Survey On Implementation And Benefits Of Data Center Virtualization

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ABSTRACT

The aim is to demonstrate the benefits of virtualization of data center. The data centers enables user to store their data and use the high quality cloud application. It can be either physical or virtual, which can be used for the storage and management of data. A data center is a facility consisting of servers, storage and network devices, power distribution systems, cooling systems.The purpose of virtualization is to improve resource utilization. Achieving virtualization at all levels (system, storage, and network) will be a difficult task. This paper explains the concept of virtualizing the data center and the benefits of data centers after virtualization.

1. INTRODUCTION

Virtualizationis the creation of a virtual version of something,such as a hardware, operating system, storage device, or network resources [1]. It is defined as a technology which introduces abstraction layer between the hardware and the operating system and applications running on top of it. This abstraction layer is called virtual machine monitor or hypervisor and basically hides the physical resources of the computing system from the operating system [2]. Since the hardware resources are directly controlled by the virtual machine monitor and not by the operating system, it is possible to run multiple operating systems in

parallel on the same hardware. As a result, the hardware platform is partitioned into one or more logical units called virtual machines. In the computer world, a virtual environment is considered to be same as that of a real environmentby application programs and the rest of the world, though the mechanisms are totallydifferent.

DATA centers have received significant attentionas a cost-effective infrastructure for storing largevolumes of data and hosting large-scale service applications.With the rise of cloudcomputing, service hosting in data centers has become a multibilliondollar business that plays a crucial role in the futureInformation Technology industry [3].Despite their importance, the architectures of today's datacenters are still far from being ideal. Traditionally, data centersuse dedicated servers to run applications, resulting in poor server utilization and high operational cost. So virtualization of data centers will increase the performance of storing and managing the large volumes of data. Data center has begun to focus several issues on performanceand resource efficiency, such as resource guarantee.Virtualization will be one of the critical technique of system,because resource protection and hardware utilization. However, it brings the complexity and system influence which are difficultto solve without detailed system analysis. Due to facingchallenges, the full testing which help to analyze the systemmust be in progress constantly. Not to mention how to testthe optimization of single layer will cause any chain reactionon the other layer. In order to help system analysis, theyusually use all kinds of system profiling tool. But, mosttool are already not suitable for virtualization data center,because the virtual machine hardware protection and multi-layer systemisolation. It causes the lack of system information that we cannot make a detailed experimental.Without profiling tool, they cannot early face the challengeof power consumption and reliability. As we know, virtual machine had control all hardwaredevice through virtual machine management. Thesystem will be segregation of each OS's security. But, thefirst challenge be caused by virtual machine is some application whichneed resource guarantee cannot provide some guaranteeof computing priority. Second challenge is also bring down theoverhead. Nowadays, virtual machine had stressedless overhead, but still need to know the relation of multilayersystem.Third challenge is large data storage Different hardwarehave different feature. In datacenter, it need a lot of storage capacity and evaluate theprice of hard disk drive.

2. IMPLEMENTATION

Virtualization is a general and ambiguous term that typically means to run multiple instances of something inside something that was intended to only run a single instance. Well there is number of options for virtualizing the data centers.

- VMware ESX and VMware server
- Citrix Xen
- Microsoft Hyper-V

VMware ESX server possesses best approaches to adopt the abstraction of hardware and most effective usage of the resources through vast available tools and services so that it can maximize the infrastructure efficiency and reduces operational cost by providing cost effective business continuity. The technology behind VMware ESX is Hypervisor. Hypervisor (Bare Metal) means no OS is required because it has its own kernel derived from linux withit provides greater resources for the virtual machines, with decrease in cost of licensing and increased usage of servers.

As ESX is enterprise wide solution for virtualization to adopt effective abstraction of hardware, it suits for large enterprises looking for hardware abstraction with enormous resources.It inserts a robust virtualization layer directly on the server hardware for near-native virtual machine performance, reliability and scalability. Its disk footprint is a fraction of the size of a general purpose operating system, reduces the complexity and provides unmatched security and reliability. It is built into the server of the hardware as an embedded component, which simplifies and speeds the deployment of virtualization. The virtualization of CPU increases server utilization without the risk of critical services being starved for CPU resources. VMware ESX usescertain process thathandles scheduling and load balancing across available processors to manage the execution of virtual machine processing. The key components that need to virtualize in the data centers are the Storage disks and the network. Storage systems typically use special hardware and software along with disk drives in order to provide very fast and reliable storage for computing and processing the data. Storage systems are very complicated, and it is a special purpose computer designed to provide storage capacity along with advanced data protection features. Disk drives are small elements within a storage

system, which contains the hardware and special purpose software embedded within the system.Storage systems can provide either block accessed storage, or file accessed storage. So there can be two types of virtualization that is Block virtualization and File virtualization. The virtualization system presents to the user a logical space for data storage and handles the process of mapping it to the actual physical location.It is possible to have number of layers of virtualization or mapping. It is then possible to have the output of one layer of virtualization can then be passed to the input for a higher layer of virtualization. Virtualization maps space that exists between the back-end resources to front-end resources. In this instance, back-endcan be referred to a logical unit identifier (LUN) that is not presented to a computer, or host system for direct use. A 'front-end' LUN or volume is presented to a host or computer system for use.The virtualization software or device is responsible for maintaining a consistent view of all the mapping information for the virtualized storage. This mapping information is referred as themeta-data and is stored in a table called as a mapping table.Some implementations do not use a mapping table, it calculate locations using an algorithm. These implementations use dynamic methods to find the location on access, rather than saving the information in a mapping table.The virtualization software or device uses the meta-data to re-direct incoming and outgoing requests. It will receive an incoming request containing information about the location of the data in terms of the logical disk and translates this into a new request to the physical disk location.When storage is virtualized, replication services must be implemented above the software or device that is performing the virtualization. It is true because it is only above the virtualization layer that an actual and consistent image of the logical disk can be copied. Data replication can be achieved either by remote data replication or by taking snapshots at a regular interval of time. The physical storage resources are aggregated into pools of storage often called as storage pools, from which the virtual storage called logical storage is created. More storage systems, which can be heterogeneous in nature, can be added as and when required, and the virtual storage space will increase by the same amount.

Over the last decade, enterprise data center customers have gained tremendous business advantages and cost savings from the introduction of compute virtualization technologies. Virtualization technology provides reductions in server provisioning time and

increasedutilization of servers, thereby creating dramatically high service levels and decreasingoperating expenses and server capital expenditures. The benefits have been realized from migrating from 20 servers per rack to more than 200 VMs per rack, customers are finding it difficult to realize the ultimate potential of network virtualization and cloud computing, because the network architecture poses difficult barriers.

Conventional data center networks are built using traditional networking platforms that are inflexible, static and not capable of meeting the dynamic needs of a virtualized cloud data center. While virtual machines can be provided in a matter of minutes with user self-provisioning capabilities, network resources are still configured manually with static policies. So, when users want to create new classes of cloud workloads, the network is the blockage, delaying the new workload provisioning for weeks while manual network provisioning is completed. Also, if the goal is to move workloads with mobility across multiple data centers for flexibility and high availability, it becomes a difficult task involving tunnels and layers of configuration to be done manually. So the traditional network platforms are just not capable enough to meet user expectations in cloud computing environments.

Network virtualization (NV) is using network resources through a logical segmentation of a single physical network [3]. Network virtualization is accomplished by installing software and services to manage the sharing of storage devices, computational cycles and applications. It treats all servers and services in the network as a single pool of resources that can be accessed without regard for its physical components. The phrase network virtualization is mostly used to describe many things including network management andstorage virtualization.Network virtualization is the method of combining hardware and software network resources and network functionality into a unique, software-based administrative matter, a virtual network.Network virtualization is categorized as either external, parts of networks, into a virtual entity, or internal, providing functionality like the network to the software containers on a single system. The virtualization is internal or external depends on the implementation provided by vendors that support the technology.Network hardware, such as switches and network adapters, also known as network interface cards (NICs). Networks such as virtual LANs (VLANs) and containers such as virtual machines have to be virtualized. Some vendors offer external network

virtualization, in which more local networks are combined or subdivided into virtual networks, with the aim of improving the efficiency of a huge network or data center. The main components of an external virtual network are the VLAN and the network switch.Network virtualization is one of the primary building blocks for multi-tenant cloud hosting and large-scale virtual machine farms. Network virtualization is a technology that compliments server hypervisors by enabling seamless workload mobility regardless of underlying network addressing and protocol choices.Virtual machines supporting the application often require network connectivity (switching and routing) to other virtual machines and the outside word with security and load balancing. The early network device virtual machines are attached to is a software virtual switch on the hypervisor. The network relevant to the virtual machines is sometimes more specifically referred to as the virtual network.Virtual servers have been fully decoupled from physical servers by server virtualization. The virtual network has not been fully decoupled from the physical network. Because of this, the configuration necessary to provision an application's virtual network must be carefully engineered across many physical and virtual switches. With Network Virtualization, the goal is to take all of the services of the network, features and configuration required to provision the application's virtual network (VLANs, VRFs, Firewall rules, Load Balancer pools, Routing, isolation, multi-tenancy, etc.) – take all of those features, remove it from the physical network, and add it into a virtualization software layer for the express purpose of automation.With the virtual network fully divided, the physical network configuration provides packet forwarding service from one hypervisor to the other hypervisor. The applying details of physical packet forwarding are separated from, and not made difficult by, the virtual network. Both the physicalandvirtual network can evolve independently.Packet forwarding is not the point of friction in provisioning applications. The physical switches of current generation do this quite well with dense line-rate 10/40/100G silicon and standard IP protocols. Packet forwarding is not the problem. The problem answered by network virtualization is the manual implementation of features,network policy, and services building the network architecture viewed by applications compute resources (virtual machines). It provides a way to run multiple networks, each customized for a specific purpose. It allows simultaneous operation of logical networks on a single physical platform. Network

virtualization is described by dividing the role of Internet service providers into infrastructure providers and service providers. Infrastructure providers manage the physical infrastructure and service providers will create virtual networks by aggregating the resources from multiple infrastructure providers and offer the services.

The migration of the network and the storage from the physical data centers to the virtual data centers is one of the most difficult tasks to be achieved. It involves the transfer of the virtual machine from a physical host to another virtual host but it should ensure the continuity of service [4]. It should ensure high availability with providing services continuously. It migrates the Operating systems, storage and the network components including the applications. The first step is to select a target host that provides the resources that are required in order to migrate the virtual machine. The second step is to make the copy of the memory for the purpose of backup, third step is to redirect the copy to the identified host. The destination machine confirms the reception of the migrated Operating system than the copy at the destination machine becomes the primary and the migrated virtual machine becomes activated on the target.It has to guarantee load balancing, power saving and the fault tolerance. When a virtual machine is running and it has to be migrated, it should minimize both the downtime and the time required for the migration. Hypervisor controlled mobile IP enables virtual live migration over distributed computing resources. It provides complete transparent migration to the Operating system and applications that run in the virtual machine. Full virtualization can be achieved in a standalone machine where requests will trap into virtual machine and it decodes the request and maps into physical hardware and drives the device to complete the request[5]. The approach is very efficient but it should control the physical device, so it is difficult to implement. The alternative to the full virtualization can be Para virtualization[5]. It consists of two drivers, a backend driver and the frontend driver. The backend will be present in the virtual machine and access the physical machine whereas the frontend driver is installed on the guest operating system which processes the requests and passes them to the backend driver. It is simpler to implement than full virtualization. Snapshots can be used to store virtual, instant copies of storage. The data has to be physically copied so it will have a severe impact on application performance.Snapshots are often used to enable the user to experimenton its data and to recover the original volume in case of

afailure to the time when the snapshot has been created.

3. BENEFITSS OFDATA CENTER VIRTUALIZATION

Data centers major part will be hardware; it is the highest cost in the data center. Reduce the amount of hardware used and the cost will be reduced. But the cost goes well beyond that of hardware lack of downtime, easier maintenance, less electricity used. Over time, this all adds up to a significant cost savings.When a physical server goes down, the redeploy time depends on a number of factors like backup server, image of the server, the data on backup server is current. With virtualization, the redeploy can occur within minutes. Virtual machine snapshots can be enabled with just a few clicks.Not only can you do full backups of your virtual server, you can do backups and snapshots of your virtual machines. These virtual machines can be moved from one server to another and redeployed easier and faster. Snapshots can be taken throughout the day, ensuring much more up-to-date data. And because firing up a snapshot is even faster than booting a typical server, downtime is dramatically cut.What better testing environment is there than a virtual one? If a tragic mistake happens, all is not lost. Just revert to a previous snapshot and it can move forward as if the mistake didn't even happen. It can also isolate these testing environments from end users while still keeping them online.One of the nice things about virtualization is the abstraction between software and hardware. This means don't have to be tied down to one particular vendor, the virtual machines don't really care what hardware they run on, so it is not tied down to a single vendor, type of server or even platform.Disaster recovery is quite a bit easier when the data center is virtualized. With up-to-date snapshots of the virtual machines, it can quickly get back up and running. And should disaster strike the data center itself, it can always move those virtual machines elsewhere. Having that level of flexibility means the disaster recovery plan will be easier to enact and will have a much higher success rate.With a move to virtual machines, it is much closer to enjoying a full-blown cloud environment. It can even reach the point where deploy VMs to and from the data center to create a powerful cloud-based infrastructure. But beyond the actual virtual machines, that virtualized technology gets closer to a cloud-based mindset, making the migration all the more easy.The

virtualization helps reduce capital expenses through server consolidation and improve operating expenses through automation, while minimizing lost revenue by reducing both planned and unplanned downtime. It enables the consolidation of physical servers, slashing the costs of operating a data center. This includes reducing the costs of server upgrades, management, power, space, and storage. It reduces in data center space and in data center equipment such as power distribution units, air conditioning units. It provides true high-availability for all servers without requiring duplicate hardware and clustering software. It enhances security and provides regulatory compliance benefits.

4. CONCLUSION

This paper aims at identifying the benefits of virtualizing the data center. It describes the requirement of the virtualization for huge data centers and how to implement the virtualization for the storage, network and also the different techniques involved like snapshots, disaster recovery. It provides impact of the virtualization technology's on the data centers and thereby helps in reducing the hardware cost, power cost and the data recovery part. Each of the virtualization technique will have different impact on quality attributes that are required for the virtualization of data center. This paper helps user about the requirement of the virtualization on the data center and the impact of virtualizing data center and the benefits of it.

5. REFERENCES

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