A SURVEY OF CLOUD VIRTUALIZATION AND PLACEMENT MANAGEMENT

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Abstract The cloud is well known for its "on-demand" service models, which is provided by some set of resources and software. Cloud computing services host huge virtual machines (VMs) for demanding situations as virtualization. Virtualization efficiently accomplish increasing demand for computing, storage and network resources in the large-scale cloud data centers. By virtual machine (VM) migration, modern situation come across the various resource management representation considering load balancing, proactive server maintenance, power management, distributive service availability and fault tolerance. In cloud infrastructure management, placements of virtual machine (VM) are one of the ambitious and challenging issues and there are several techniques for virtual machine (VM) placement. In this survey, an analytical view on cloud computing in virtualization perspective is provided and modern virtual machine (VM) placement methods for economical usage of power consumption and resource management.

Keywords: Cloud Computing, Virtualization, VM Migration, Data Centers.

1. Introduction

Cloud computing is a model which enables accessible, on-demand access to the shared computing resources such as applications, services, storage, networks and servers [1]. It rapidly provides resources with minimum control management effort and service provider interaction [2]. The underlying concept of cloud computing is to bring the specific services from shared resources with the help of virtualization technology [3]. The aim of cloud computing model is to produce a powerful usage of distributed resources, assign them along to make high turnout and to control large-scale computation efficiently and economically [4]. Cloud computing architecture as shown in Figure 1 is classified into three levels of model [5]. Cloud computing services are.

• **Infrastructure-as-a-Service (IaaS):** IaaS is basically hardware and software resources that operate it all like servers, networks, storage and operating systems. Cloud computing substitute primarily hardware resources. Users of IaaS layer manage to support applications and functional systems, however there is no requirement for server, networking hardware and storage, so it is an information center to control the hardware. Popular example of this supplier corporation is Amazon [6].

• **Platform-as-a-Service (PaaS):** PaaS is a collection of services and tool developed to create coding and deploy applications fast and efficiently. Cloud computing replaces machine language by providing the system to execute software system of the user. The example of PaaS is the suppliers, corporations such as Google [7].

• **Software-as-a-Service (SaaS):** SaaS applications are developed for end-users service over the network. The cloud users interact directly with this cloud software system and pays for usages. Popular examples of SaaS supplier is Google Apps [8][9].

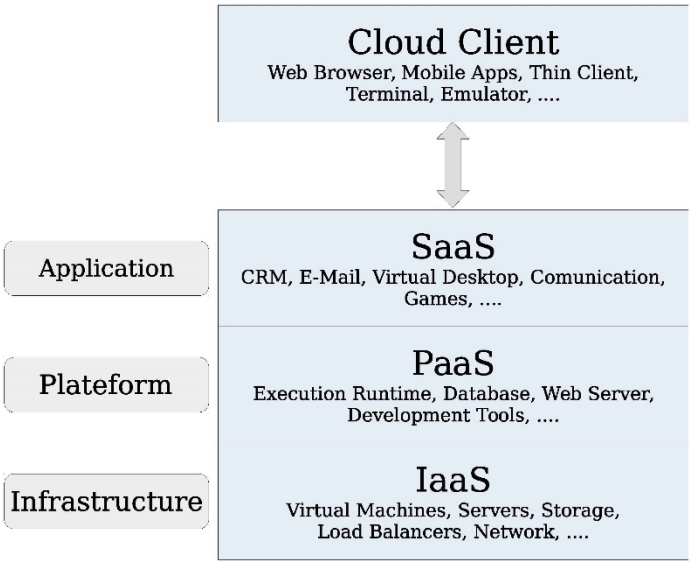

Figure 1: Cloud Computing Architecture

2. Cloud Data Center

With rapid growth in information and data flow, storage service is going to be the biggest business organization, along with the storage cost and enhancement are other key factors. This known approach of data storage service is the cloud data center (CDC). Cloud data centers are the group of heterogeneous computing with clusters of storage components together to host various applications and to store data, using very fast communication links [10][11]. The customer pay charges to the cloud operator for cloud resource applications usage which are based on the "pay-as-you-go" cloud service model. By this model it is certified that the end-user pays charges only for the required resources they have really used in the specific time duration. The cloud data center (CDC) proposes a wide variety of services to be retrieved through web links. However, the computational cost of cloud and its application execution are significantly affected by internal resource such as low CPU utilization and bandwidth limits enforced by the cloud data center (CDC) network architecture design [12][13].

The architecture of cloud network is an essential component in network design of cloud data center (CDC) since it importantly affects the CDC throughput. The architecture of modern data center network frameworks are generally based on tree-based hierarchical three-tier graphical architecture. The center layer links CDC to the Internet backbone in this three-tier architecture, the aggregation layer uses various functionalities such as content switching and firewalls, and the access layer verifies inter-rack connectivity. The architecture of cloud data center (CDC) is categorized as switch-centric, server-centric and hybrid models according to the design of network routing protocol [14]. Figure 2 represents a set of cloud services furnished by cloud data center (CDC) to its end consumers. As presented in Figure 2, the cloud services, including PaaS, SaaS and IaaS are controlled and managed by the cloud operator.

Among other services, the SaaS service model gives accounting application services like office automation, e-commerce, knowledge and information management services. Similarly, IaaS model includes hardware resources like CPU, storage, and network [15]. Likewise, PaaS service model gives various cloud execution platforms, like developer studio, IDE, database management system (DBMS) and operating systems to assist the IT professionals for developing, deploying, testing, debugging, and hosting advanced and complex web applications. Virtualization efficiently controls the cloud computing resources to effectively deliver on-demand services to the end customer, within a CDC [16].

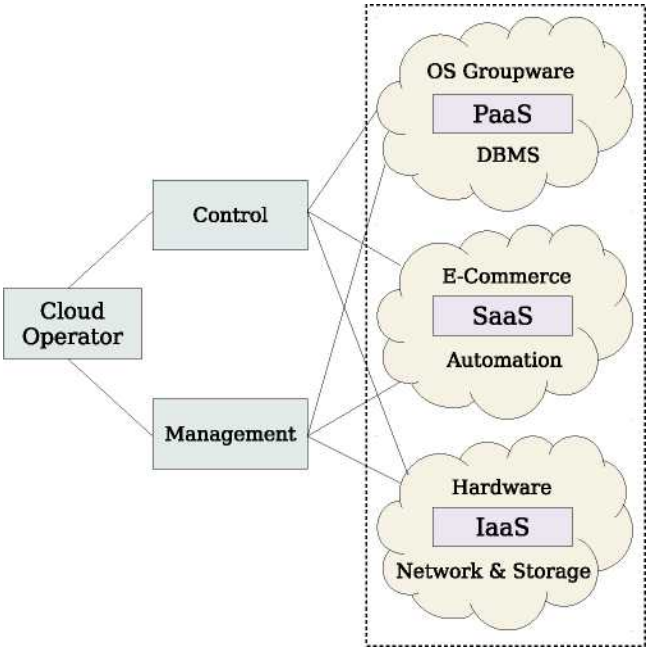

Figure 2: Cloud Service Models

3. Virtual Machine Migration in Cloud Computing

In cloud computing, virtualization is a fundamental element in modern cloud data center (CDC) with the support of isolation, consolidation and migration of server workload. Virtual Machine (VM) migration technique migrate the status of virtual resources such as CPU, memory and I/O devices among physical hosts during the process of VM migration [17][18]. The migration of a VM may be either in live or non-live communication mode. In non-live VM migration mode, the applications migration services are not provided during VM migration, however, it is provided in the live VM migration mode.

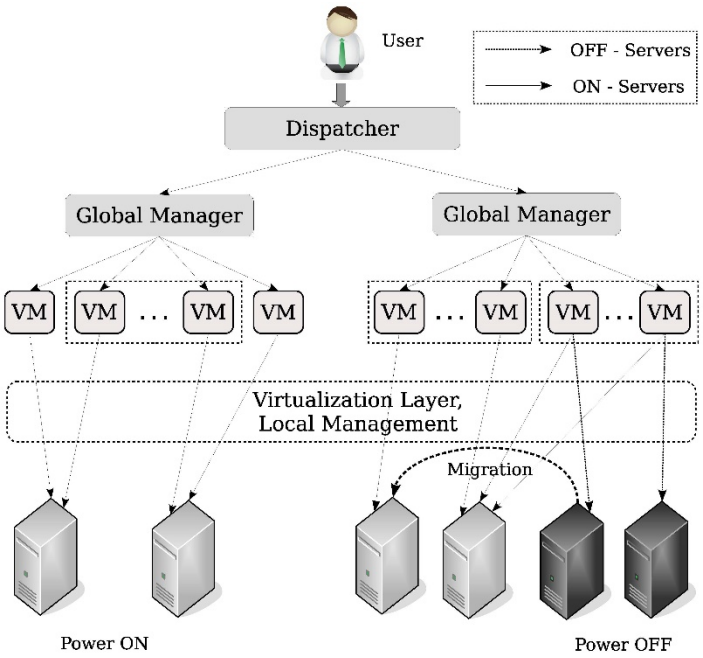

Figure 3: VM Migration Process on Distributed CDC

In a cloud data center (CDC), the technique of virtual machine migration attempt to improve control management, application performance and fault tolerance. Figure 3 represents a basic overview of a distributed cloud data center (CDC) working model. For efficient resource utilization, the model represents a live mode virtual machine (VM) migration from an underutilized server to a fully resourced server to power off the server.

The global manager basically manages a group of physical servers called a cluster and establish virtual machine (VM) for the new user application in the response to the request made by the dispatcher module. The system components conditions are examined by the local manager and they recommend to migrate some VMs if needed. In response, a global manager commands the virtual machine manager (VMM) to migrate the virtual machine (VM). Figure 3 illustrates virtual machine (VM) migration among servers placed under similar administrative system. The VM migration can be placed throughout the cloud data centers (CDCs) and can be managed by other service providers.

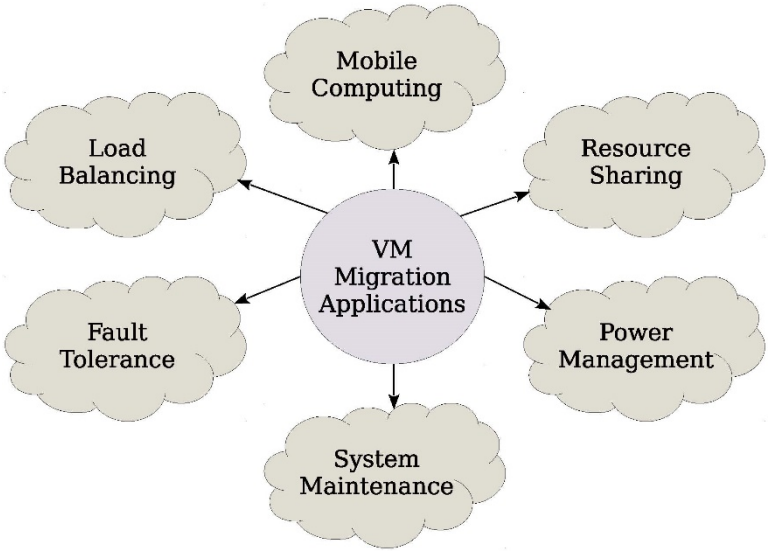

Figure 4: Applications under VM Migration

The virtual machine (VM) migration process supports to accomplish different resource management activities as presented in Figure 4. The elaborated explanation on VM migration and its applications are:

• **Mobile Computing:** It provides VM migration method to increase portable computing potentiality. Now, users prefer to work on only smart phones than desktop while they are traveling. VM migration method provides the way to migrate user's running applications within operating system from a desktop to smart phone.

• **Load Balancing:** By distributing the workloads of servers across various physical hosts within a cloud data center (CDC), load balancing mechanism assists cloud operator to avoid system failure. System performance is degraded if workload of the server exceeds its limitations so, load balancing technique using VM migration minimizes the degradation of application performance.

• **Resource Sharing:** The limited system resources sharing produces low application performance in the cloud network, resources as system CPU, memory, cache and I/O, can be adjudicated by relocating resource VM to the resource-rich server. The high resource sharing system minimizes cost of cloud operation as unused servers can be powered off.

• **Fault Tolerance:** A fault-tolerant system represents self recovery from partial failure, activate VM migration before fault occurrence. It generally migrates back VM to its original server after system recovery and maintenance, if required. A fault-tolerant system immensely modifies the system avail-ability to increase the cloud data center (CDC) reliability characteristic.

• **Power Management:** For accomplishing power efficiency procedure within a cloud data center (CDC), virtual machine (VM) migration process displace all over server workload from an under-loaded server to an underutilized server to save energy. Server consolidation enables VM migration techniques sharply co-locate the VMs and minimizes CPU clock cycle rate, to accomplish power efficiency in a CDC at the cost of system performance degradation.

• **System Maintenance:** Providing system maintenance periodically extends the lifetime of the cloud system. During system maintenance process, VM migration technology is applied to migrate running application from one machine to another host which provides continuous application service.

4. Proposed Approach

The effective virtual machine (VM) migration activities, and various VM migration strategies can improve application and network performance within Cloud Data Centers (CDCs). For better application performance, the VM migration methods mitigate some disturbance which is observed as packet drop rate, delayed response and low application throughput. The adverse disturbance of the VM migration process for running application performance is referred as migration noise. The migration noise can be minimized if resource demands for the VM migration activities are predicted in advance. This approach can solve the problem and challenges in modern VM migration methods for organization of an efficient live VM migration system.

The issues and challenges encountered by VM migration method are very dynamic. The unpredictable workloads, the heterogeneity of cloud resources, VM memory size and various resource-awareness are computationally affordable VM migration methods. If large memory is required for VM memory then it can increase migration time and service period. Some optimization techniques such as duplication redundancy, memory compression and dynamic write throttling instrumentation including soft computing methods can improve and enhance application performance at the cost of the required system resources. Finally, the security mechanism is another major issue for the VM migration process, so it must be implemented by securing the network connections. Efficient and effective placement of the VM can improve the overall performance of the cloud system.

5. Conclusion

In this paper, an exploratory survey about the virtual machine migration and its importance, types of virtual machine migration, working principle are discussed. This survey also discussed the concept of VM migration process, Cloud Data Centers and completely explained different types of VM migration methods to improve network and application performance in Cloud Data Centers. This survey explains about the various methods and techniques applied to reduce the downtime during virtual machine migration. Finally, some proposed approaches are discussed for virtual machine environments for better effectiveness. So, it is a critical and challenging task to prefer a technique that is desirable for both the cloud user and cloud service provider.

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