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Selective Resource Usage and Performance Enhancement through IaaS Cloud

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Abstract

Infrastructure-as-a-Service is an emerging trend in the usage of infrastructure via cloud computing. The enterprises use a pay-as-you-go infrastructure service which provides the enterprises benefits like increased scalability and utilitarian and economic costing. IaaS is still evolving and there are cases where the enterprise is capable of purchasing the resources, but is unable to carry out the maintenance tasks. In such scenarios, there is a demand for a service which can incorporate such needs. This research work proposes a model as a solution for the specified problem.

Keywords

Cloud computing, Hypervisor, Infrastructure-as-a-service (IaaS), Virtualization, Virtual Machine (VM), Virtual Machine Manager (VMM).

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Introduction

Cloud computing implies involving in centralized services which is used by user as their need and pay as-per-use. In cloud computing services, demand for Infrastructure-as-a-Service is gaining momentum day by day and it is becoming one of the most sought after commercial services. IaaS provides the facility to "provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications" [1]. Virtualization is very crucial part of IaaS. IaaS is a way to obtain and make available virtual hardware, operating system, storage devices, etc. for the organization. Moving an entire infrastructure to the cloud can yield significant benefits. Not only do the organizations attain the computing power, storage or other services they need. All this is carried out without going into when, where and how the infrastructure is to be set and maintained, and the organization is concerned only about payment which is based on time and capacity used.

For the past few years, Amazon has become the biggest company which is successfully providing all the cloud services including IaaS. Amazon creates virtual server with unique ID and provide this ID to their users. The user connects to the virtual server with that unique id. Users will pay as per the use just like one pays for water and electricity bill. It means the user simply selects from a choice of Amazon WorkSpace bundles that offer a range of different amounts of CPU, memory, storage, and a choice of applications. User renders information and launches the number of Amazon WorkSpaces that are required. Amazon WorkSpaces may be downloaded and connected as soon as they are ready. Users can connect from a PC or Mac desktop computer, or an iPad, Kindle, or Android tablet [2].

Section II of the research paper provides an overview of Infrastructure as a Service, where concepts like virtualization, hypervisor, and benefits of IaaS are discussed. Section III deals with the issues regarding the existing IaaS system. Proposed system along with its implementation is detailed in section IV and section V of the research paper discusses the advantages of the proposed system.

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IaaS: An Overview

In generic terms, IaaS is a highly automated cloud service. It provides several virtual services like virtual hardware, operating system, storage etc. that can only be approached through the network. All these services improve the system performance. It collectively includes the hypervisor, cloud bursting, multi-tenant computing, and resource pooling. The, user virtually exploits all resources via the service provider. Consequently only service provider is all responsible for deployment, maintenance, hosting and data security. All of these services are bought on contract basis from the service provider.

Benefits of IaaS

Usage of IaaS facility provided by the cloud offers a number of benefits to the users which are discussed as under:

1. Agility [3] is the first and foremost benefit derived from IaaS. It aids in speedy adaption to change in terms of scalability. In addition to change, the adaption is carried out quite easily also which is normally not possible in private setups.

2. IaaS is an automated service. User doesn't need to manually deploy an operating system on his own system. User sends request with his requirements (like ram and hard disk size, CPU number, etc.) to the service provider. The service provider then prepares a virtual server as per the user requirements and provides them with a unique ID.

3. User pays as per the usage of their services. Generally, the service provider charges on an hourly basis.

4. When the user connects the provider's workspace to their on-premises infrastructure, the WorkSpaces may be managed with the existing tools as he may be using for his on-premises infrastructure and thus has the experience of full administrative control.

Virtualization

Virtualization has become a crucial part of cloud computing world. It is a way to hide the physical configuration of the physical machine. It makes it easier to work in heterogeneous environment. This can be made possible by making use of the virtual machines .One can use virtual machine to run multiple isolated servers on a single physical machine.

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Hardware abstraction hides the complexity of managing the physical computing platform and simplifies the computing resources scalability. Hence, virtualization provides multi tenancy and scalability, and these are two significant characteristics of cloud computing [4]. Virtualization reduces infrastructure costs and redundancy, and enhances scalability and reliability.

Hypervisor

In virtualization technology, hypervisor is a software program that manages multiple operating systems (or multiple instances of the same operating system) on a single computer system [5]. The hypervisor manages the system's processor, memory, and other resources to allocate what each operating system requires. Hypervisors are designed for particular processor architecture and are therefore also known as virtualization managers. The operating system assumes that all control is under the hardware. Virtualization architecture provides this illusion through a hypervisor/VMM. The hypervisor is also called as virtual machine manager (VMM).

The hypervisor is thought of as running on the bare hardware. However, in many cases, such as User Mode Linux [6], VMware Workstation [7], and Microsoft's Virtual PC [8] the hypervisor runs with the support of a full operating system. Virtualization and hypervisor concept is outlined in the following figure 1.

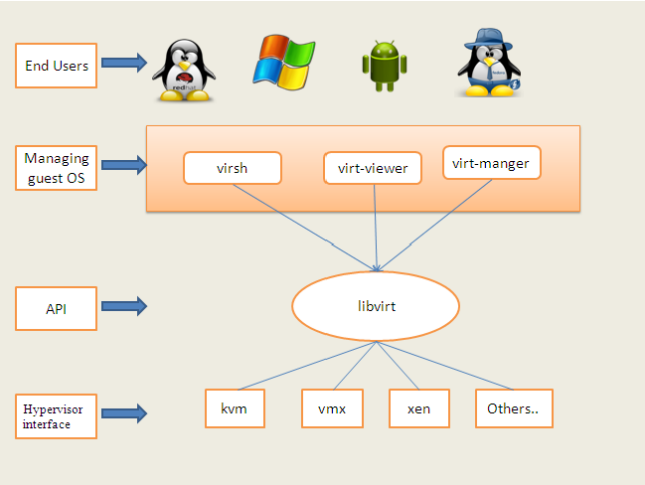

Figure 1: *Hypervisor & Virtualization*

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Existing IaaS Setup: Issues

The existing IaaS system provides services, but in the process, the end user company makes use of the resources provided by the service provider. For example, amazon offers virtual operating system to the end users and the users use all the resources of amazon for the provided service. Two major issues arise for the explained scenario.

First issue is related to the maintenance at the client end. The current IaaS setup makes it mandatory for the client to use all the resources (related to the infrastructure service) which are provided by the cloud service provider. Many organizations are capable of purchasing their own resources, but are unable to carry out the maintenance. Such organizations are interested in paying for the maintenance alone rather than paying for both resources and the maintenance

The second issue is related to infrastructure related performance. When all users are accessing server based resources, the server responds slowly. It henceforth decreases the overall performance, as the resources available at the service provider's end are also limited.

Proposed System

This proposed system is for those organizations which have ample of resources but are deficient in the maintenance of these resources. Such organizations can benefit a lot from this system.

Preliminary Phase

To improve the existing infrastructure related cloud computing services the following system has been proposed. The prerequisites are at least two machines - one for the creation of cloud server and the other one for the client machine. To promulgate IaaS, both systems cloud server and client must be support hardware virtualization. This purposed system is demonstrated on RHEL environment.

To enable hardware virtualization on the system, it is required to bypass or escape the booting process and check the BIOS of the system. Option of hardware virtualization must be enabled through configuration settings. With hardware virtualization, one can implement multiple virtual machines. Linux provides commands to check whether virtualization is supported or not for a

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given system.

The following command provides complete information about the CPU.
`vim /proc/cpuinfo`

If system works on an Intel processor, the system will be set with VT-X and vmx, but if the system is working on an AMD processor, it will be set with AMD-V and smv values. Anyone of the vmx or smv, as per the processor, are essential for both systems, the cloud server and the cloud client.

Another crucial part is the network for communication between the server and the client. Socket programming is used to connect the client with the server. It is can be much easily carried out with programming languages like Python. Apart from the networking connectivity, the server must be ready with sufficient workspace so that the user can connect and use all the services.

Implementation Phase

The implementation steps discussed below are meant for the RHEL environment, though the implementation may be carried out for other environments also. Hardware virtualization must be enabled for both the client and the server machine.

1. Installation of virtual machine on cloud on the request of client.
2. After installation of the operating system on the VM end user receives information like server IP and virtual machine name, etc.
3. After deployment of the VM, end user has to mount the server machine's image on to his machine and then run his own machine's VM.
4. When VM is mounted on end user's system, it then uses all the resources of the end user's machine instead of server's resources.

Finally, all administrative control gets into the hands of the user. The user may stop, start, or resume the VM. The process of the system is shown in figure 2.

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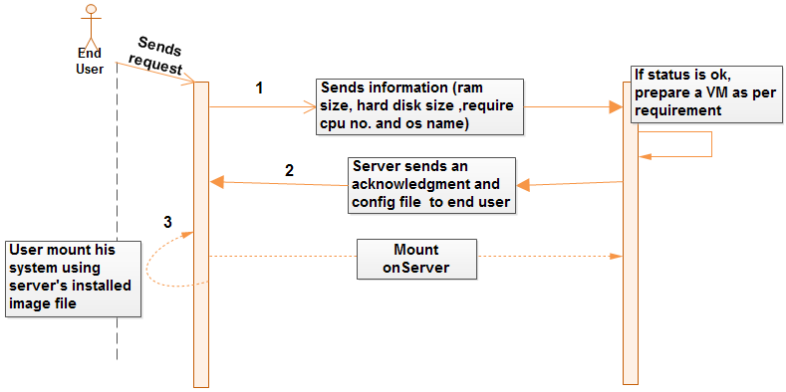

Figure 2: *Sequence Diagram of the Proposed System*

Advantages of the Proposed System

1. System attains high performance because the user is using its own resources and these resources are not in sharing mode.

2. The user does not pay for resources provided by the service provider. The user will pay only for the deployed VM.

3. The maintenance of the VM is carried out by the service provider. If any additional software is required, the VM service provider makes it available for the user.

4. More workspace is available on the service provider's system. This increases the performance for the other users who are using the service provider's workspace.

Conclusion

With more and more specialized services, IaaS is transforming at a great pace. This paper presents an IaaS cloud service which is running on virtual environment. That is a very economical service and it increases the performance of the end user system as the user makes use of their own resources.

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