Automation Framework Development for Continuous Integration and Deployment in CT Machines Using LXC and Docker Container Lightweight Virtualization Techniques

Lakshmikanth B
Computer Science Engineering
Ramaiah Institute of Technology
Bengaluru, India
blakshmikanth9@gmail.com

Monica R. Mundada
Computer Science Engineering
Ramaiah Institute of Technology
Bengaluru, India
monica@msrit.edu

***Abstract*—In the present enterprise level, computer system assets are supreme to the point that they frequently have surplus limit. It is legitimate practice to devote singular system to a individual application. Only some applications utilize limited running power, yet with the utilization of local techniques and advances, a large number of PCs will be utilized particularly with regards to a completely fledged industry. Virtualization comes into picture here where the manager can solidify a huge number of individual PCs to a solitary server. Virtualization supports new chances to server farm management, letting client's assured uptime of servers and as well as applications, speedy disaster recovery, Instant deployment of new virtual machines, Elasticity, Reconfiguration of running computing environments without affecting the clients/users. Virtualization plays a vital role in improving maintenance of healthcare devices such as CT machines. There are several CT machines which are running with a very naïve technology for which specific number of resources such CPU, memory, processing, labour must be dedicated which is definitely a huge wastage of resources. Using virtualization techniques, resources can be used in an effective manner, and there is a need to develop an automated framework which should be language independent and supports cross platform by which unification of different CT models can be done. This framework also automates many manual tasks related to CT machines reducing the man power and indirectly reduces the manual mistakes.**

Keywords— Virtualization, containers, CT machines, automation, lightweight virtualization.

I.INTRODUCTION

The Technology that allows the user to create one or more than one simulated environments is called virtualization. Virtualization is done by dedicating resources to these environments, the resources are allocated from a single physical hardware most of the times. By directly enabling the virtual machines(VM's) connect to the bare metal resources the hypervisor software enables the VM's to share the underlying resources. Hypervisor or Virtual machine manager (VMM) is an intermediate managing software used to manage, control and even to provide an environment which is very secure for multiple VM's created on the single host. All the VM's on the host machine are directly dependent on the ability of the hypervisor to separate as well as distribute the resources individually to every VM present on the same machine. In most of the cases the resource to be allocated is taken as an input from the user. The machine with the physical resources and equipped with a hypervisor on it is called a host machine. VM's that use the resources in the distributed fashion that gets allotted by the virtual machine manager are called as guests. The guests assume and treats the system resources like CPU, storage, RAM/memory as the set of resources that can be easily re-locatable. The virtual instances of the mentioned resources are maintained by the operators to make sure that the VM's or guest OS will get the requested resources on demand. Fig 1 diagrammatically represents the lightweight virtualization.

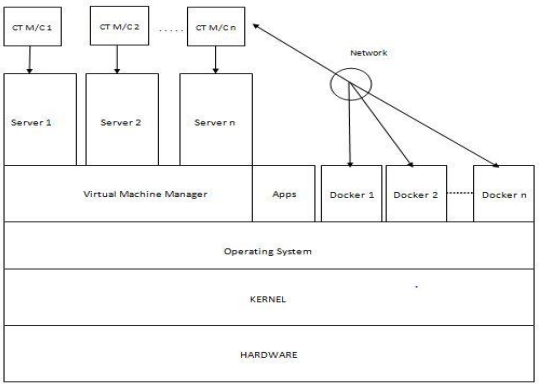

Fig.1: Lightweight virtualization

VM management will be done using the virtualization management console which is a web based consoled in ideal cases. Due to this console, the things will be speeded up. Virtualization also enables user to decide the processing power and the network parameters to be allotted to the VM's. Since these VM's are mostly isolated from the underlying hardware the environments are well protected. Even there is a complete isolation between the VM will result in a better security for these virtual machines.

In simple terms virtualization is a technology that enables to provide the software services using a different approach than that of the traditionally bounded hardware technology with comparatively higher performance and maximum utilization of resources.

Virtualization is broadly classified into 2 types

1. Full virtualization
2. Para virtualization (also called light weight virtualization)

II.LITERATURE SURVEY

[1], discussed the impacts of virtualization in the paper "VirtualizationTechnology and its Impact on Computer Hardware Architecture". Authors discuss about how today's hardware of computer is designed and architected to run one operating system, which makes most of the resources underutilized. Authors also discuss about what is virtualization, its significance in reducing costs, space and several other issues. Also discusses about virtualization impacts on computer hardware architecture such as CPU, memory, IO, memory allocation methods. Advantages and disadvantages of virtualization such as security, power consumption and network complexity. Also suggests some new methods and techniques to include and follow in industries.

[2],have reported about various virtualization techniques in the paper "A Study Report on Virtualization Technique". Authors mainly focuses on the literature survey where the do the survey and review several papers written on virtualization and its techniques. They conclude the paper by saying that there are 3 major areas where virtualization is used to the most and they are storage virtualization, network virtualization and server virtualization. Several new designs and frameworks were schemed which increases the CPU utilization, availability of the system and reducing the power consumption, management overhead and operational flexibility.

[3], talked about various techniques used in CT scan in "Comparative Study of Different Techniques Used for medical imageSegmentation of Liver from Abdominal CT Scan". Author discusses about the how fast, accurate and safe the Computed tomography (CT) imaging is. Author also discusses how CT imagining provides the cross sectioned view of internal tissues and how it is visualized. Main aim of this paper is to discuss the different methods and how those algorithms are used for scanning the liver with abdominal CT imaging and how this image is used by radiologists to get to know and see the detailed information about the tumor detected in liver. Author concludes by saying that using NS based Thresholding will not only reduce the computation time but also gives good segmentation results.

[4], mainly emphasizes on docker and its features in the paper, "Model-DrivenManagement of Docker Containers. Authors discuss about the virtualization technique called Docker, its features and background details such as architecture, underlying and surrounding technologies with some drawbacks. Authors propose a new Docker model based on model based management system by explaining the new Docker model architecture in an overview, designing tools, synchronizing tools for dockers, Docker design, a graphical model-driven tool chain which is used to design, reason, and deploy containers and also how the new Docker model is connected to online. Authors also discuss the validation done for new Docker model with respect to performance, online model manipulation and Scalability of model-handling at runtime.

[5], proposed a framework called DCSPARK and mentions the details in paper, "DCSPARK: VIRTUALIZING SPARK USING DOCKER CONTAINERS". Authors discuss about the conflicts several applications get into such asconfiguration, library dependencies etc. while running on the same MapReduce cluster. Toovercome these conflicts while maintaining the same MapReduce cluster, authors have proposeda framework called DCSPARK which can grease the power of docker containers in 1 physicalcluster. Further, authors explained the implementation of DCM framework which manage thephysical cluster, processing, scheduling problems. Paper is conclude by saying that this framework may add negligible overhead for CPU and memory resources when compared with fundamental spark cluster.

III.SYSTEM DESIGN

System Architecture

System architecture is the logical representation of the entire project, the details of this architecture is as follows. The requester who may be customer sometimes initializes a request and this request is made through the input module which is graphics user interface and this request is further sent to a server where it identifies the model type and forward the request to the respective container that had been setup at the very beginning phases of this project and the servers even parse the scheduling details i.e.

where and when the requested content has to be sent and stored in a scheduler and this scheduler sync with the timer in the server. Below Fig 2 shows the system architecture.

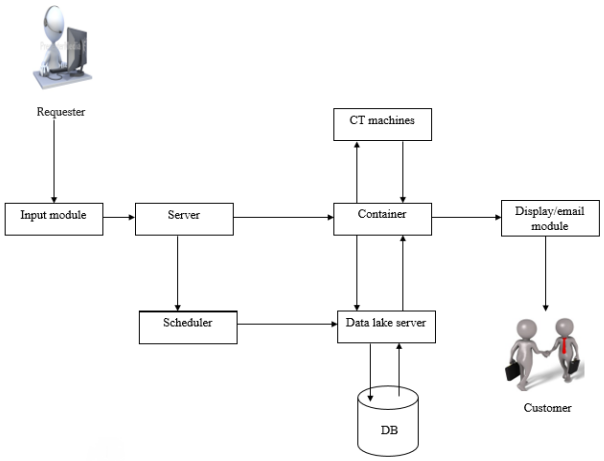

Fig.2: System Architecture

Once the request reaches the respective container to which it is intended then the immediate action like making a sweep request to the CT machines linked to that container takes place. The data retrieved will be mostly in text and not structured, this data must be formatted properly so that it can be parsed easily and then this formatted data will be forwarded to the data lake server which manages all the databases. The request data is now well formatted and gets stored in the database. When the requested time comes then the scheduler will trigger the request to send the data, this request is made to the data lake server and this server immediately fetches the data from its database and forwards it to the container such that the container will send it to the output or the email module based on the type of request made and finally the customer will receive the data without any intermediate manual processes.

Existing System

The Computed tomography (CT) machines developed and manufactured by the many companies now-a-days are distributed to various locations in the world. Different set of models present in these CT machine and every model runs on their own customized operating system (OS) and applications developed in different programming languages. Once the CT machine is turned on the continuous interacts with the servers at the developers site till they get turned off, the servers that interact with the CT machines are also model specific i.e. a CT machine of model A can interact with the server specific to model A, this is because of OS and language dependent architecture used in these systems. Over time many CT machines with different models has been deployed over the world with different set of OS and customized applications in each model. Managing these systems has to deal with many complexities that ranges from minor bug fix to major upgrade , Further adding to this some of the simple task like collecting error reports from these machines also involves lot of manual work where different types of sweep request has to be made for various set of devices. All these put together causes two major problems

- Increased maintenance cost that includes the overheads of upgrades and patches and even data retrieval operations
- Underutilization of resource which is true especially in legacy model where only a few of these models are still in existence, we can't compromise for the device support due to various reasons which include the company's reputation.

Proposed System

For the above mentioned problems virtualization seems to be suitable solution, i.e. instead of maintaining a dedicated server for different models, it is better to use virtualization techniques where a single server can be divided in to several servers virtually and each of these virtual servers are capable of performing the same task which is performed by dedicated servers. As per this problem light weight virtualization techniques like KVM, LXC and dockers are very appropriate here the resources gets allotted on demand basis and all the available resources(servers) can be pooled and virtualized, Every server is considered as a separate host machine and a layer called hypervisor will be introduced over these hosts OS and above the hypervisor layer several guest OS will be installed i.e. virtually creating a dedicated servers over same hardware, each of these guest systems are used to support the ongoing operations related to CT machines as a dedicated servers. The below Fig 3 shows the pictorial view of proposed system

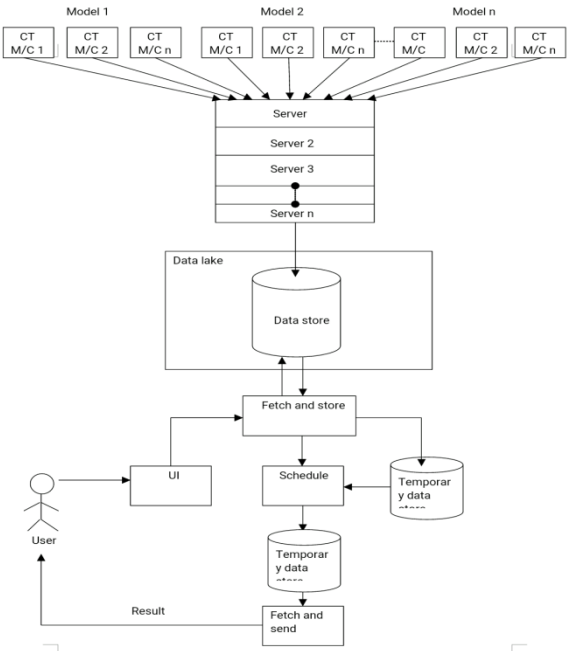

Fig.3: Proposed system

By making use of the light weight virtualization techniques automation framework can be built and this framework will make continuous integration and continuous deployment (CICD) possible in different models i.e. by creating the image files from the code and some configuration files in the docker container. These image files are both platform and language independent which mean the image files can be run on any system irrespective of the OS present and the language present. On the other hand by creating multiple containers on the servers and assigning some predefined set of CT machines to interact with these containers ensure the maximum utilization of resources.

Using this framework some of the tasks that has been carried out manually in the existing system can be automated, for instance it is a hectic job to collect data from different models since different type of requests has to be made for these machine but due to this frame a single REST API call in an automated script can collect the data from all the devices at once.

IV.RESULTS AND DISCUSSION

We observed that about 30% improvement in resource utilization such as memory, CPU, storage etc., from using existing method to proposed method. Manageability of servers also increased as the need of maintaining 5 severs is decreased to 1 sever (in our usage) and also observed an improvement in the obsolescence management which is lack of availability of original source (such as GPU in our case) can also be simulated for some software which is in need.

V.CONCLUSION

This paper presented with an approach which can be used to overcome the drawbacks of the current existing system to maintain every single model that runs on their own customized operating system (OS) and applications developed in different programming languages such as increased maintenance cost that includes the overheads of upgrades and patches and even data retrieval operations and underutilization of resource which is true especially in legacy model where only a few of these models are still in existence, where compromise cannot be done for the device support due to various reasons.

REFERENCES

[1]. S. Amir Ali, J. Pham, B. Englert, and X. Wu, “Virtualization Technology and its Impact on Computer Hardware Architecture”, *inEighth International Conference on Information Technology, ITNG 2011, Las Vegas, NV, USA, April 11-13, 2011, IEEE, 2011.*

[2]. G. Neha, G. Anshi and Dr. N.S. Shailendra, “A Study Report on Virtualization Technique”, in *International Conference on Computing, Communication and Automation, ICCCA 2016, Noida, India, April 29-30, 2016, IEEE, 2016.*

[3]. M. Jayanthi, ”Comparative Study of Different Techniques Used for medical image Segmentation of Liver from Abdominal CT Scan”, *in International Conference on Wireless Communications, Signal Processing and Networking, WiSPNET 2016, Chennai, India, March 23-25 2016, IEEE, 2016*

[4]. P. Fawaz, C. St´ephanie, A. Yahya, M. Philippe, “Model-Driven Management of Docker Containers”, *in 9th International Conference on Cloud Computing, CLOUD 2016, San Francisco, CA, USA, June 27 – July 2, 2017, IEEE, 2017.*

[5]. L.D. Zhou, C. Shengbo, Z. Caixin, L. Xianyang, “DCSPARK: VIRTUALIZING SPARK USING DOCKER CONTAINERS*”, in International Conference onAudio, Language and Image Processing, ICALIP 2016, Shanghai, China, July 11-12, 2016, IEEE, 2016.*