing and storing the data and programs over the Internet instead of using your own computer's hard drive. Thus, using cloud computing would provide access to files anywhere provided network connectivity is present. Generally, there are three types of services provided by the clouds. They are as follows:

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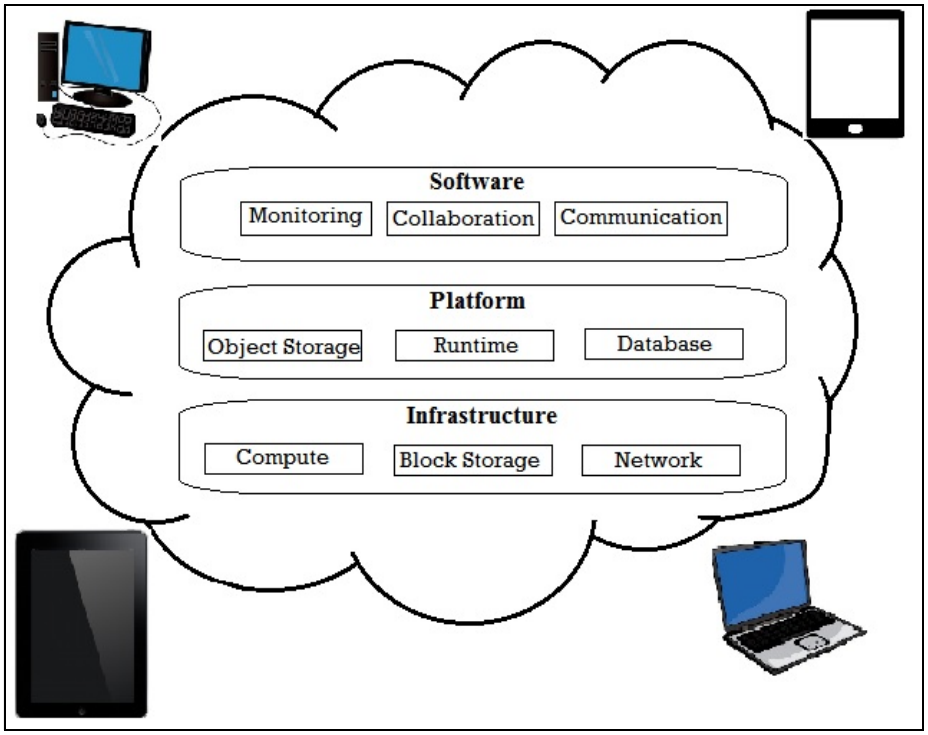


Figure 1: Cloud Computing Types

1) SaaS (Software-as-a-Service)
In SaaS, users are been provided to have an access of using software as a service. It is a software service deployed over a network. For example, e-mails, online payments, online converters and many more.

2) PaaS (Platform as a Service)
In PaaS, users are provided with extra tools, libraries and services of the software to build some product. This tools and libraries helps user to develop the product according to users requirement. For example, Google Docs, w3schools.com, force.com, etc.

3) IaaS (Infrastructure as a Service)
In IaaS, users are provided to access the infrastructure of the service provider. These services as either be data storage, networked computer hardware and operating systems. There are several IaaS providers such as Amazon, Google, Virtual Machine Manager, etc.

B. Android Operating System

Android is an open-source Operating System introduced by Google and OHA (Open Handset Alliance) in September 2008. Android is a layered Operating System based upon Linux kernel v2.6. The layers of Android Operating System consists of, Application Framework, ART (Android Run Time), Libraries, DVM (Dalvik Virtual Machine), and Linux Kernel as the base. The most recent Android version is Android 4.4, widely known as Android KitKat. Google provides Android SDK for developers for developing applications for Android easily. It is the most widely used mobile operating system with more than 80% of the world's mobile operating system being Android. The Android operating system provides users and developers with a complete suite of software for mobile devices such as an Operating system, middleware and key mobile applications.

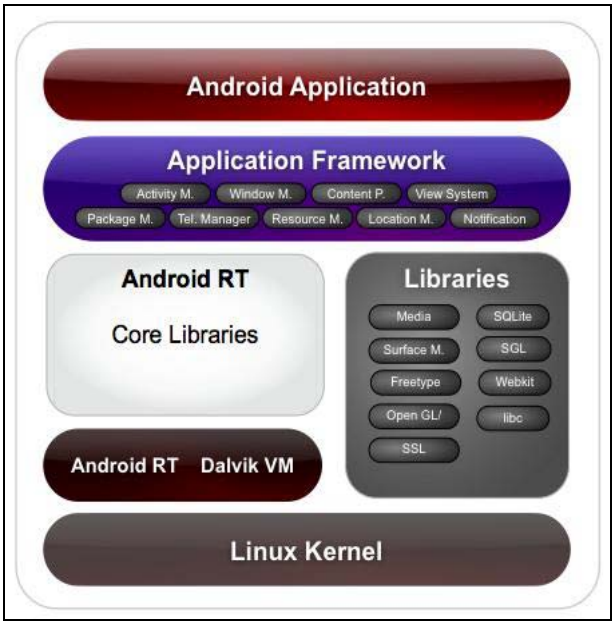


Figure 2: Layers of Android OS

3. Difference Over Regular Compilers

The proposed system compiler has many advantages over general compilers which are installed on one computer. So, because of compiler being present on cloud:

- User's device memory to install compiler is saved.
- No need to upgrade the compiler, every part of maintenance is under cloud provider.
- User will not have to install compiler on different devices, just connect to the service and use it.
- No need to install different compilers for different language code. Cloud compiler will automatically detect the language of code written. This code will be sent to appropriate compiler.

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- A lot of users processing power for compiling and executing the executable will be saved.
- Users workspace on cloud can be accessible from anywhere the user wants using Internet connection.
- This workspace or cloud storage space can be extended on request.
- The workspace is implemented with the high level of security algorithms which will prevent attackers from intruding in the system.

4. Proposed System Architecture

The system is designed to work for three fields, we call it as zones. So, the system is divided in specially three zones:

1) Application Zone
2) Communication Zone
3) Database Zone

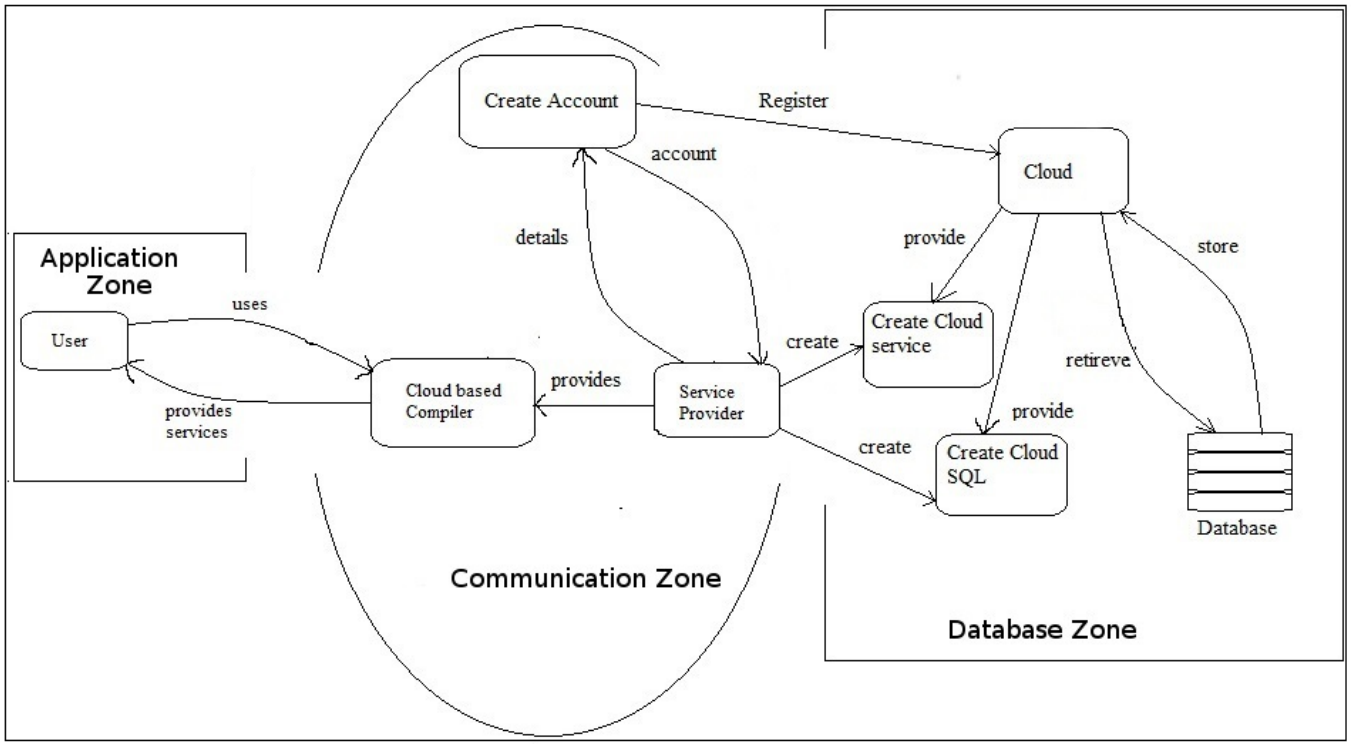


Figure 3: Architecture of the System

Application Zone: The application zone consists of the interface from where client can interact with the proposed system. The modules included in this zone are the Android application and the browser. The Android application is only for versions Gingerbread and above. Any person who doesn't have Android can also use the proposed system through web browser. This web browser can be for any platform like Windows, Linux, Mac OS, etc. These interfaces will provide the user with editors and various options through which user can avail functions needed such as compile and file upload. The application zones must be provided with an Internet connection. Without Internet connection, the compilers can't be used. Only editors can be used for writing the code and can be stored. Whenever the device gets Internet connection, the files will be uploaded automatically if the user wants.

Communication Zone: After once code being sent for compilation, the flow will move into the communication zone. The communication zone is the core part of the model. First, the code's language is used to detect the type of language the code consists. So that the code should be sent to appropriate compiler. Communication zone also includes scheduling the compilation queue and to check whether the compiler is idle or not, if not then the code goes to wait state. After the compiler being detected in the idle state, the codes are sent directly for execution. For getting access to the workspace, the user has to register first time and then login. This transferring of user-name and passwords in an encrypted format is included under communication zone.

Database Zone: The Database zone consists of total back-end contents such as workspace, user-name and passwords. These passwords are saved in encrypted format in the tabular database. The users will be provided with the limited workspace for storing their codes or projects. Whenever any particular user logs in, he will be provided with his workspace only. These files are accessible either from Android application or from the web browser.

5. Modeling Diagrams of System

The whole system's data flow can be well understood from these data flow diagrams. The system can be explained well only in splitting at two levels.

DFD Level 0: Level 0 states in general what the system is all about. User will send code to cloud compiler and the compiler will send back the output to the user.

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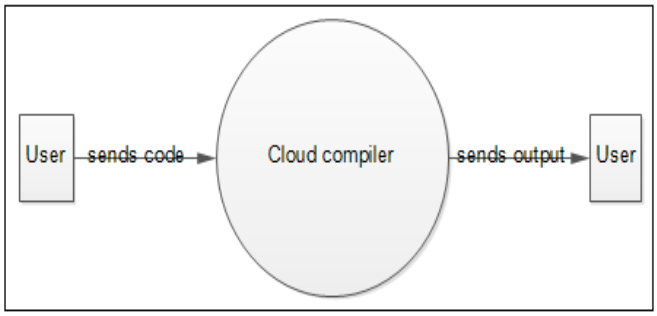


Figure 4: DFD Level 0

DFD Level 1: Level 1 goes little deeper in the DFD. It shows the two interfaces through which user can interact. The interfaces are web browser and the Android application. Then they interact with cloud for compilers and database. The compilers can interact only if they are in Free State.

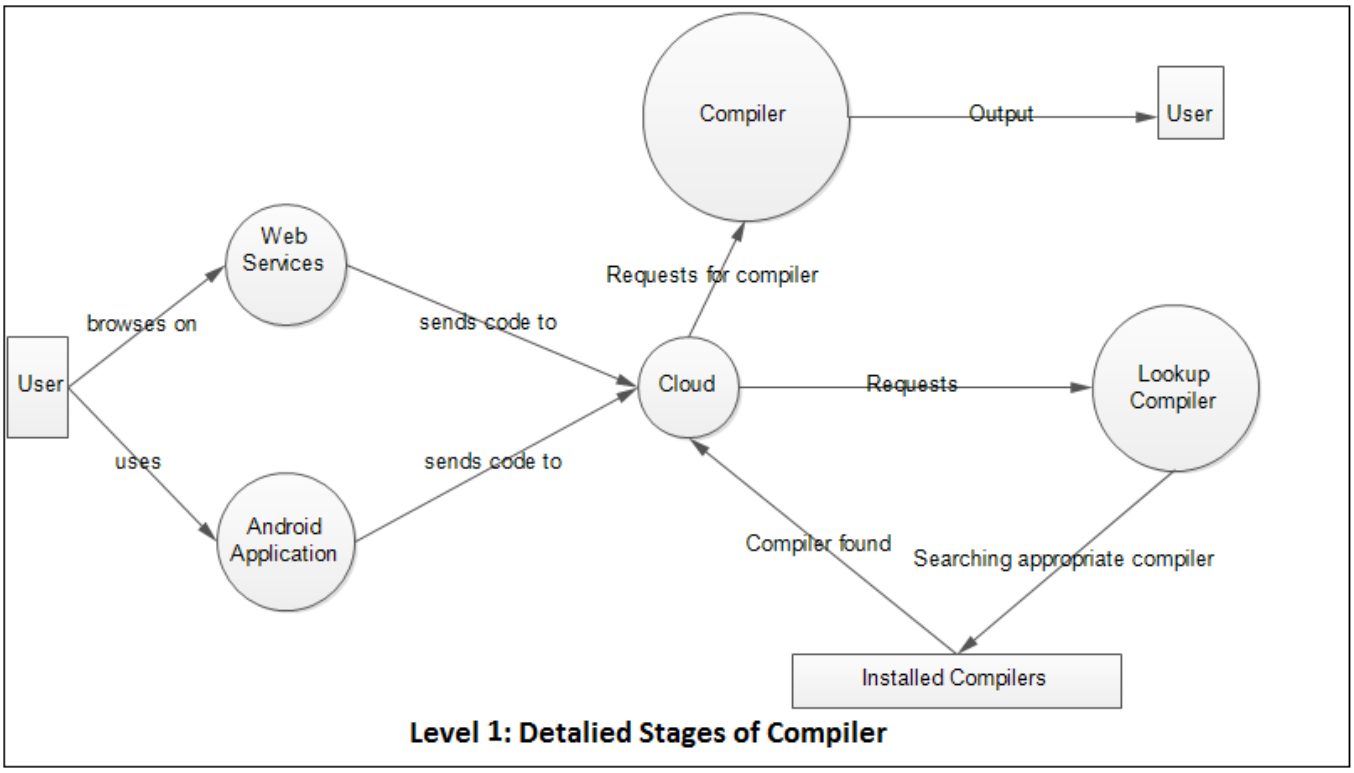


Figure 5: DFD Level 1

6. Future Scope

Although Cloud Compiler has many advantages as compared to its limitations, the future work on this system can include a lot of additional features which will help the user for using this system more interactively. The proposed system's one of the internal goal is to create a system, that will be so user friendly such that user will be most comfortable for programming in this system. For achieving this goal some more work has to be done in future such as:

1. Availability of few more compilers: Currently the system contains C, C#, Java compiler. Later on, C++, PHP, PYTHON, FORTRAN, COBOL support can be added.
2. Parallel compiling for more numbers of codes at a time can be setup with the help of load balancing mechanisms in the cloud. This can form parallel queues hence will decrease waiting time.
3. Implementation of proper real-time input system can be included in the proposed type of systems. Currently, the feature of accepting runtime inputs in the system is not present.
4. Due to such incompatibility with the run-time interaction with the system it creates the high level of complications to provide a debugger in the system.
5. Further, systems can provide the public forums to discuss the problems faced during the development of their projects. These discussions should be accessible all over the web.
6. One interesting thing that can be included in the system is that, user should be able to share their workspace with whom they want. This sharing can be for a person, a group or public with the proper privileges and access rights facility.

7. Conclusion

The online cloud compiler can be a future for compilers. Cloud is a concept like a boon for today's generation. Because of compiler being on cloud general users won't have to indulge in installation or upgrading of compilers. Using a compiler from the low end devices is the great advantage a programmer can have. Users who do not have Android can also grab the opportunity of using this system through web browser. A private workspace is the cherry on

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cake for the registered users from where they get a storage area for codes and executable. Such list-full advantages and many more can make the cloud compiler for multiple languages, a successful system.

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