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Towards Virtualization in Cloud Computing

Mohammad Masdari
Computer Engineering Department
Science and Research Branch, Islamic Azad University,
West Azerbaijan, Iran
M.Masdari@iaurmia.ac.ir

Behnam Zebardast
Computer Engineering Department
Science and Research Branch, Islamic Azad University,
West Azerbaijan, Iran
behnamzebardast@gmail.com

Yaghoub Lotfi
Computer Engineering Department
Science and Research Branch, Islamic Azad University,
West Azerbaijan, Iran
Itco24@gmail.com

Abstract: Cloud computing is a model for easy access upon request network which can be configured to a set of computing resources (e.g., networks, servers, storage, services, and applications). It can be provided upon request with lowest labour and without the meddling of the user. Of serious problems faced by IT managers is Excessive number of single-purpose server hardware. The main reason for the increasing number of such hardware is incompatible applications which are running on different servers. As a result, system administrators prefer to run applications on separate servers. It imposes additional cost for service providers and users. In this paper, we discuss about the utilization of virtualization for server consolidation and to reduce the overall cost and reducing the number of servers.

Keywords: Cloud computing; virtualization; servers consolidation; reducing the overall cost

I. INTRODUCTION

The evolution of computing can be assumed in a way that it can be after water, electricity, gas and telephone as fifth essential element. In such cases, users try to access server based on their needs and no matter where a service is and how it is delivered [1, 2]. The IT experts have provided the diverse computing systems to meet needs of users which can noted as cluster computing [3], Grid computing [4] and recently cloud computing [3, 4]. The result was, users have found wide adoption in cloud computing technology rather than other Cyber computing technologies, after 2007 [5]. An example of cloud computing is often virtualized resources as a service over the Web. Instead of personal data storage devices, they are on servers on the Internet. In the meantime, users have no knowledge or control over clouds and the technology infrastructure of data encoding [6]. Internet world is moving toward online store and information process. Now to edit a simple text file or merge two images we don't need to install bulky and expensive programs such as Word or Photoshop, instead we can simply use an Internet-based service, without the need to purchase and install a program. Nowadays, cloud Computing is the only part of the world at a rapid pace that most companies are moving towards it [7]. Simply cloud computing is referred to an Internet-based implementation computing capabilities. The main idea states that Cloud Computing can provide hardware and software services through the Internet to users and organizations at all levels.in such a computing environment users have no ownership to provide service and they just use it [8] .To Use cloud computing technology users need just to take a regular PC, high speed internet connection and a good browser and connect to their cloud. Two main reasons for using cloud computing is to maximize performance and minimize costs [9]. Cloud computing reduce heavy hardware costs for companies. For example, we don't need to buy a high capacity hard disks and advanced processors. Furthermore, there is no need for physical storage space but only pay for rent and put the information on the store tool and access our data. A cloud computing system is also faster boot and setup because in that case computers have fewer programs and process that will load into memory. The performance of this computer compared with other computing systems is optimized with maximum performance [10]. One of these methods to reduce the overall cost of server consolidation is virtualization [7] which is the most widely used method in cloud computing as a cloud computing infrastructure. In the second part of this article we will talk about cloud computing models. In the third part of the article the relationship between Grid computing and Cloud computing and virtualization in the application of these methods will be discussed. In fourth Part the relationship between virtualization and cloud computing models will be discussed and in the Fifth Part, ways to reduce the cost of cloud computing using virtualization will be discussed. Also we will conclude about the results of the study in the conclusion part in Section five.

II. CLOUD COMPUTING

Cloud Computing has been introduced by the National Institute of Technology (NIST) to share resources and provide low-cost resources that can be accessed and configured with high-speed access [3].

Cloud Computing Models

Cloud computing models are divided into four categories [6]: Public cloud, community cloud, private cloud, hybrid cloud.

1) Public cloud: Public cloud describes cloud computing in the original sense is common. The public cloud resources and applications are dynamically provided via the web [11].

2) Community Cloud: where there is a similar requirement that several organizations have and seek for sharing the benefits of cloud computing infrastructure. It is more expensive but with more privacy and security policies to bring compatibility rather than public cloud [12].

3) Private cloud: Private Cloud is a cloud computing infrastructure for internal use by an organization [11]. The main factor that separates private clouds and public clouds is Place and manner of maintenance of cloud infrastructure hardware. A private cloud enables greater control over all levels of cloud implementation (e.g., hardware, networking, operating systems, and software). Another advantage of private clouds is more security due to equipment located within the boundaries of the organization and the lack of communication with the outside world.

4) Hybrid cloud: Hybrid cloud is composed of several domestics or foreign providers [12]. Hybrid cloud is a good option for most of the businesses, and provides the combination of various services to users. Figure 1 shows a diagram of cloud computing models.

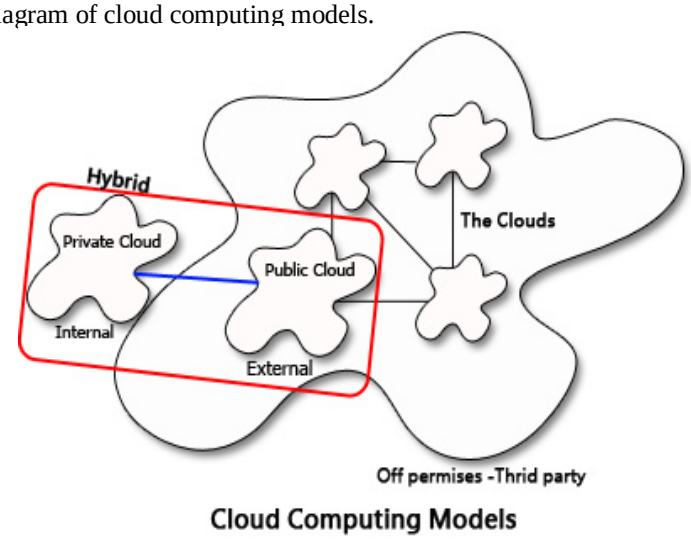

Figure 1. **Diagram of cloud computing models**

Layers of Cloud Computing Services

Cloud computing service providers offer their services based on three basic models [6]: Software as a Service (SaaS), platform as a service (PaaS), Infrastructure as a Service (IaaS). The virtualization has usage in each of these layers. Also in 2012, two other models named the network as a service (NaaS) and Communications as a Service (CaaS) have been officially identified by the International Telecommunication Union as part of the cloud computing model based on an ecosystem of cloud-based service categories. We explain them below [13, 14, and 15].

5) Software As a Service (SaaS): In this model, the cloud providers, installs cloud applications on the Cloud and users can access the application via the web and thus do not need to install software on client devices [16]. This section contains the software which is running on cloud infrastructure providers [17]. In this model, software updates is centralized and there is no need to download software.

6) Platform As a Service (PaaS): In this model, PaaS, cloud providers deliver a computing platform typically including operating systems, programming languages, runtime environments, databases and web servers. The Aid of this service enable customer to put the software that he purchased or made on the cloud platform and then to control, to test or to change it [17]. In this model, the only limitation is client monitoring of the underlying infrastructure, networks or servers [6]. Google App Engine service is an example of the services offered. Microsoft also recently has introduced the Azure Platform for cloud computing [17]. This layer manages all hardware complexity which is hidden from the user's perspective and allows web applications to be developed.

7) Infrastructure As a Service (IaaS): The purpose of this layer is providing the required servers in physical or virtual format. This type of service is a virtual server in the cloud for customers is fully placed. These services provide the processing power, networks, storage space and computing resource base, the customer does not need to purchase hardware and networking equipment [17]. In this layer, end-users has complete control over the virtual machine, and can customize it. In IaaS, developers of virtualization have better controls over security [18]. Users instead of buying hardware and software, data center space or network equipment, purchase this entire infrastructure as a fully outsourced service. Service accounts are usually based on utility computing and the amount of resources consumed will be calculated. It reflects the cost of the activity .This is actually evolving supply of private virtual server models. Infrastructure Service gives us facilities for storage and processing of standard network service. Servers, storage systems, switches, routers, and other systems for the collection, processing a variety of components to an application can handle complex calculations. Examples of such services include Microsoft Azure Platform, Amazon EC2 and ... Are [17, 18]. Figure 2 shows the architecture and service models of cloud services in the three models.

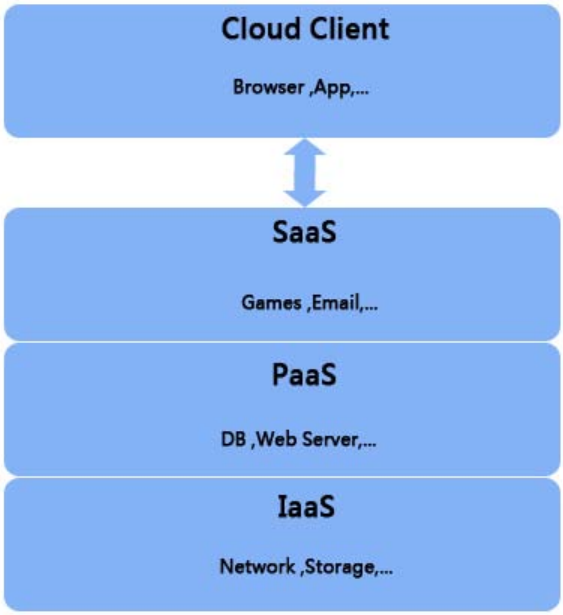

Figure 2. **The architecture and service models of cloud services on three service models**

8) Storage As a Service (NaaS): A set of cloud services that provide functionality to the user to use cloud services, network and transport services within the cloud, there is a connection or network services. NaaS include optimizing the allocation of resources according to network resources and computing resources to be integrated as a single unit [19, 20]. NaaS services including VPN and developing flexible bandwidth upon demand. Also NaaS is the virtual network service provided by network infrastructure owners [20, 21].

9) Communications As a Service (CaaS): CaaS enables consumers to use enterprise level Voice over Internet Protocol (VoIP), VPN data, private branch exchange (PBX) and Unified Communications without the costly investment, hosting and infrastructure management [22, 23].

III. CLOUD COMPUTING AND GRID COMPUTING IN VIRTUALIZATION

Cloud computing technology came into existence in the continued development of grid systems. Thus, in some systems, the Grid technology is also used. But despite these problems, grid computing and cloud computing have many differences. But the common point of these two technologies is virtualization capabilities in its implementation. Grid computing is used in many cloud computing implementations. In addition, many Grid networks can be seen as examples of cloud computing. But the grid is not necessarily related to cloud computing. There are clouds in the hardware and software infrastructure which do not use grid networks. Grades are based on the virtualization as well as clouds. But efforts are done to take place virtualization on the grid. The context of cloud computing is virtualization of software and hardware but most of grid computing is to virtualize resources and data [3, 4]. Many grids models use calculating model with the team planning. It looks very different with cloud computing models [24, 25]. Despite the resources dedicated specifically to the cloud is dominated by the queuing system available to all users. This allows delay-sensitive applications, provides for the implementation of the Clouds. However, to ensure adequate quality of service to end users is dedicated. This is probably one of the main challenges for cloud computing is the increasing number of users and cloud scale [26, 27]. Another challenge is that virtualization puts potential problem for the control of resource monitoring in front of the clouds. Although many Grids such as Tera Grid [28] put restrictions on the type of sensor or long service leave the user to start, but do not directly control the clouds, like Grids. Because there are different trust model of Grids in which users identify themselves through trades can have access to the resources of different Grid sites. Grid resources, such as what is seen in the clouds are highly abstract and figurative. In a cloud, various levels of services provided to the end user and the end user is only exposed to a predefined API. Lower levels of resources for the user are ambiguous [28, 29]. While many scholars and writers acknowledged similarity of cloud computing and Grid, There are other ideas, they are more focused on the problem of the cloud computing, Grid computing has evolved. Fester represented connection between the cloud and the grid and Grid and cloud computing not only overlap, but really, the grid emerged the cloud and Grid computing is infrastructure of cloud computing and it relies on it [4]. Figure 3 represents the overlap of cloud computing systems and Grid cluster.

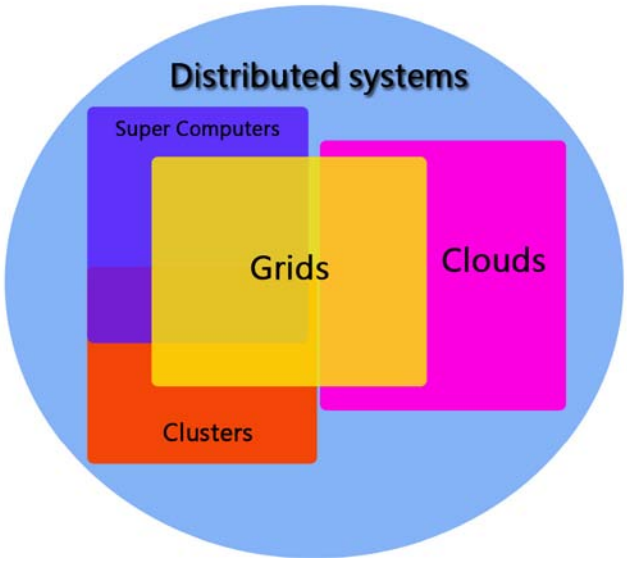

Figure 3. **The overlap of cloud computing systems, Grid cluster and cloud computing**

Based on Figure 3 supercomputers and cluster computing based on the more traditional minded focus on applications of non-service. As can be seen in all of these areas grid computing overlaps with others and cloud computing spectrum includes service-oriented applications.

IV. VIRTUALIZATION

Virtualization is one of the emerging technologies in the IT world, and technical knowledge using it can overcame a lot of obstacles in the field of infrastructure (software and hardware), and to create conditions for sustainable development and good for business. Application Virtualization is so wide that not only people but also many IT professionals and experts in other fields related to computers and IT benefit from it. [30, 31]. Virtualization is a technology that can help the physical components of a computer aided software, the operating system can be shared by many of them in an instant and clearly can be used simultaneously .virtualization is designed to provide the virtual environment for the use and access In reality [7] Virtualization technology is due to its specific design is functional and logic does not seem real, but it is a real function. Virtualization is introduced as Inseparable member of every cloud due to its abstraction and encapsulation. Service users are required to give the computer the whole thread, and each thread runs simultaneously and uses all available resources. Clouds also should have several applications, or even thousands or millions of users to run applications and all applications are available to users in a way as if they are running simultaneously and use of all available resources in the cloud [32]. Virtualization provides the necessary abstraction layer in a way that is coherent and unified fabric infrastructure as a set of resources and overlapping resources (e.g., data storage service, Web hosting environments) can be built on them. Therefore, security management capabilities and offer better resolution [33]. There are other reasons, such as clouds that tend to be compatible with virtualization, Integration of applications and servers on a single server to run multiple applications if the resources are used efficiently. 2) The ability to show that the situation is quite different sources for different applications. It means some require a lot of storage and some need computation so that resources for different needs to be

summed up in the dynamic forms. 3) Providing resources to improve the accountability, monitoring and maintenance that are automatically available to share and reuse resources [34, 35] there are wide variety of hardware virtualization, such as virtualization, application virtualization and storage virtualization [30]. From the perspective of a private cloud, virtualization hardware will be more applicable. Hardware virtualization is a way of simulating multiple physical servers into one physical server help [34]. Simply, outsourcing means unlimited cloud-based management and According to the customer demand it is present. The definition of a public cloud, private cloud point may be true, but we should reflect a bit on it. Private cloud, as the name suggests, is part of so-called private data center [36]. One of the benefits of virtualization technology is green technology. Since the computers of the cloud data system use virtual data center it makes their environment less warm. Therefore they are known as Green technologies [34].

V. HOW TO REDUCE THE OVERALL COST WITH THE USE OF VIRTUALIZATION IN CLOUD COMPUTING

One of the biggest problems faced by IT managers is that the number of single-purpose server hardware is more than enough .The main reason for the increasing number of such hardware are incompatible applications which are running on separate servers [7, 34]. Apparently, increasing the number of servers is not a big problem, but over time big amount of secretly cost should be paid to raise unlimited servers. Hardware costs contain failure to utilize all the power of server hardware of computers, and software problems such as inability of paying attention to software problems of different servers in different short time distances, used electricity of servers, cooling equipment of data center, the place of keeping servers, and the most important one talented experts who have the duty of managing systems containing both hardware and software convinced managers accept the integration of servers as an accepted principle [35].The most reliable method for server consolidation is using virtualization technology. Virtualization allows multiple virtual machines to run on any physical hardware. Each virtual machine can have its own operating system and run it [37, 38, and 39]. The use of virtualization can be on one server at a time, multiple operating systems (even mutually exclusive). Each operating system executing an application [37]. Figure 4 shows the operating system using virtualization can be placed on a server.

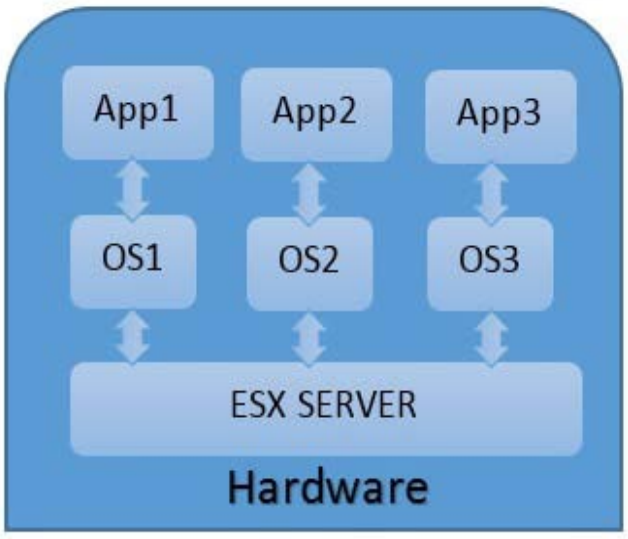

Figure 4. **Different operating systems are on a server**

In Figure 5, using virtualization for server consolidation is shown.

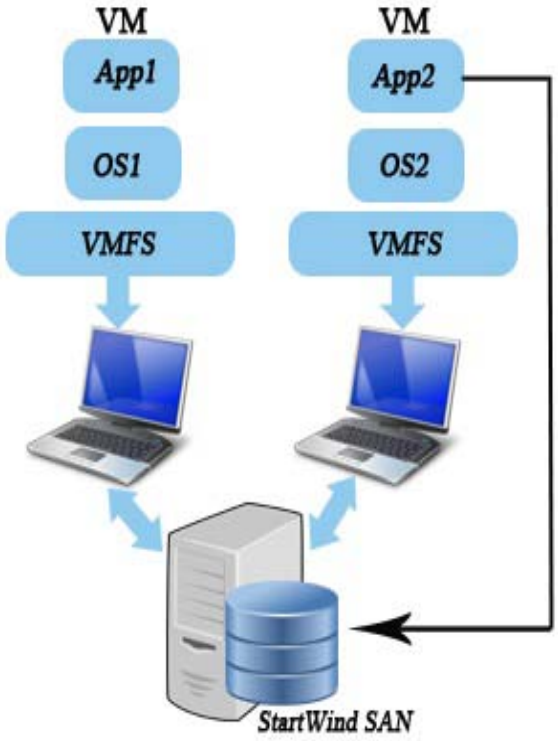

Figure 5. **Installing multiple operating systems on a single server using virtualization**

In Figure 5 we use multiple operating systems on a server using virtualization technology which will lead to lower overall costs. As a whole, virtualization technology makes more efficient use of hardware resources, increase productivity, Easier management and thus reduce the number of necessary technical expertise, independence of virtual machines to hardware resources, the division, Virtual machines, the direct and indirect cost savings, integration of services in one or more servers that make up the centralized management and security, expedite the implementation of various services and create new services in a rapid increase of business support services to older systems and the organization, Integration of hardware resources, to create a test environment and deploy systems without interruption and without risk, low costs maintenance, will be high safety factor of virtual machines. To respond to the challenges and benefits of using this technology, large companies around the world have turned to virtualization [40, 41]. Some examples of companies are VMWARE XEN, HP, pointing warns example, VMware is the global leader in virtualization and cloud infrastructure which In 2012 they were able to introduce network virtualization to market and, a global cloud infrastructure provider and VMware Service Provider of the Year 2012, announced the benefits of network virtualization VMware to reduce operating costs and speed up service [13]. Key components of the software architecture, data centers based on VMware, enables organizations through virtualization agility, productivity and Cloud Management [13]. So we can say that according to the description provided by the optimization idea of virtualization and cloud computing models are useful in any way at all.

VI. CONCLUSION

Reduce costs in today's world of cloud computing in many respects is quite useful. This is why researchers are always looking for one of these techniques in reducing costs. In this paper Grid computing and its application in virtualization of cloud computing is discussed and compared with the Grid. Also in this article we have talked about the relationship between virtualization and cloud computing comparing to other models and we observed how server consolidates using virtualization technology, we see this technology has contributed in any way to reduce cost when compared to other methods. It is the most controversial and very efficient in security issues as one of the most important issues in cloud computing.

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