

Programming Language Compilers on the Cloud

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Abstract: Cloud Computing is a method that allows demanded access to a data centre. These data centres are a shared pool of computer resources. This paper proposes an online compiler that allows to compile all languages. Thereby reducing the storage and compilation needs of the host computer. This allows the user to pick any preferable tool to fit the project. Our major motivation in designing this project is the ability to create codes that are platform independent. All the dependencies related to the code that must be fulfilled by the hardware can be resolved by a single access to the cloud.

Keywords: Online Compiler, Compiler, Cloud

1. Introduction

Cloud computing is getting very prominent in our society. It is used in feels like online shopping. Many large conglomerates like Flipkart hire data centres before large shopping festivals. For example, Flipkart hires SAP Data centres before the 'Big Billion Days'. Data Centres are also used in gaming. New Google's Stadia has changed the future of gaming, by having its own graphics processing unit on the cloud.

Data centres also use the concept of SDN. Software Defined Networks are a new type of Networks, they make use of a centralised controller to program the distributed devices. In legacy devices, the control logic is also present on the device. SDN separates itself by taking the control logic off the device and places it onto a centralised controller. This controller can then communicate to its underlying devices which is often thought of as running the data plane. There is also an application layer to which the user application can be plugged into. The controller acts as a middleman between the upper application layer and the bottom data plane. The controller provides an abstraction to the application layer about the underlying devices, it also instructs the underlying devices by placing forwarding rules in them. Compilers are very commonly used in the field of online cloud computing. In the present day people search for easier ways, faster and more efficient ways to do certain tasks and one such task is building a concept generating an algorithm coding and executing a certain code, this can be done one of two ways either we can use the development kits which are manually installed in each and every device or in recent years a more efficient way has come into play which is using online compilers, many such compilers are there and are used by many people on a day to day bases to make the task of

executing codes easier this can prove useful for many types of people especially those with coding background or jobs related to coding or for students or any personal who are interested in coding or want get in touch with coding as this combination of online cloud and compiler provides an smooth platform to run the code without any complications and behaves just like a typical compiler shows errors and helps in the debugging of the errors ,but one of the downside of using an online compiler is the need for a good speed internet connection as accessing the online compiler is not possible without internet connection this is where the traditional compiler has the upper hand as it does not require any type of network connection other disadvantage about cloud being that the user has no control on the infrastructure These however stand no chance to the many advantages like- less price, fast processors and probability and that online compilers are more diverse in nature and due to which it is chosen by many people over traditional compilers. An online compiler is not drastically different from a regular compiler. The basic functionality of the compiler, such as executing and storing the code is done, the only difference is that these tasks are performed by the web browser rather than the users host machine.

2. Need for project

Cloud Computing is used in many fields because it offers a variety of advantages. Some of them are lower costs, better service due to portability, reduce dependency on the host computer, etc. With our project we aim to provide an advantage in the form of lightness of user devices. Many processors with an internet connection, like Raspberry pi can also use the advanced computational power provided by our project. Thereby providing even the most rudimentary processor the ability to perform deep neural network computations if the user so wishes. It has applications in a variety of fields including banking, engineering. Even in the medical field, microchips can be inserted into the patient's body and can perform complex computations to regulate and maintain vital signs of the humans.

Online compilers can be made very diverse as we will be able to provide a platform to the user who is writing the code to pick the a programming language in which they choose to write the code and then the server in the cloud will see the option picked by the user and a field is provided where the code can be written

and with just a click of a button provided the program will start to run and errors are displayed if any, if no error exists a no error message will be shown and the code will run and provide the desired output. This cannot be done in a traditional compiler as each language will have a development kit which has to be installed in each and every device in which we choose to carry out the coding activity, this can be very time consuming and can be very limited in terms of accessing the code from another device as it will not be possible but if we use an online compiler then each individual will be given a username and a password which is unique to that person this is done to protect the personal information of the user and for the purpose of authentication and once that person types in the unique information they will be automatically taken into their workspace or account where all their previous codes and data will be stored in an organised manner and can be accessed anytime from any place with any device with a moderately good network connection so as to gain access to the account. When we talk about online compilers everything is stored in the cloud safe from intrusion and other risks making it a safer way to store valuable codes, traditional compilers will not have such a personalized way to deal with its user making online compilers more user friendly.

Other common examples we have noticed are whenever people want to get into coding, they really struggle with the installation of compilers and frameworks on their desktops. We have devised this project in an attempt to eliminate all these unnecessary problems. Another added advantage of our project is security. By maintaining a server side database, we can send only the required .exe code to a client machine. Thereby preventing the client machine from making any changes to the high level language code.

3. Related works

In our quest to understand this topic and its many implications, we stumbled on a variety of papers:

“Online Java compiler using cloud” by Mayank Patel, is one such example of this. Along with a few listed in the references. There are many systems that also provide cloud computing, each with their own features. Amazon EC2 provides its infrastructure as a service. Whereas the Google’s App Engine and Microsoft do this by offering their platform as a service. Another such work is a file system developed by Google known as the Google File System. This method is fast and reliable and stores large data’s on the server. The file is split into 64Mb and provides throughputs that are high and latencies that are low.

Shuai Zhang has spoken about the advantages of cloud computing such as having no need of expensive equipment and thus reducing cost and this is safe and reliable. Professionals are ready to remove any virus and provide recovery services to failed storage space. Satyanarayanan has proved another advantage of portability of compilers in servers. To drop a process, we add a Virtual Machine or an Operating System in the process. The data that is inside the Virtual Machine is very

big. To reduce it we use a small product known as the Cloudlet which is installed on the base VM. And hence this can be used by Wi-Fi and 4G to acquire a server.

Characteristics of cloud are very difficult to distinguish for example their grid, cluster and systems as told by authors. So we can use a Cluster with a single entity and a Grid is used with a multiple entity. Both are used in the administrative domain. The National Institute of Standards and Technology has said that the Cloud Computing enables easy and provides access to a pool of resources at the given moment. So this provides very good flexibility, cost is reduced and overhead for end-users is very less. Many IT companies and organizations have their own private cloud that is used only for their own needs and communicates with other clouds of different companies and organizations. So the author has described that for each cloud in company, the infrastructure of the cloud has to be very good. One author has described cloud to be of two types: one being the cloud infrastructure and the other which is the cloud application itself. All or both of the two types must contain very good availability and has to be properly distributed. There must be a local storage to store offline which is a major requirement is every modern industry.

4. System design

The Cloud Computing is applied in a 3 tiered architecture.

- *Front End:* Ensures that the Syntax and Semantics of the high level language code is correct. It utilizes the front end to also perform type checking and error reporting.
- *The Middle End:* performs the function of the intermediate code generator as well as the code optimizer.
- *The Back End:* This performs the required translation from high level to assemble level.

The functions performed by our project can be broken down into 3 steps:

1. *Compile Option:* This basically takes the codes written by us to the server side for compilation purposes.
2. *Execute Option:* This option provides the user with a list of executable files. These files were compiled by our framework.
3. *Start Test option:* This is basically a button which allows us to start the compiler

All the executed codes and the timestamps of when they were executed can be stored in a Database that's maintained on the Server. Our online compiler has the ability to execute the code that's been put on the frontend by the user (for example: .c / .cpp). The compiler after executing this code to an executable form(.exe) stores it on the server side database. The database contains many such .exe files. Any particular .exe file can be accessed using a URL. These URLs are sent by our compiler to any device over a secure network connection. Therefore, any device, irrespective of the processing power can run these .exe files successfully.

5. Project architecture

The architecture that we propose is a 2 tiered. The upper layer consists of the Data centre running the SDN network and the lower layer consists of the client machines.

The important components of the system are as follows:

- The Data centre, where all the compilation of code is actually performed.
- The Server, which is required to handle the HTTP messages from the client machines.
- The Database, this is further broken down into 2 parts: User database and a code database. The code database is used to store the executable files and the user database basically stores information about the user, whether he is saving the high level code or if using the machine level language code. It also contains metadata about the user.
- Then comes the clients who are using our project.

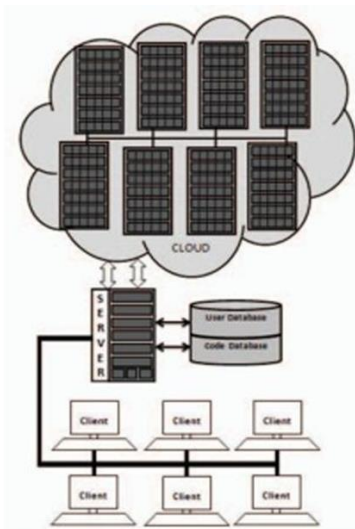


Fig. 1. Architecture of online compiler

6. Compiler development in cloud

So basically, the compiler will host itself on the web server in the cloud and then it can be accessed on the web browser like html.

1. The cloud will be stored in the machine that contains the node.
2. The compiler will then come into presence for all programming languages like C, C++, Python, Ruby, PHP etc. will be the application that is used in the cloud in the server side of the web.
3. Finally, it is accessible by SaaS which is known as Software as a Service and it will now have a private infrastructure.

Various inputs and outputs of compilers are listed below for each language for a program:

1. C - printf (“ ”)
2. C++ - cout<<” “ and cin>>” ”

3. PHP - echo ’ ‘
4. Python - print “ “
5. Ruby - puts “ “

7. Conclusion

Compilers are a very important and useful component as they convert high level language to machine level language so that our device can understand the operations it should perform to provide us with the desired output and whose implementation is fairly easy and can help shorten the time of execution of a program which might be written in any programming language such as Java, Python, C/C++, HTML by making access to the cloud easy. Since such compilers are inside the cloud, portability is an added advantage as it can be used anywhere in the world. Another advantage is scalability as compilers in the cloud can be used without development kits and not being installed in all devices used by the user.

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