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An Optimized Virtualization Using Docker Container

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Abstract*: *In cloud, hypervisor based virtualization is the most prevailing technology for virtual environment. On any guest operating system it can perform but it increases the overload on memory and CPU. So managing the overload on memory and CPU are quite a challenging task on virtualisation environment. In this project, Docker container method is proposed for reducing the overload on memory and CPU. The proposed method is a container based virtualisation, which does not execute on complete operating system but run on partial instances of host operating system.
Keywords: ***Virtualization, virtual machine, Docker container, CPU, memory, performance evaluation***

I. INTRODUCTION

In past decades cloud computing has made a good progress in how information can be stored in virtual way, exchange information and protect the data from unwanted users. Due to this cloud computing, the virtualization came into the highlight. Virtualization is software which acts as version of something like hardware, storage system and network resources. Virtualization is technique which helps to share single physical instances of an application or resources with the different customer. A user shares the infrastructure with help of virtualisation for building own application. There are various types of virtualization such as hardware virtualization, operating system virtualization, server virtualization and storage virtualization. In hardware virtualisation, a virtual machine manager (hypervisor) is directly installed on hardware. Whereas in operating system virtualisation, virtual machine manager (hypervisor) is installed on the host operating system instead of directly on to the hardware system. VMware workstation is used as the virtual machine manager (hypervisor). This virtualization helps to run two or more operating system on different virtual machines on one physical system. These guest operating systems is maintained by a single hypervisor or virtual machine monitor. A virtual machine is emulation of physical system, on which user can run multiple virtual machines at same time with different guest operating system. But due to this feature, there is a problem of CPU and memory overload on virtual machine. To overcome the above problem, a new technique named Docker can be used as best solution for memory and CPU overloading problem.

Docker provides the lightweight virtualization at system level by extending a common container format model on Linux called as Linux Containers. There is no separate operating System (OS) required for running Docker containers and uses same operating system as its Host. This primarily enables Docker to share the host operating system resources and trade-offs on the kernel's functionality which is provided by the underlying Linux containers and cgroups technologies that offers resource isolation like memory, CPU, I/O, network etc. that reduces the CPU and memory overload. A virtualization framework like that of container is an easy, lightweight virtualized environment where containers hold all the dependencies for portable applications. A portable, lightweight, self-sufficient container deployment of any application is automated and will scuttle virtually anywhere. Docker is a tool which is specifically designed to make it easier to create, deploy, and run applications by using containers. Docker is a slightly similar to a virtual machine, but unlike a virtual machine, in place of creating a whole virtual operating system, Docker allows applications to use the same Host operating kernel as the system on which they are running and only requires applications be shipped with things that are not already running on the host computer.

In performed experiment, one application is created where login file upload, file download and file encrypt and decrypt processes is performed. This same application is performed on both virtual machine and docker container at the same time. And at the end admin will check the performance of the both the system.

II. LITERATURE SURVEY

Key Yang, Jianhua Gu, Tianhai Zhao, Guofei Sun[1] In this paper, virtual machine the migration technology has received extensive attention in balancing the load. Load is nothing but includes CPU, memory, I/O and network bandwidth utilization load. The hosts

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within different load status domain adopt different migration strategy that considers migration timing, migration candidate VM and migration destination. Using this strategy, it reduces the number of the overloaded hosts, avoids instantaneous peak problem caused by the migration of virtual machines and solves the imbalance problem. But the problem with this solution is that it takes lot time to calculate whether the machine is overloaded or not [1]. Gursharan Singh, Sunny Behal, Monal Taneja [2] In this paper, virtualization is improved by reducing the data to be sent back to the source host using the memory reusing approach. Here, only processed data is sent back to the host rather than sending the whole data since only few pages have been updated. The pages that have not been updated already have their memory image present on the source host. Because of that the load of the host system decreases at the time of virtual machine migration. The problem with this technique is that the host system is get load because when number of virtual machine is stored the process images on the host system .and it is time consuming too [2].

K R Remesh Babu, Amaya Anna Joy, Philip Samuel [3] , this paper is paper is presented in 2015 Fifth International Conference on Advances in Computing and Communications This bee colony algorithm is based on load balancing. The bee colony parameters are mapped to cloud environment for achieving balancing the overload on the CPU and memory. This algorithm tries to achieve minimum make span, minimum degree of imbalance and minimum number of task migrations in cloud environment. The problem of with this technique is the bee colony algorithm is time consuming as well as energy consuming [3].

N.Madani, A.Lebbat, S.Tallal, H.Medromi[4] Using hypervisors within a cluster environment allows for a number of standalone physical machines to be consolidated to a virtualized environment, thereby requiring less physical resources than ever before. While this improves the situation, it often is inadequate. Large Cloud deployments require thousands of physical machines and megawatts of power. Therefore, there is a need to create an efficient virtualization system which maintain the physical CPU load and minimize the less energy. So it designs and implement a power-aware architecture, based on the collection of different resources information; CPU, RAM, Storage and Networking. And also use the virtual machine scheduling and consolidate them based on CPU usage. But the CPU scheduling algorithm is not that strong it takes time to perform [4].

III. METHODOLOGY

Figure 1 shows the processes performed by the user on the application which is run on both virtual machine as well as docker container system at a time and at the end the performances of the both system will be checked.

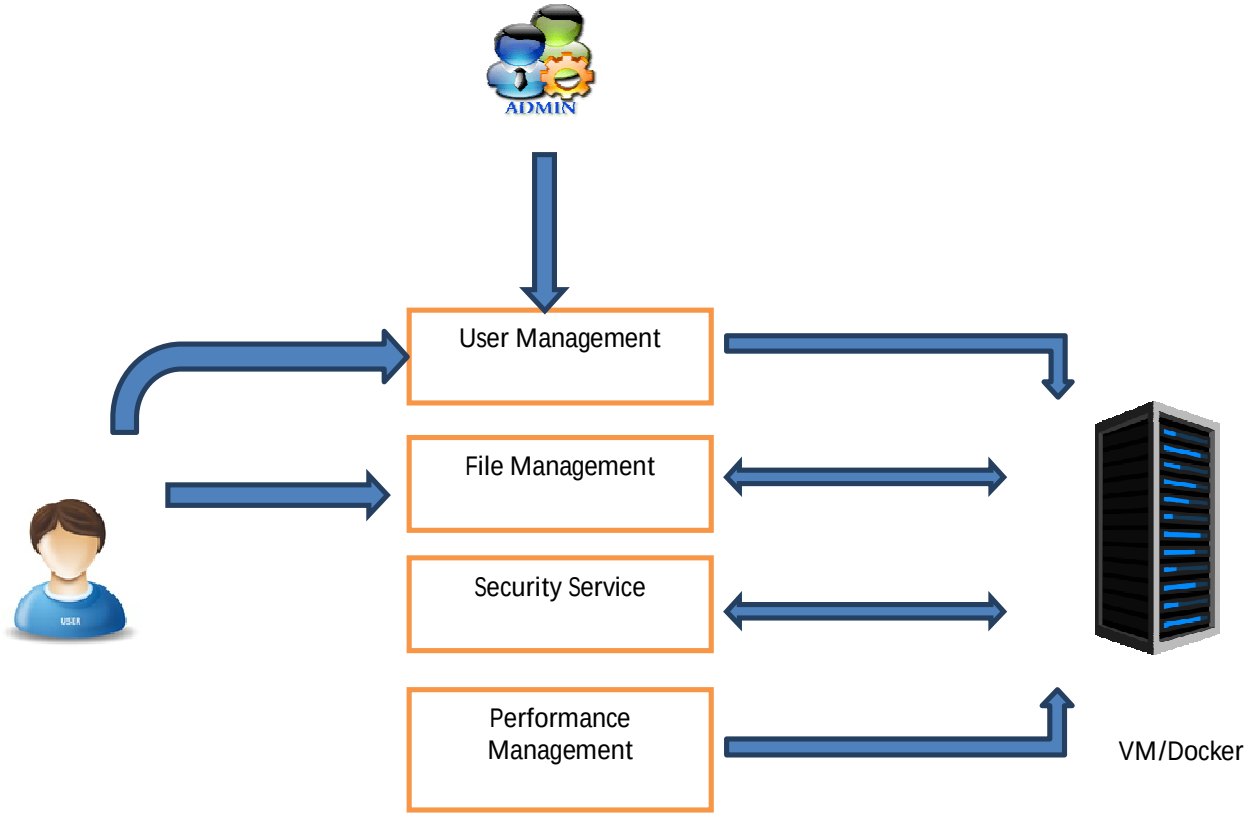


Fig.1 System architecture

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The methodology adapted for carrying out the project involves following steps

A. User management

In this module, number of user can create and login account on the application by using registration and login form respectively. Each user need to enter use valid user id and password.

B. File management

In this module user can upload file from the system on the web application. for uploading file user need to use the choose file option and from the wizard user need to choose the file.

C. Security services

When the file is uploaded, file is encrypted by security algorithm and when file is downloaded it will again decrypt and will be available to user. For this process user can use AES algorithm.

D. Performance management:

In this module CPU and memory performance will be checked for the process login, file upload, file download, file encryption, file decryption on both the virtual machine and docker container system.

E. Docker container

Docker is a container management service. Docker is software technology that builds, run and deploy the application by using containers. Docker provides the operating system level virtualization on windows and Linux. Docker also provides the isolation, namespace and cg group with each container. Docker is the world's leading software container platform. Mostly developers use Docker to eliminate "works on my machine" problems when they are collaborating on code with co-workers. Docker can deploy on any physical machine or even cloud. The docker container is having basic component like docker images, dockerfile etc. The docker and container are quite lightweight because of which it can be easily scalable. In the project work, the docker for windows runs chat application on container by using the apache tomcat. The same application will run on the virtual machine also. And at the end performance is checked. The application can perform login, file upload, file download, encryption and decryption process. The application is stored on the apache server and apache server is connected to the docker. For each process, performance will be checked in both the technology. Since, the docker does not use any guest operating system like virtual machine because of this the docker reduces the overhead such as CPU and memory overload unlike virtual machine that caused overhead. The application is running on the docker by using the apache tomcat server [5].

F. Virtual machine

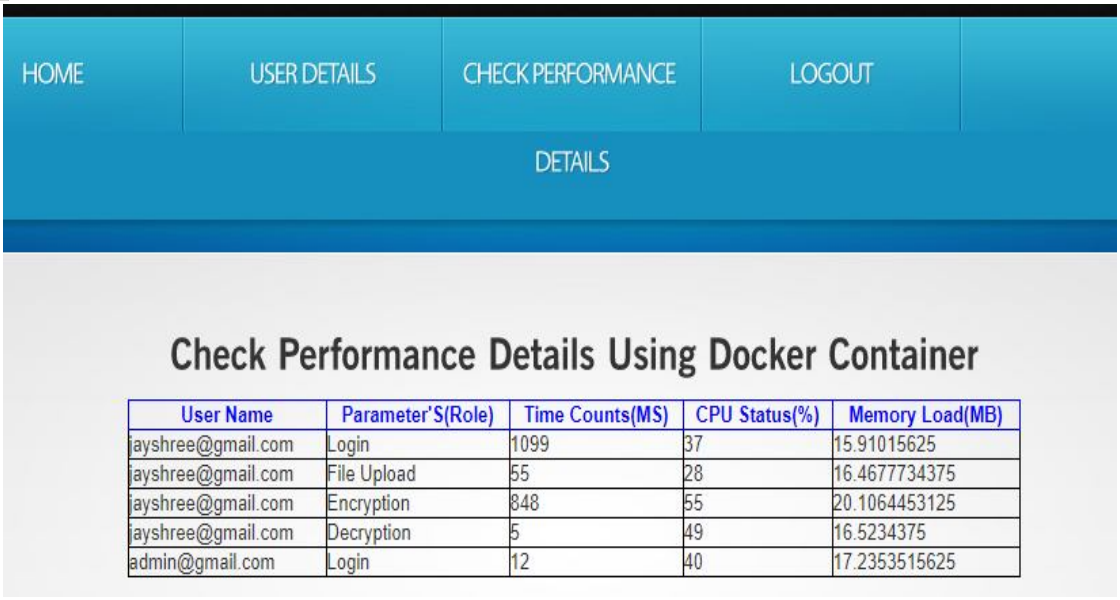
Virtual machine is immolation of physical system. A virtual machine (VM) can be described as an operating system (OS) or application environment which is installed on software that imitates dedicated hardware. The experience of end user working on a virtual machine will be same as they would have on dedicated hardware. Number of virtual machine user can run on the one physical system. virtual machine is not provide the isolation so all the task contains dependency, because of which if one task get fails then all the tasks fails. For performing the experiment Netbeans IDE 7.2.1 is used to run the application. Netbeans IDE is an open source and integrated development environment.Net beans are java software development platform used to run java applications. Net beans allows to run the number of modules of the application. Net bean IDE runs java applications but also support other language too. The user can install the application into the Netbeans dynamically [9].

IV. EXPERIMENTAL RESULTS

A. Virtualization over docker and container

Figure 2, shows the performance of Docker container depicting the user name, various role performed by user, time, CPU and memory status. The CPU performance is given in the percentage and memory performance is mentioned in MB. Here, the user jayshree@gmail.com run one file, for which the user performs file upload, encryption and decryption on docker container. For each role/parameter performed percentage of CPU usage and memory status is calculated. Same application and file will be used to check performance of virtual machine.

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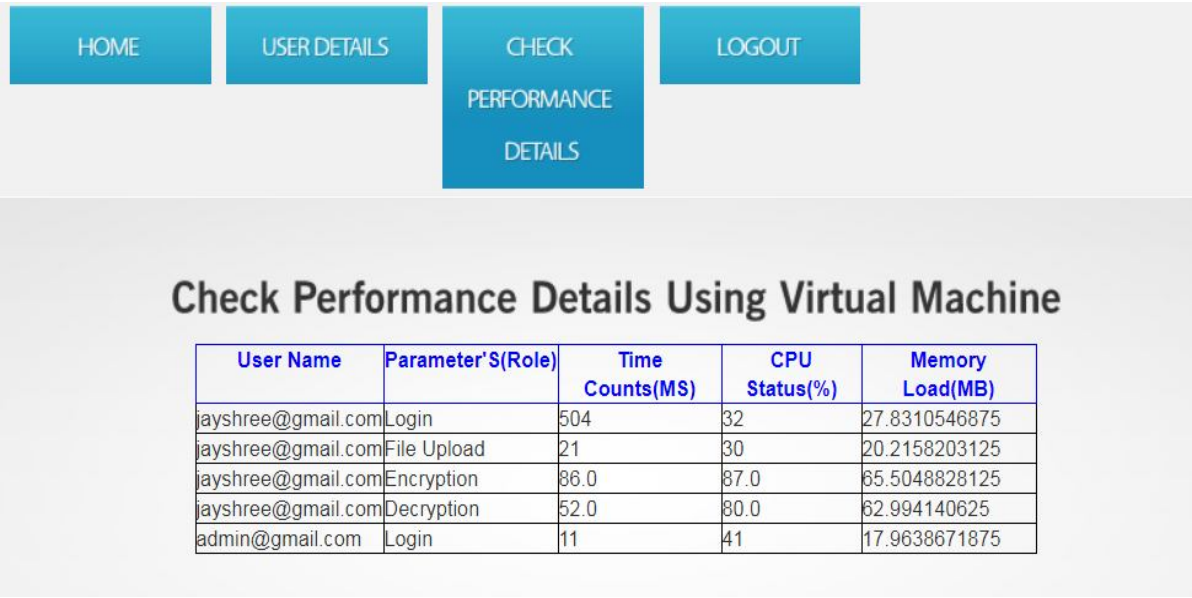


User Name	Parameter'S(Role)	Time Counts(MS)	CPU Status(%)	Memory Load(MB)
jayshree@gmail.com	Login	1099	37	15.91015625
jayshree@gmail.com	File Upload	55	28	16.4677734375
jayshree@gmail.com	Encryption	848	55	20.1064453125
jayshree@gmail.com	Decryption	5	49	16.5234375
admin@gmail.com	Login	12	40	17.2353515625

Fig. 2 Docker container performance

B. Virtual machine performance

Figure 2 shows the virtual machine performance depicting the user name, various role performed by user, time, CPU and memory status. The CPU performance is given in the percentage and memory performance is mentioned in MB. Here, the user jayshree@gmail.com run one file, for which the user performs file upload, encryption and decryption on docker container. For each role/parameter performed percentage of CPU usage and memory status is calculated.



User Name	Parameter'S(Role)	Time Counts(MS)	CPU Status(%)	Memory Load(MB)
jayshree@gmail.com	Login	504	32	27.8310546875
jayshree@gmail.com	File Upload	21	30	20.2158203125
jayshree@gmail.com	Encryption	86.0	87.0	65.5048828125
jayshree@gmail.com	Decryption	52.0	80.0	62.994140625
admin@gmail.com	Login	11	41	17.9638671875

Fig. 3 Virtual machine performances

After comparing both the docker container and virtual machine performance, it is found that maximum parameter shows the CPU and memory load is more on virtual machine whereas docker shows the less CPU and memory load than the virtual machine

V. CONCLUSION

The experiment was performed on two different virtualization systems. Wherein, System based on Docker container has outperformed compared to virtual machine system in terms of CPU and Memory performance. Because of better scalability and utilization of resources, Docker container can be used for application deployment to reduce overhead in terms of CPU and memory on host systems. Virtual machine has its entire guest operating system including its own memory installed, because of which its

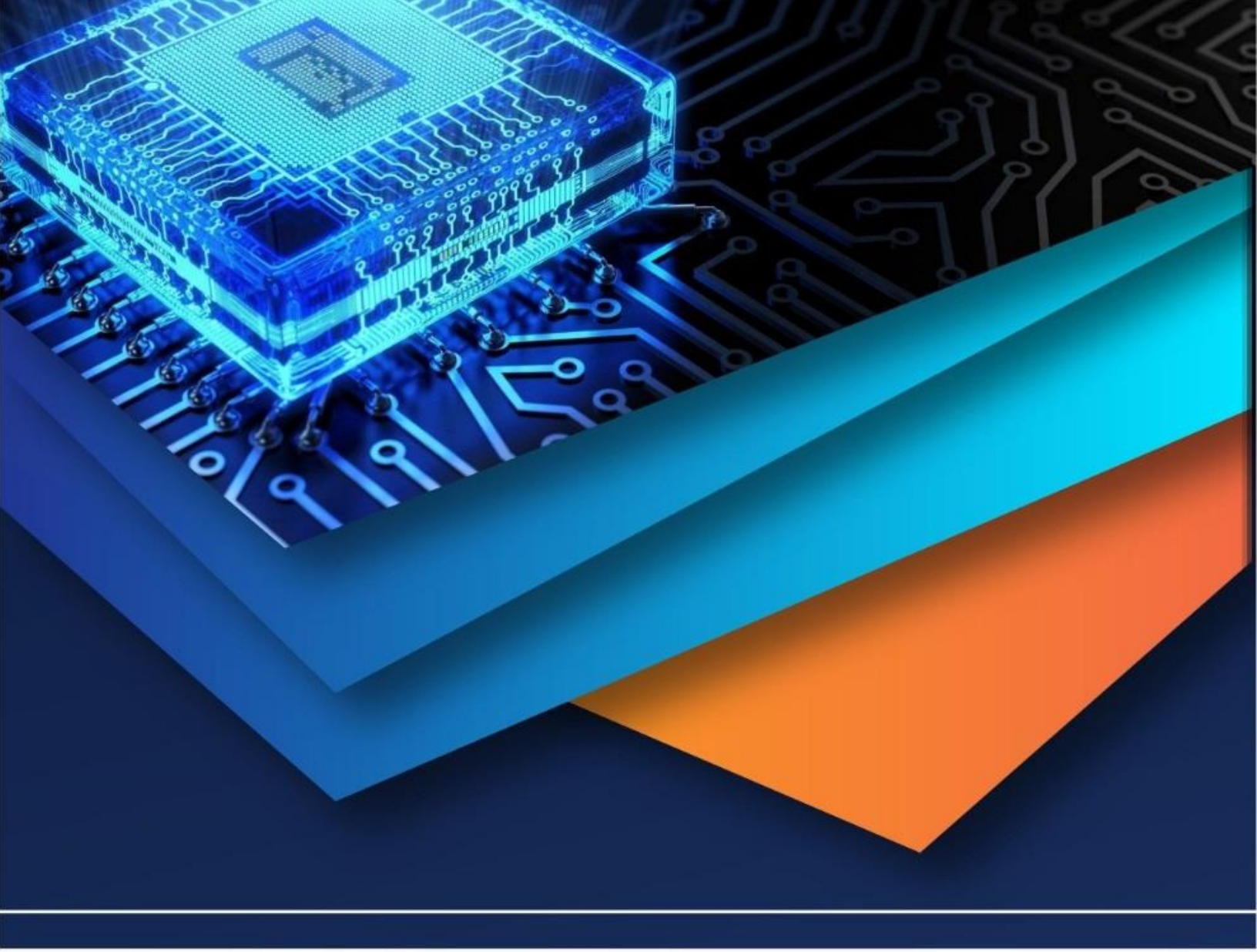
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increases the overhead on the physical system. Since, Docker does not use any guest operating system and container uses the host operating system kernel to run the application because of this ability, it reduces the CPU and memory load.

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