Design a RESTFul Web Servicefor Private Cloud

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Abstract:-

This paper is an illustration of a controller designed for Lab Server on a Private Cloud. RESTFul labs architecture helps the Lab Servers to maintain all the hardware in place, and use that hardware for different experiments. This helps the user to provide real lab experience. This was mainly implement on a private cloud which provides virtual machines and physical machines on demand for the user, run tasks on those machines and return those machine to the pool. RESTFul web service is aimed at developing a robust and scalable Controller that manages the pool of machines efficiently and enable Lab Server to perform on the host machines.

Keywords: - REST,Private Cloud,Lab Server,remote laboratories, web services

1. INTRODUCTION

iLab is a Lab as a service private cloud application that provides physical machines, virtual machines, ESXI hosts on demand for the user. The main feature of this project is to address the scalability of user access [1] .iLab can reduce the cost of setting up of labs all over the world. Instead the underutilizedlab equipments can be pooled and can be used by the client as and when required by implementing a feature such as reserving a machine for a particular during and running tasks on it. iLab is a cloud infrastructure which can be accessed across the globe. This can be an outstanding feature of cloud as the labs can be shared across the globe. And when there is space constraint and new labs cannot be setup, shortage of finances in developing countries, they can access these labs and can have real lab experience.Web service is software which can be accessed from the web browser that uses standardized XML format for communication. These web services can be accessed from any operating system or platform. Such as Windows can communicate with Linux. Java can talk to PHP, Perl, and Python etc. Web services are mainly used for information exchange between applications and software on different platform. Traditionally SOAP was used with WDSL standard. XML data format is used. SOAP is used to transfer of data. WDSL describes the rules of how to transfer the data and availability of services. SOAP was developed by Microsoft. SOAP has an inbuilt error handling capacity. This is extremely important as when a request has errors, it sends a response with the reason for errors, this makes it easy to debug. In much language using XML with SOAP becomes more complex, and if any errors persist, SOAP is intolerable to errors. REST is an architectural style where communication to a particular server is done in URI format. This overcomes the shortcomings of SOAP. Previously SOAP was used which supported

only XML format for sending and receiving data. Since XML has beginning and closing tag for every data that is sent, if becomes a heavy weighted format to send on network. To overcome this, JSON (Java Script Object Notation) format is used which is a key value pair. It is language, platform and transport independent. REST works well in distributed environment. In this paper we are developing an architecture that will monitor the client machines and using iLab UI enable to execute tasks and experiments on a particular hardware or a machine. This uses the RESTFul architecture to implement the proposed system in this paper. Users can now execute their experiments and tasks on web without the need to have those hardware components needed for experimentation on the users machine. No need to make local installation.

2. RELATED WORK

The ilab developed in this work is based on many previous works that are done by different organizations and institutes. One such work is done it MIT university ilab architecture which mainly concentrates providing virtual labs for science, engineering and research students. This was mainly concentrating on iLab shared architecture integrating with open source Learning Management System (LMS) [2]. Another work was developed as an Android application which was based on operational amplifier circuit. The student has to connect the wires to the nodes and send the specification to Lab Server via Service Broker. That experiment gets executed and returns the results in the form of waveform. Experiments can be executed through the mobile interface by students all over the world. It uses3-tier architecture, where the middleware is a Service broker, servers as a web service[3]. Another work on Lab as a Service is using cloud computing features to provide training sessions on the very cloud computing feature. These labs provide virtual machines, physical machine, ESXI hosts, networking infrastructure etc to learn cloud. This provides a real lab experience and help

student around the world to take advantage of these labs; this is mainly helpful to students who cannot have expensive lab setup. These classes were also integrated with audio and video streaming to give real lab experience [4]. Another work was based on MIT iLab architecture, which was based on iLab Shared Architecture (ISA). Sharing the lab experimental results across the institutes was implemented in Europe. ISA has ainbuilt mechanism of having trusted connection between its network nodes. This can be extended to cross institution platforms by using service broker architecture. This service broker authenticates and authorizes different institutes and their users and allows them to access only those experiments and results they are authorized to have access [5]. IIT Mumbai has also made an initiative to setup virtual labs to provide access to science, engineering and research labs to students. This initiative was made to utilize the resources by students other than their own college. Remotely triggering the experimental setup and getting results in the form of simulation gives a real lab experience to students [6].

3. PROPOSED SYSTEM

RESTlabs architecture is being used to address the short comings of previous architecture which did not use the URI format. The lab architecture will be 3-tier architecture. First is the lab Server, second is the Web service and third is the user machine or interface. Main features of RESTFul web services.

•   All the clients can access the Lab server through the web browser only thing needed is to redirect the Lab Server to a proper web service.

•   SOAP uses XML which is a heavy weight sending and receiving language. If we use REST it is compatible with XML and Json (Java Script Object Notation) which is a key value pair. This does not have beginning and ending tags needed. So it is easy to send with http/https protocol. REST also uses http methods such as Get, Post, Put, and Delete.

This mainly helps in iLab Shared Architecture (ISA). It helps to share the resources all around the world. iLab also address the problem of underutilization of resources. Many students or users from around the world can access this iLab application through the web browser interface. Every user or student should have a user id and password to access the application. Whenever someone login that time he/she will have access to all the shared resources on the web. If this is implemented in an organization level, then the employees of that office can have access to the company's resources, remotely manage and schedule tasks on pooled machines. Main objective of this project is to design a generic controller which is a web server needed to enable virtual labs Lab Server to send tasks/experiment specification to actual hardware/client machine. This web service uses the above REST architecture which will allow making communication through URL format on a particular port. This controller will receive the information and save that information into its database. This information is then sent to the client machine/hardware to execute the experiment. Then the client machine sends back the results to the Lab Server through the controller. This controller acts as a broker between the client and the server.
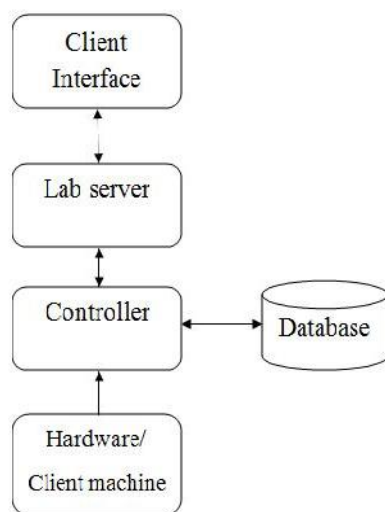

Fig 3.1 iLab architecture

A. REST implementation

The RESTFul architecture uses URL format. So it uses the protocol to communicate. The network protocol used here is HTTP/HTTPS protocol. The web service can be tested with the chrome plug-in called postman. This acts as a agent interface for the testing framework. The controller is programmed using PHP5.4 and HTML. This uses a PHP framework called YII framework, which works on MVC architecture. MVC architecture means model view controller. Models are the database tables. Controller is where the actual implementation details reside and View is the UI interface. This uses the HTML code. All data that is passed with results and received with the data is in the form of Json which is light weight message sending format. This format is independent of all the languages. This format can be easily parsed in different languages. These properties make Jsonan ideal data interchange language. RESTFul web service has a tight binding with HTTP as it uses the HTTP methods. Controller also uses the Database to save the information. The Database used is MYSql and we need to make connections with the PHP to communicate. Sql queries are used to fetch and save data to the DB. We can also use MongoDB as it saves in the form of key value pair, which is compatible with Json Object. Watchdog implemented using the cron jobs provided in linux systems

CONCLUSION

This paper has outlined the way in which a generic RESTFul controller for any iLab remote labs. This controller can be used for different virtual lab architecture with minimum changes according to particular lab specifications. This controller is compatible with any operating system platform such as Windows and Linux, and even flavors of Linux such as fedora, ubuntu etc.

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