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Virtualization in Cloud Computing

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ABSTRACT

Virtualization to allow large expensive mainframes to be easily shared among different application within the environments. As hardware cost went down, the need for virtualization decades. More recently, virtualization at all levels (system, storage, and network) became important again as a way to improve system security, reliability and availability, reduce costs, and provide moreover advantages. It explains the basics of system virtualization and addresses performance issues related to modelling virtualized systems using analytic performance models. A case study is illustrated to discuss over it. Therefore, the concept of virtualization needs to be understand and implement in the cloud computing systems and it would enables the us how to better use of it and make it better management of cloud. In this paper the virtualization approach in the cloud computing environment are well presented with the concept of the cloud service models. The virtualization process and implementation with their advantages are documented and the different types of virtualizations are presented with some survey on the Indian data centre and the virtualization architecture. This approach needs to be evaluated in different cloud platforms for finding the cost effectiveness in the cloud infrastructure development.

Keywords: Virtualization, Cloud Computing, Infrastructure

I. INTRODUCTION

Consider a production environment consisting of batch jobs and online transactions that run on top of a Transaction Processing Monitor (TPM). Developers need to test new features of the system. A typical approach is to use one machine for the production environment and another, typically smaller, for development and testing. Virtualization allows you to run the two environments on the same machine in such a way that these two environments are completely isolated from one another operating system OS1 and the test environment runs on top of operating system OS2. Both operating systems run on top of the Virtual Machine Monitor (VMM). The VMM virtualizes all resources (e.g processors, memory, secondary storage, networks) and allocates them to the various virtual machines that run Cloud computing is defined by the concept of web centred computers, services and resources that system developers use to implement compound web based systems. It basically deals in allocating the computing resources over internet .In cloud computing one uses the service over internet rather than keeping data in hard drive and regularly updating the applications. Thus it is observed that there is a significant change in workload. The computers make up the cloud handles the workload instead. The hardware and software demands are decreased. An interface software like web browser is the only thing required by the user's computers and rest care is taken by the cloud's network.

II. METHODS AND MATERIAL

1. Virtualization Basic Concepts

It describe now in more detail what is known as virtualization through direct execution Let us start with some basic facts of computer architecture . The instruction set is generally divided into (at least) two categories: non-privileged and priviliged instructions. The former instructions do not change the allocation (and in some cases the state) of any of the resources of the machine that are shared among the various executing processes. Examples of such resources include

processors, main memory, secondary storage devices, network connections, timer, and special purpose registers such as the program counter and mode bit. Privileged instructions include all those that are used to change the allocation or state of a machine's shared resources. Examples of such instructions include: halt the machine, set the timer, set the program counter, change the value of memory allocation registers, set the mode bit, and I/O-related instructions. A machine operates in two modes: user and supervisor. In supervisor mode, the entire instruction set can be executed. This is the mode in which the operating system runs. In user mode, only non-privileged instructions can be executed. The operating system sets the mode bit to user before giving control of the CPU back to a user program. If a privileged instruction is executed in user mode, an interrupt is generated and control is passed to an interrupt handling routine, which is part of the operating system. Most architectures have more than two levels of privilege. For example, the x86 architectures has four levels, called rings, numbered from 0 to 3.and this is the level at which the operating system runs Ring 0 has the highest privilege in non-virtualized environment In a virtual machine environment, the VMM runs in supervisor mode and controls access to the resources shared by all virtual machines and the virtual machines run in user mode. The VMM schedules the virtual machines, in a manner similar

2. Cloud Service Model

A cloud can interact with a client in variety of ways, through capabilities called services. There three major types of service and the details are presented schematically. The details discussion of each service are discussed below.

A. SaaS (software as a service)

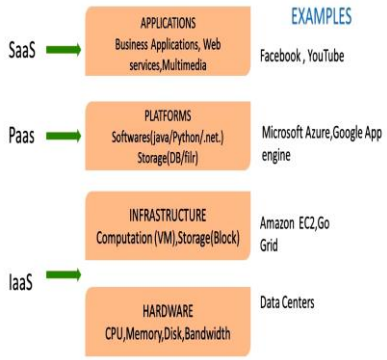
The software as a service (SaaS) provides cloud based foundation for software on demand. In general SaaS is a web delivered content that users access by a web browser. It Is mainly accessed through a web portal and service oriented architectures based on web service technologies. The advantages of SaaS solutions are simplicity of integration, cost and scalability. The disadvantages of SaaS solutions is the perception of security issues. Ex Facebook, YouTube, Zomato etc.

B. PaaS (platform as a service)

PaaS comprises the environment for developing and provisioning cloud applications. The main users of this layer are developers wanting to develop and run a cloud application for a particular platform. The hardware and software within a PaaS solution is managed by the platform provider. Well known PaaS solutions providers include Windows Azure

C. IaaS (Infrastructure as a Service)

The infrastructure as a service (IaaS) model provides a virtual data centre within the cloud. These resources are usually delivered as a virtualized platform and are not responsible for managing the underlying infrastructure. These important IT resources include services related to computing resources, the communications channel and data storage resources,. They assist existing applications to be provisioned on cloud resources and new services implemented on the higher layers. Within an IaaS solutions the developers must install their own operating system, support software and database management. The developers must manage both the hardware and software. Ex. amazon elastic compute cloud



The above figures represent how the different cloud model interact each other.

3. Cloud Deployment Model

a. Public Cloud

It is available for use by the general public. It may be owned by a large organization or company offering cloud services. As the cloud here is open it is less secure. A public cloud is generally the least expensive. Some of the best-known examples of public cloud systems are

Amazon Web Services(AWS) containing the Elastic Compute Cloud (EC2) and the Simple Storage Service (S3) which form an IaaS cloud offering and the Google App Engine with provides a PaaS to its customers.

b. Private cloud.

It is owned by a specific entity and normally used only by that entity or one of its customers. The underlying technology may reside on or off site. A private cloud offers increase security at a greater cost. The chief advantage of these systems is that the enterprise retains full control over corporate data, system performance and security guidelines.

c. Community cloud

In a community cloud, organizations with similar requirements share a cloud infrastructure. It may be meant as a generalization of a private cloud and a private cloud. Community clouds are a form of clouds which are built and operated specifically for a particular group. This group have similar cloud requirements and their ultimate goal is to work together to achieve their business objectives. These are used by the organizations that work on joint projects, applications and, building and executing.

d. Hybrid cloud

A cloud that consists of two or more private, public or community clouds. The hybrid model is also suitable for enterprises in which the transition to full outsourcing has already been completed, for instance, to combine community cloud services with public cloud services.

4. Types of Virtualization

A Server virtualization

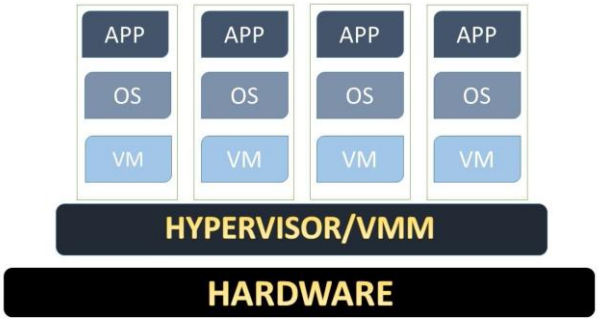
Making one server appear as many .Each virtual server may run the same or different operating systems. In order to decrease the server idle time a single physical server is virtualized to form multiple virtual servers. It can be concluded that the CPU utilization is the main reason for server virtualization.

B. Desktop virtualization

This allows switching between various operating on the same operating systems, which makes the task easier for software developers and other tester staffs. This reduces the need for duplicate hardware and has other economic aspects. If the framework cloud computing is a critical

C. Virtual networks

These create a illusion that a user is connected directly to a company network and resources, although no physical connection may exist. Virtual networks are sometimes called VPN (virtual private network),using a virtual private network the users can connect to a network and access the resources from any internet connected network.



5. Advantages of Virtualization

There are several advantages to virtualization across several dimensions:

- Security: By compartmentalizing environments with different security requirements in different virtual machines one can select the guest operating system and tools that are more appropriate for each environment. For example, we may want to run the Apache web server on top of a Linux guest operating system and a backend MS SQL server on top of a guest Windows XP operating system, all in the same physical platform. A security attack on one virtual machine does not compromise the others because of their isolation.
- Reliability and availability: A software failure in a virtual machine does not affect other virtual machines.
- Cost: It is possible to achieve cost reductions by consolidation smaller servers into more powerful servers.

- Cost reductions stem from hardware cost reductions (economies of scale seen in faster servers), operations cost reductions in terms of personnel, floor space, and software licenses. VM ware cites overall cost reductions ranging from 29 to 64%
- Adaptability to Workload Variations: Changes in workload intensity levels can be easily taken care of by shifting resources and priority allocations among virtual machines. Autonomic computing-based resource allocation techniques, such as the ones in [2], can be used to dynamically move processors from one virtual machine to another.
- Load Balancing: Since the software state of an entire virtual machine is completely encapsulated by the VMM, it is relatively easy to migrate virtual machines to other platforms in order to improve performance through better load balancing.
- Legacy Applications: Even if an organization decides to migrate to a different operating system, it is possible to continue to run legacy applications on the old OS running as a guest OS within a VM. This reduces the migration cost

III. RESULTS AND DISCUSSION

Virtual Infrastructure Management

The various responsibility of virtual infrastructure management
Are-

- Provide a uniform and homogenous view of virtualized resources, regardless of virtualization platform
- Manage VMs lifecycle
- Setting up networks dynamically for group of VMs
- Managing storage requirements
- Support resource allocation to meet organization's specific goals
- Adapt to organization's changing resource needs

Virtual Infrastructure Managers

The various virtual infrastructures managers are

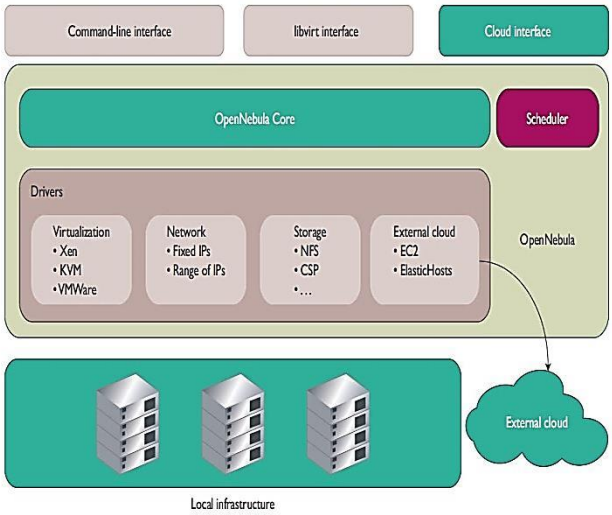
A. OpenNebula

1. To control VM's life cycle, the OpenNebula core has three different management areas.
   - Image and storage technologies
   - Virtual tools for preparing disk images for VMs
   - The network fabric
   - DHCP servers, firewalls and switches
2. Underlying hypervisors
   - For creating and controlling VMs The OpenNebula core also supports service deployment
   - Services typically include set of interrelated components requiring several VMs
   - The core handles the delivery of context information
   - Web server's IP address, digital certificates and software licenses
3. A separate scheduler component makes VM placement decisions
   - Creating and updating resource schedule and sending appropriate deployment command to OpenNebula core
   - The default scheduler provides a rank scheduling policy that places VMs on physical resources according to ranking algorithm that the administrator can configure
   - It relies on real time data from both the running VMs and available physical resources
4. Open Nebula can support a hybrid cloud model
   - Uses cloud drivers to interface with external clouds
   - It helps organizations supplement the local infrastructure with computing capacity from public cloud to meet peak demands
   - Includes EC2 driver which can submit requests to Amazon EC2 and Eucalyptus and also includes ElasticHosts driver

B. The Haizea lease Manager

- Open source resource lease manager
- Can act as a VM scheduler for OpenNebula
- Simulator to evaluate different scheduling strategies performance over time
- Haizea provides resources to users on lease terms

- Haizea supports advance reservation lease in which resources must be available at a specific time
- Best effort lease in which resources are allocated as soon as possible



Immediate lease in which resources are provisioned when requested

Virtualization Need

We have been hearing a lot about Virtualization as we talk about cloud computing. Most of the businesses often use a combination of a number of application servers, catalog server, web servers, image servers, file servers, video and audio servers, and the most important the database servers. Although modern web usage developments may suggest that all of the above mentioned hardware infrastructure is being used well almost all the time, this is falsehood and more accurately, an illogical belief. If 75% of the hardware appearsto be used at any time it is considered to be underutilized. The servers typically take only about (1-10) milliseconds to service each request. Generally ,the amount of time the server machine is kept up and running relative to the actual time spent by it servicing the requests, is much higher .This clearly shows that a significant amount of energy is wasted per server in the process of keeping the servers up and ever-ready to service requests upon their arrival. So the efforts to maximize the server utilization is limited by the number of incoming server requests. For ensuring that a good fraction of time is spent by the server in servicing requests, virtualization must be ensured. Virtualization technique ensures the availability of hardware and gives every application running on top of it. The details of the virtual, simulated environment are kept transparent from the application. The advantage here is the reduced cost of maintenance and reduced energy wastage which is not very surprising. So virtualization reduces the number of physical servers as a result of which one needs to maintain few servers ,this becomes much cheaper and easier. The amount of energy wasted is a function of the number of physical servers that is reduced in a virtualized environment. In case of desktop virtualization updates may now be made available much sooner as a single firmware update does not update one client machine, but several instances of the same.

IV. CONCLUSION

Using Cloud Computing the complexity and cost of owning and operating computers and networks can be significantly reduced. Customization of Cloud services can be done and it is also flexible to use, advanced services can be offered by the providers so that an individual company might not have to spend money or expertise to develop. In this work cloud computing and virtualization has been briefly introduced. This contains the evolution of cloud computing. The cloud models are explained with proper examples. The need of virtualization and the process involved in it is depicted. The advantages of virtualization are given with brief explanation. The requirement and importance of virtualization in data centres have also illustrated. How virtualization reduced the problems of machines Virtualization may bring several advantages to the design of modern computer systems including better security higher reliability and availability, reduced costs, better adaptability to workload variations, easier migration of virtual machines among physical machines, and easy coexistence of legacy applications. Many vendors including Sun, IBM, and Intel have already announced or already have virtualization solutions. Intel has just announced a new architecture, called Intel Virtualization Technology, that provides hardware support for virtualization allowing the virtual machine monitor to run at a protection level below ring 0. Sun has introduced the concept of zones in Solaris 10, which allows for many Solaris 10 instances to coexist on the same machine (www.sun.com/bigadmin/content/zones/). IBM provides Logical Partitioning (LPAR) technology on its p, i, and z platforms. This technology was originally developed for its mainframes but is now

available on its midrange servers (www-03.ibm.com/servers/eserver/iseries/lpar/03.ibm.com/servers/eserver/pseries/lpar/) It is important to briefly discuss two major directions for virtualization that can be encountered on the market. One is called full virtualization and the other para virtualization. In the former case, the Virtual Machine Monitor provides an identical abstraction of the underlying hardware to the virtual machines. However, not all architectures are virtualizable. Thex86 architecture is such an example. Paravirtualization can then be used to overcome these situations by providing an “almost” identical abstraction of the underlying machine to the virtual machines. This abstraction implements some new virtual instruction so as to make the machine virtualizable. The drawback is that the guest operating system has to be modified to use these instructions while in the full virtualization case this is not required. Para virtualization provides better performance than full virtualization since the guest operating systems are aware that they running on a VM and therefore can be optimized for that type of environment. Examples of virtual machine monitors that use para virtualization include the open source Xen and Denali . An example also been depicted.

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