

# Efficient Resource Management in Cloud Computing Using Virtualization

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**Abstract:** In the past decade, there has been a paradigm shift from traditional network computing environment to cloud computing. The reason is increase in the size of data to be stored, transferred and processed from several Megabytes to Terabytes, Petabytes and Exabytes. This paper describes the role of virtualization as technique for improving resource utilization and energy efficient computing in conventional client server environment as well as in modern cloud computing environments.

**Keywords:** Cloud Computing, Virtualization, Virtual Machine, Cloud Operating Systems, Service Oriented Architecture.

## I. INTRODUCTION

Enterprise data centers support a number of applications e.g. Web Server Applications, Database applications, ERP applications etc. Each of these applications demands a different computing environment e.g. specialized operating systems and configurations, multiple processors etc. due to incompatible loads and conflicting processing needs, combining the services for different applications on a single server is a tedious task. Adding or upgrading operating systems and hardware is difficult. Moreover up-gradation of existing services or installation of new services is also difficult and workload balancing is not possible [9].

## II. VIRTUALIZATION

Virtualization provides a solution to above problems by delinking operating system services from the hardware. It allows multiple virtual machines on one physical machine, where applications may be executed as in case of real machines. Lightly loaded services can be installed on common hardware and can be migrated from one host to another. The Operating Systems provides services for upgrading of existing services and installation of new services. A virtual machine operating system provides illusion of existence of multiple processors. Each one of these virtual processors can execute independently where sharing is provided through message passing using network protocols thereby enhancing the security. A user can logon to a virtual machine only. A virtual machine provides all facilities e.g. devices, memory interrupts etc.

Therefore, operating system can be simulated as symmetric multiprocessor or a computing cluster. The operating system that is actually running on hardware together with a virtualization layer simulates an environment for various guest operating systems which are in fact simulation and are required for executing different applications [1,8].

Virtualization not only provides the efficient resource utilization by improved resource sharing but also permits energy efficient computing resulting into low Carbon Dioxide emission and reduced cooling requirements. Without virtualization, the server utilization on the average is limited from 10-20 percent whereas virtualization may increase this utilization from 70-80 percent. While the server is running, the services can be migrated to other machines in a user transparent manner. Failure of a particular service does not disrupt the execution of other services. Online backup operation is also possible. However, the virtual machine concept is difficult to implement particularly some features like handling of page fault by guest operating system and implementation of real time devices like clock. Modern virtualization tools like VM Ware provision to overcome such problems [2].

## III. VIRTUALIZATION IN CLOUD COMPUTING

Cloud computing model is based on massive virtualization of data centres where the experts are engaged in managing resources in a grid. Virtualization is an enabling technology for datacenter implementation by abstracting the processing, networking, and storage devices from the underlying hardware. The virtual machine manager or cloud operating system is a key component of the datacenter architecture as it guarantees optimal datacenter operation by efficient, scalable, secure management of virtualized infrastructures. The cloud OS orchestrates the deployment of virtual resources and manages the physical and virtual infrastructures i.e. it manages various components so they achieve a desired result. It also provides federation capabilities for accessing and deploying virtual resources in remote cloud infrastructures. The cloud OS components include the virtual machine (VM) manager, network manager, storage manager, and information manager.

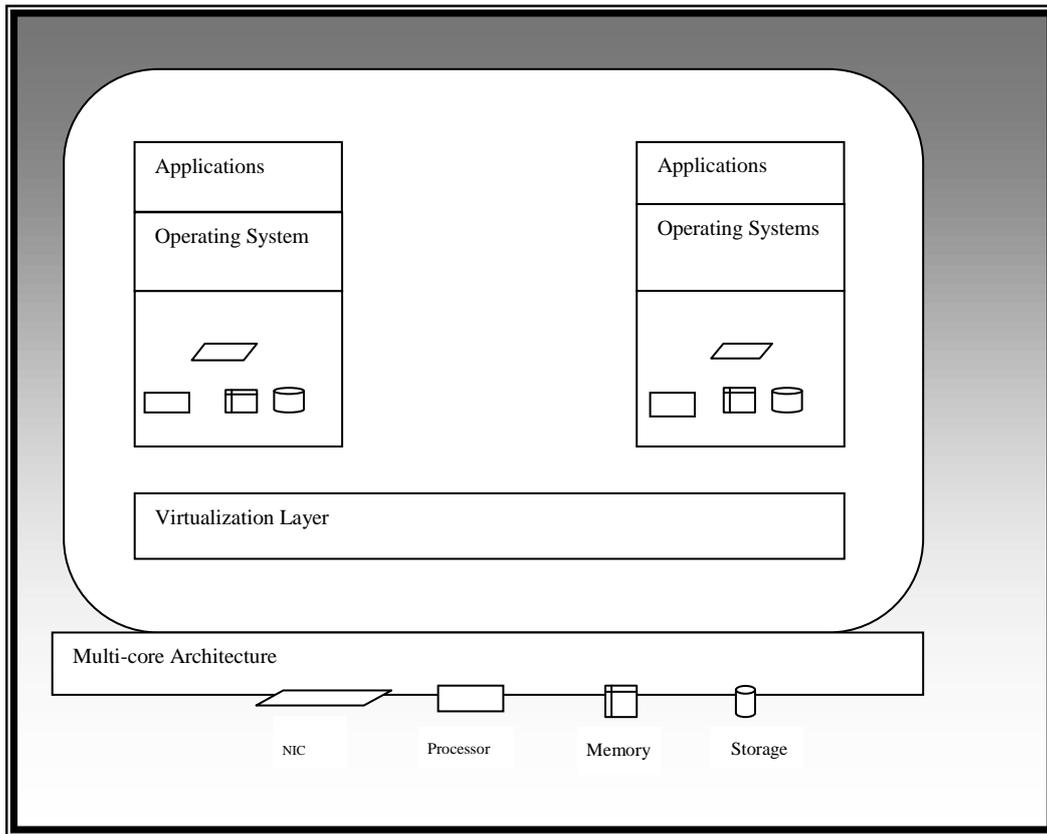


Figure 1. A Virtual Server

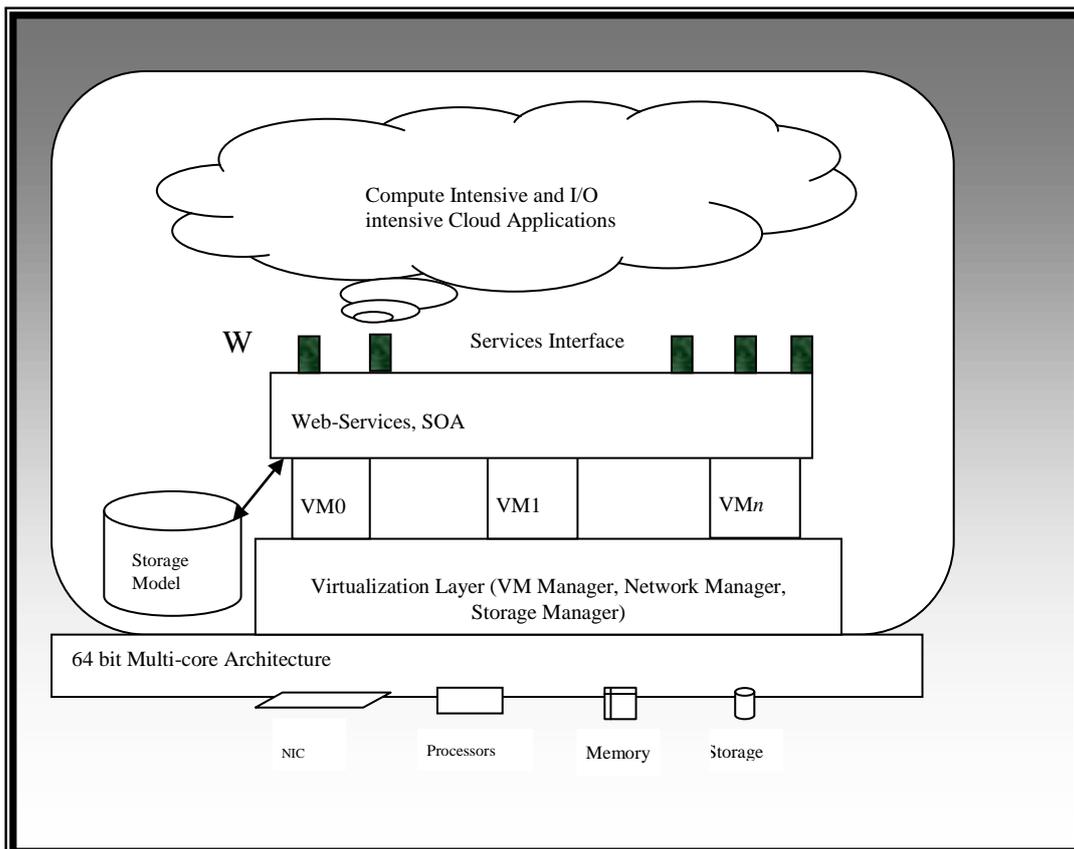


Figure 2. Cloud Model Based on Virtualization

These components are dependent on these infrastructure drivers to deploy, manage, and monitor the virtualized infrastructures [4, 6]. DataCenter in form of cloud provides advantages like:

- Server consolidation,
- Low power requirements,
- Runtime resizing of the physical infrastructure,
- Load balancing to improve efficiency and utilization,
- Server replication for support fault tolerance and increased availability,
- Dynamic partitioning for executing and isolate different services and workloads.

A cloud OS defines the Virtual Machine (VM) as the basic execution unit and the virtualized services as the basic management entity. A VM consists of a set of parameters and attributes, including the OS kernel, VM image, memory and CPU capacity, and network interfaces etc [7]. It manages VM's life cycle and performs different VM tasks viz. deploy, migrate, suspend, resume, shutdown based on scheduling strategies. The VM manager is also responsible for preserving the service-level agreements contracted with the users. To guarantee this availability, the VM manager should include different mechanisms for detecting VM crashes and automatically restarting the VM in case of failure [5, 11].

#### IV. CONCLUSION

Virtualization not only provides the efficient resource utilization by improved resource sharing but also permits energy efficient computing. Virtualization may increase this utilization from 70-80 percent. Cloud computing model is based on virtualization of datacentre. Cloud operating system is a key component of the datacenter architecture as it guarantee optimal datacenter operations by efficient, scalable secure management of virtualized infrastructures [3].

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