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A Survey Paper: Cloud Computing and Virtual Machine Migration

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Abstract - Cloud computing is one of the well developing fields in Computer Technology. Now days cloud computing is one of the fast growing technology because of online, cheap and pay as use scheme. Cloud Computing involves the concepts of parallel processing and distributed computing in order to provide the shared resources by means of Virtual Machines(VMs) hosted by physical servers. It is a service oriented design that reduces the cost of access to gather the information of the clients offer greater flexibility and demand based services and so on. The idea that provoked cloud computing concept is that information processing can be public utility and can be done more well on large farms of computing resources as well as storage systems with the availability of all time throughout the world accessible via the Internet. Efficient management of VMs directly influences resource utilization and QoS delivered by the system. As the cloud setting is dynamic in nature, the number of VMs distributed among the physical servers tends to become uneven over a period of time. Under this circumstance, VMs must be migrated from overloaded server to under loaded server to balance the load. In this paper, we present a complete survey of cloud computing and virtual machine migration.

Keywords - *Distributed Computing, On Demand Resources, Cloud Computing, Virtualization.*

1. Introduction

In the cloud computing, the computing resources are provided to the client through virtualization, on the internet. The large scale computing infrastructure is established by cloud providers to make availability of online computing services in flexible manner so the user find easiness to use the computing services [1]. According to NIST cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources. The computing resources include networks, servers, storage, applications, and services. In cloud computing, the shared pool of computing resources can be rapidly provisioned and released [2]. The management effort or service provider interaction for cloud user is also minimized to enhance easiness. This cloud model is basically composed of 5 important characteristics, three types of service models, and four deployment models.

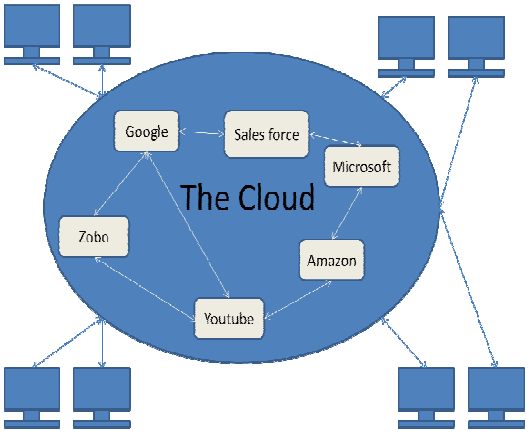

Fig. 1 Cloud Computing

As many enterprises, government organization, and other companies begin to start to use cloud computing, security issues came out as a basic problem in computing, as every individual client or user preferred to work on a clear and safe environment where privacy and security of their data is a major concern.

In this paper, we discuss the overview of cloud computing with their components basic model and process scheduling. The goal of the paper is provide a complete study of cloud computing with different types. In section 2, we discuss the background knowledge of the cloud computing with their complete framework. Section 3 gives brief descriptions about working model of cloud. In section 4, we present the process scheduling in cloud. Section 5 discuss about different techniques and their survey of scheduling techniques in cloud.

Section 6 concludes the paper with the focus on the future work.

2. Cloud Components

The cloud computing are mainly five part as shown in figure 1. Service delivery model and service deployment model are main concept of cloud computing. Cloud computing infrastructure, their resources and defining attributes.

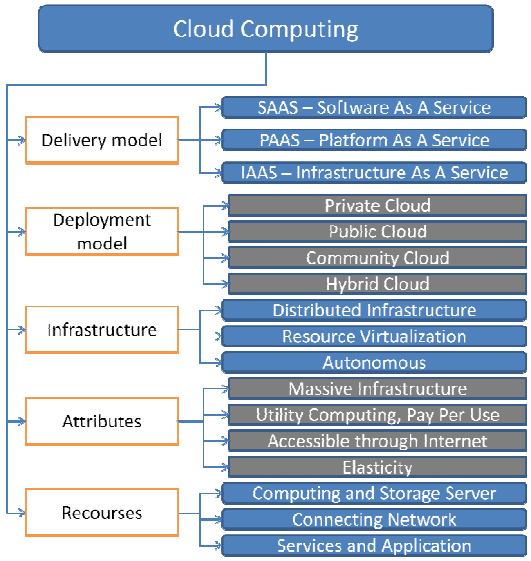

Fig. 2 Cloud Computing

2.1 Delivery Model

In the cloud computing there are three types of service delivery model [3] as software as a service (SAAS), platform as a service (PAAS), and infrastructure as a service (also known as hardware as a service).

2.1.1 Software as a Service

Software as a services mainly deliver the online software application to the client of cloud computing. It is responsible to provide capability to use cloud applications in a cloud infrastructure which is supplied by the cloud service provider. The applications are accessible from various client using computing devices like a thin or thick clients interface such as a web browser. The users do not have authorization to manage or control the basic cloud infrastructure including hardware resources or platform infrastructure etc. Gmail and Facebook is one of the most famous cloud applications.

2.1.2 Platform as a Service

Platform as a Service (PaaS) gives the competence to create application services as on their need. It allows users to develop their software using programming languages and tools supported by the provider. The user does not manage or control the basic cloud infrastructure including network, servers, operating systems, or storage. The user has control only over the deployed applications and application hosting environment configurations.

2.1.3 Hardware as a service

Infrastructure as a Service (IaaS) provides the capability to have control over complete cloud infrastructure with CPU processing, storage, networks, and other computing resources. The cloud user is able to deploy and run their software, which can include operating systems and other software applications as website.

2.2 Deployment Model

There are four types of cloud deployment model [4] in the cloud computing known as public, private, community and hybrid cloud.

2.2.1 Private Cloud

Private Cloud is a model of cloud computing whose frame is permitted to use with a particular organization. All the resources and services are keen to a limited number of peoples. The server and data center is also setup within organization. occasionally infrastructure is setup by third party but it is in full control of organization. The private clouds are good to privacy and security.

2.2.2 Public Cloud

Public cloud is model of cloud where all users are allowed to access the services using internet. The user need only internet connection and web browser to access with pay per use scheme.

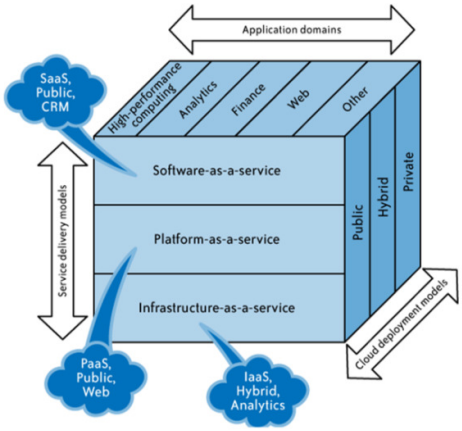

Fig. 3 Cloud Computing Models in 3D

All the services with infrastructure of cloud provider are available on the internet. User need to subscribe the application and make enable to use it.

2.2.3 Community Cloud

Community cloud includes numeral of organization to allocate their services to increase resource utilization of cloud infrastructure. The cloud infrastructure is not restricted to only one organization.

2.2.4 Hybrid Cloud

Hybrid cloud combines both public and private cloud with their advantages. Hybrid cloud offers the benefits of both the public and private cloud. The hybrid cloud is the good explanation for purely business oriented thought because many contemporary businesses have a wide range of concerns to support users requirement.

2.3 Cloud Infrastructure

The infrastructure of cloud computing is mainly based on distributed server located throughout the world [5]. System resource virtualization plays one of the important roles in the cloud industry. The autonomous system also increases the adaptability of the systems. Virtualization is very useful concept. It allows abstraction and isolation of functionalities of hardware resources. Virtualization also enables portability of computing application and sharing of the physical computing resources. It has been applied to all aspects of computing memory, CPU processing power, storage media, software, networks, as well as services that IT industry offers.

2.4 Cloud Resources

The cloud resources are mainly three types namely storage and computing server, communication network and services applications [5]. In the cloud computing, datacenter is the collection of distributed servers and each server has computing resource to allocate them their users. Datacenter is a large work station in the basement of a building or a house with large number of host computer. Each computer is connected to the other side of the world that is accessible via the Internet to everyone. The cloud users access the resources using virtualization techniques that allow the sharing of computing resources of a host server to many of the users. To implement virtualization there is hypervisor, which allow one machine to be divided into many of the instances generally known as virtual machines. But users don't feel that it is sharing of resources. The distributed servers are in different geographical locations.

2.5 Cloud Attribute

The cloud computing have various types of characteristics and attributes [2]. The first most famous attributes is pay per use concept. The basic characteristics are given below.

On-demand self-service: in the cloud computing there I no human interaction. Ever thing is in the form of online services.

Broad network access: The cloud users have many of the option to access the services. There is many of the service providers who offer the services with effective service cost model.

Resource pooling: The cloud computing resources are pooled to serve large number of cloud user with virtual resources. Resources include storage media, processing capacity, primary memory, and network bandwidth etc are available to their client.

Rapid elasticity: As the cloud is a distributed collection of server and datacenter so capabilities are increasable with minimum effort. When consumer demand increases then cloud provide can increase the resource capacity by adding a new datacenter or server at any time.

Measured service: Cloud systems control and optimize all the installation and configuration related issues with automatically. Resource utilization, process scheduling and other infrastructure management work can be monitored, controlled, and reported only automated system and providing transparency for both the provider and consumer.

3. Cloud Working Principle

Resource virtualization is the foundation for cloud computing. Virtualization provides isolated, transparent, encapsulated, and manageable environment for both cloud service providers and end users. By following an elastic resource pool, virtualization allows cloud service providers and users to make use of the computing/storage resources more capably, such as load balancing, energy saving, host failure handling, and users' resource reassignment. In these basic functional modules, we often need to live migrate a virtual machine (VM) from one host to another without interrupting the current running applications in the VM.

In order to provide services, large-scale data centers are established. These data center contain numbers of running computational nodes given that virtualization by introducing many virtual machines (VMs) on each node. Figure 1, shows the actual system view cloud computing environment. There are mainly two types of actors on cloud: end-user and brokers. The end-user requests for the application on cloud and brokers process these request.

The Cloud computing refers an online delivery of computing and storage services to an end-recipients. Cloud system is a collection of distributed data center located throughout the world and these data centers are connected using communication network like as internet. The computing resources are provided to their client using virtualization. Virtualization plays a key role in cloud computing by sharing of single host machine to number of Clint's application. Virtualization technology allows all physical resources to be virtualized and be transparent to client. Client doesn't need to have any information about the hardware type, physical location, level information of computing resources.

Client just make a demand for the computing resources and according to the client requirement, the cloud system creates virtual machines inside any one of the host machine of a data center and using that virtual machine clients perform or execute their task. Process scheduling is one of the important parts of cloud system, in which appropriate resources are assigned to users' task. Efficiency of process scheduling algorithm directly affects the performance of the whole cloud system performance. There are several studies [5, 6, 7, 8 and 9] related to the problem of management cloud resources of host machine in various levels like as virtual machine level, host machine level and data center level.

4. Cloud Virtual Machine Migration

Migration of virtual machines (VMs) is a powerful tool that allows for the relocation of VM between different physical hosts. The whole software stack can be consistently transferred, while the continuous execution of the workload is guaranteed. VM migration provides substantial flexibility for many tasks of data centers and cloud platforms, including the following.

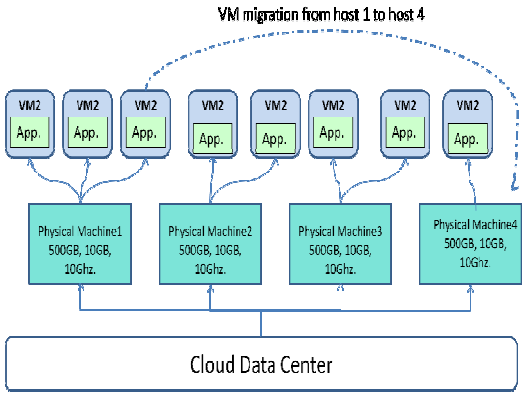

Fig. 4 Cloud Virtual Machine Migration

Load balancing: VM can be migrated from overloaded hosts to under loaded hosts to eliminate hot spots of the system.

Online maintenance and fault management: An administrator may migrate the running VM to prepare for software updating, hardware maintenance, or upcoming system fault.

Energy conservation: In cloud systems and data centers, the loads of servers are usually uneven. During peak load times, applications need more server resources to maintain the service quality. Then, when the load comes down, those light load applications with their underlying VM can be integrated into fewer hosts, so that some servers can be shut down. This strategy of power management reduces operation costs of cloud systems and data centers and benefits the natural environment.

VM migration involves migrating the VM's memory data, network connection, and virtual devices. In practice, the VM image file is usually stored in a network-attached storage (NAS) device. Therefore, the disk storage need not to be migrated. In this paper, we focus on the memory migration issues. Fig. 4 provides an overview of the architecture. The pre-copy algorithm is a widely used memory migration approach, which consists of two phases: an iteration phase and a stop-and-copy phase. Pre-copy method is generally used for live migration. In the first round it transfers all the memory pages to destination machine then iteratively copies pages modified in last round. Process is repeated until the writable working set (WWS) becomes small. Pre-copy method keeps most recent data on source side, results in more reliable than post copy method [8]. Standard pre-copy method doesn't provide the facility to record the frequently modified pages thus when dirty data generation rate (high frequently modified pages) is faster than memory page transfer rate, migration can be failed. Many pre-copy based algorithms have developed [9][10][11] which improves the performance of standard pre-copy method and reduces the downtime as possible.

5. Conclusion

This paper discuss complete fast growing technology known as cloud computing. Cloud computing have large number of resources to distributes their resources on demand. Cloud computing provide all the computing related services through the internet. For storage there is data as a service, for application there is software as a service, for computing there is platform as a service and infrastructure as a service etc. However cloud computing have various advantages but there is also some of the critical issues which needs to resolve with urgency. One of the major issues of cloud computing is virtual machine migration from current host system to another system due to over loading or other resource utilization factor. So there is always a requirement to resolve the existing issues.

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