A STUDY ON STORAGE VIRTUALIZATION

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ABSTRACT: Over the past several years, virtualization has evolved from a popular buzzword into a formidable strategic technology that many organizations have adopted and many others are strongly considering. This study paper revolves around the impact of virtualization at the various layers of storage stack. There is a rapid growth in the storage capacity, and hence the processing power in the respective enterprises storage appliances coupled with the requirements for high availability and it needs a Storage Area Network (SAN) architecture for providing the storage and performance elements here. The Storage Virtualization provides us with a combination and management of storage resources for Storage Area Network with multiple servers as well as the storage devices. The main aim for storage virtualization is its necessity to be inexpensive and not affect the performance. This paper focus as on how virtualization helps security ,Memory Management, Power Management and Disaster Recovery.
Keywords: Storage, Performance, Virtualization, Network, Storage Virtualization, Storage Area Network (SAN), Network, Attached Storage (NAS), Server, Storage Device (Sub-System), Host, Virtual Machine, Hypervisor.

I. INTRODUCTION

The Act of abstracting, hiding, or isolating the internal functions of a storage system from applications, host computers, or general network resources, for the purpose of enabling application and network-independent management of storage or data. The application of virtualization to storage services or device for the purpose of aggregating functions or devices, hiding complexity, or adding new capabilities to lower level storage resources..The data storage industry is one of the most dynamic sectors in information technology today. Due largely to the introduction of high-performance networking between servers and storage assets, storage technology has undergone a rapid transformation as one innovation after another has pushed storage solutions forward. At the same time, the viability of new storage technologies is repeatedly affirmed by the rapid adoption of networked storage by virtually every large enterprise and institution. Businesses, governments, and institutions today depend on information, and information in its unrefined form as data ultimately resides somewhere on storage media. Applying new technologies to safeguard this essential data, facilitate its access, and simplify its management has readily understandable value. Storage systems are complex, and may be thought of as a special purpose computer designed to provide storage capacity along with advanced data protection features. Disk drives are only one element within a storage system, along with hardware and special purpose embedded software within the system. Storage systems can provide either block accessed storage, or file accessed storage. Block access is typically delivered over Fibre Channel, SAS , iSCSI, FICON or other protocols. File access is often provided using NFS or SMB protocols.

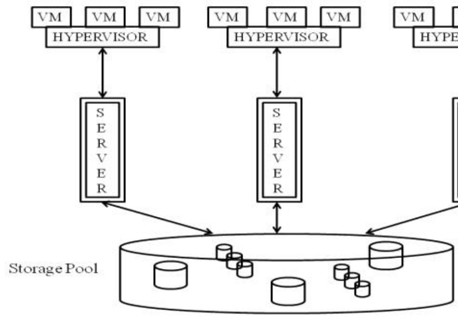

Figure 1: Basic Architecture of Storage Virtualization

A virtual machine (VM) is an operating system (OS) or application environment that is installed on software, which imitates dedicated hardware. The end user has the same experience on a virtual machine as they would have on dedicated hardware. Specialized software, called a hypervisor, emulates the PC client or server's CPU, memory, hard disk, network and other hardware resources completely, enabling virtual machines to share the resources. The hypervisor can emulate multiple virtual hardware platforms that are isolated from each other, allowing virtual machines to run Linux and Windows Server operating systems on the same underlying physical host.

II. SNIA STORAGE VIRTUALIZATION TAXONOMY

The SNIA (Storage Networking Industry Association) storage virtualization taxonomy (see Figure 10-3) provides a systematic classification of storage virtualization, with three levels defining what, where, and how storage can be virtualized.

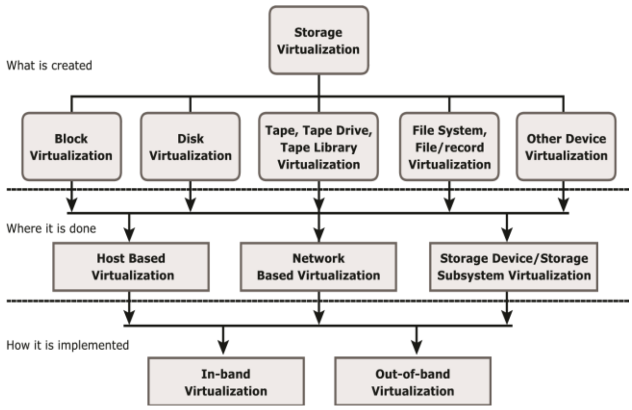

Figure 2 : SNIA storage virtualization taxonomy

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The first level of the storage virtualization taxonomy addresses “what” is created. It specifies the types of virtualization: block virtualization, file virtualization, disk virtualization, tape virtualization, or any other device virtualization. Block-level and file-level virtualization are the core focus areas covered later in this chapter. The second level describes “where” the virtualization can take place. This requires a multilevel approach that characterizes virtualization at all three levels of the storage environment: server, storage network, and storage, as shown in Figure 2. An effective virtualization strategy distributes the intelligence across all three levels while centralizing the management and control functions. Data storage functions—such as RAID, caching, checksums, and hardware scanning—should remain on the array. Similarly, the host should control application-focused areas, such as clustering and application failover, and volume management of raw disks. However, path redirection, path failover, data access, and distribution or load-balancing capabilities should be moved to the switch or the network.

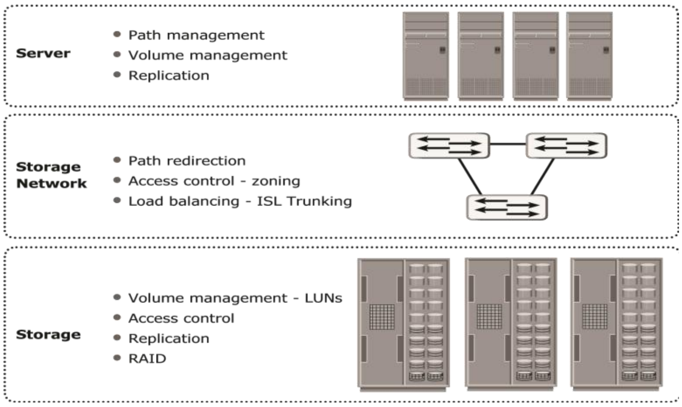

Figure 3: Storage virtualization at different levels of the storage environment

The third level of the storage virtualization taxonomy specifies the network level virtualization methodology, in-band or out-of-band.

III. EVOLUTION OF STORAGE TECHNOLOGY

Storage is the core functional and fundamental component of the computer to hold the digital data and information. Day by day the need and utilisation of storage and disk is changing rapidly.

Direct Attached Storage (DAS) - DAS is the traditional method of locally attaching storage devices to servers via a direct communication path between the server and storage devices. The connectivity between the server and the storage devices are on a dedicated path separate from the network cabling. Access is provided via an intelligent controller. The storage can only be accessed through the directly attached server. This method was developed primarily to address shortcomings in drive-bays on the host computer systems. When a server needed more drive space, a storage unit was attached. This method also allowed for one server to mirror another. The mirroring functionality may also be accomplished via directly attached server to server interfaces.

Network Attached Storage (NAS) - NAS is a file-level access storage architecture with storage elements attached directly to a LAN. It provides file access to het erogeneous computer systems. Unlike other storage systems the storage is accessed directly via the network. An additional layer is added to address the shared storage files. This system typically uses NFS (Network File System) or CIFS (Common Internet File System) both of which are IP applications. A separate computer usually acts as the "filer" which is basically a traffic and security access controller for the storage which may be incorporated into the unit itself. The advantage to this method is that several servers can share storage on a separate unit. Unlike DAS, each server does not need its own dedicated storage which enables more efficient utilization of available storage capacity. The servers can be dif ferent platforms as long as they all use the IP protocol.

Storage Area Networks (SANs) - Like DAS, a SAN is connected behind the servers. SANs provide block-level access to shared data storage. Block level access refers to the specific blocks of data on a storage device as opposed to file level access. One file will contain several blocks. SANs provide high availability and robust business continuity for critical data environments. SANs are typically switched fabric architectures using Fibre Channel (FC) for connectivity. As shown in Figure 3 the term switched fabric refers to each storage unit being connected to each server via multiple SAN switches also called SAN directors which provide redundancy within the paths to the storage units. This provides additional paths for communications and eliminates one central switch as a single point of failure.

IV. RELATED WORK

Virtulization is the key technology that empowers cloud computing. Cloud is essential because local resourse is limited and not consistent across multiple devices.Storage virtualization is an example of resource virtualization whichcreates a pool of logical storage by abstracting all physical resource. Some of the reseachers have designed storage virtualization recently . We haveclassfied previous work according to the major chaallenges in the storage virtualization.

Implementation- Li Bigang et al heve implemented storage virtualization on SCSI target simulator.They are work was compatible of all operting system and runs on target host. This technique was based on mapping table to modify the SCSI command address. Free space was managed by the help of bitmap techniques. However, this technique was not pracitacally implemented. This technique was implemented on simulator.

Security – The study mode by Benard O. Osero and David G. Mwathi on security implementation in virtualized network storage environment found that this system have all traditional software security issue because the services of virtualization is offerd by hypervisor which is a software program. Their finding was that such system must have efficient resource sharing and isolation which should ensure the virtualization meaning. There is high responsibility to ensure security here because in storage virtualization there are several logical machines so more risk of posible attacks.

Storage Management – guangyn zhang et al were designedand implemented out of band virtualization for large

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SAN. This implementation was very robust to power failure. It incorporated existing legacy system. This technique was based on SLAS2 approach for scaling round robin stripped volume. Although their approach was able to manage memory & power failure but they didn't provided security to the data stored on the infrastructure.

Power Management- The proposal made by Huojun Ino et al. on multi protocol switch using PCI Express protocol with PCIe switch fabric for I?O and switch virtualization achieved high bandwidth . Low power as well as low latency multiprotocol switching . Their proposal is based on the fact that latency and I?O rate suffers due to legacy components. They have proposed a technique to overcome it. But they didn't consider the security ,isolation and policy based allocation.

Disaster Recovery – Jiang guo-song et al has extended previous works and proposed their own way which was very efficient for Wide area data sharing. It supports collaborative processing Their approach was efficient to support wide area virtul storage resource management. They used RAID for mirroring of data in the SAN but they still lacking security and efficiency.

V. PROPOSED WORK

In this paper, we investigate the problem in storage virtualization, which is essentially a distributed storage system. The study of different possibilities of designing of a storage area network(SAN) and to get an optimized solution for it. There are different protocols available for storage area network such as iSCSI , SCSI , FC , FCIP and FCoE. Based on the study, iSCSi is recommended as the best suited protocol for the SAN. Hence, iSCSI is used to enable communication between storage server and client in SAN design. The main advantage of virtualization in SAN is for efficient utilization of hardware , replication , scalability of storage and possibility of live migration.

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