Cloud Data Management Interface based Storage Virtualization Mechanism for Cloud Computing

Vijay. G.R, A.Rama Mohan Reddy

Abstract- Cloud computing refers to the use of Internet based computer technology for a variety of services like memory, storage, processing and bandwidth. In internet cloud computing plays a major role to maintain the collection IT resources which are used by the cloud providers. In this paper we have proposed the concept of virtualization, where the Storage Virtualization and CDMI (Cloud Data Management Interface) are discussed.The CDMI gives how standard interfaces, coordinated between different organizations can meet the emerging needs for interoperability and portability of data between clouds. The Open Cloud Computing Interface (OCCI) is a free, open, community consensus driven API, targeting cloud infrastructure services.

Index Terms: Cloud Computing, CDMI, OCCI, Storage Virtualization,.

I. INTRODUCTION

Cloud Computing involves aggregation of multiple computing, storage and network resources into a single entity called 'cloud' into which location-independent computing is performed. Cloud computing is a natural evolution of the virtualization, Service-Oriented Architecture (SOA) and Utility Computing.

Virtualization in computing is the creation of a virtual version of a hardware platform, Operating system, a storage device or network resources. For example**,** a single physical server or machine can be sliced into various virtual machines or VMs, each embodying various resources like memory, disk, CPU cores, etc.Virtualization can be viewed as part of an overall in IT enterprise that includes autonomic computing, a scenario in which the IT environment will be able to manage itself based on utility computing.

The aim of virtualization is to centralize administrative tasks while improving Cloud Computing and virtualization are synonymous.

Cloud computing is based upon vitalizing and allocating compute, storage and network services in a shared multi-tenant environment.

Virtualization is a key enabler for cloud computing. At the same time, cloud computing is also a powerful force pulling virtualization into the enterprise. The two are intimately linked, and had a symbiotic relationship.

The main five areas of virtualization and cloud are

• Server virtualization
• Storage virtualization
• Desktop/Endpoint virtualization
• Private Storage-as-a-Service
• Private or Hybrid cloud computing

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According to the research results, most enterprises follow the same pattern of adoption ie.,first, organizations implement server virtualization, later they add other types of virtualizations, such as storage and desktops/endpoints. finally,they implement private Storage-as-a-Service, private cloud and/or hybrid cloud[3].

II. CLOUD COMPUTING OVERVIEW

Recent interest in Cloud Computing has been driven by new offerings of computing resources that are attractive due to per-use pricing and elastic scalability, providing a significant advantage over the typical acquisition and deployment of equipment that was previously required. The effect has been a shift to outsourcing of not only equipment setup, but also the ongoing IT administration of the resources as well.

Just like Cloud Computing, Cloud Storage has also been increasing in popularity recently due to many of the same reasons as Cloud Computing. Cloud Storage delivers virtualized storage on demand, over a network based on a request for a given Quality of Service (QoS)[2].

A. Benefiting from Cloud Computing

The benefits of cloud computing include quicker implementations and lower costs while providing greater scalability, adaptability, and reliability to the environment. Especially in terms of web applications, a solution can be available at any time, in any location on the planet, by any person. As use of the application increases or decreases, the cloud solution adjusts accordingly.

B. The role of server virtualization software

The new technology underlying this is the system virtual machine that allows multiple instances of an operating system and associated applications to run on single physical machine. Delivering this over the network, on demand, is termed Infrastructure as a Service (IaaS). The IaaS offerings on the market today allow quick provisioning and deployment of applications and their underlying operating systems onto an infrastructure that expands and contracts as needed to handle the load. Thus the resources that are used can be better matched to the demand on the applications.

C. Cloud Computing Interfaces

Having a programmable interface to the IaaS infrastructure means that you can write client software that uses this interface to manage your use of the Cloud. Many cloud providers have licensed their proprietary APIs freely allowing anyone to implement a similar cloud infrastructure. Despite the accessibility of open APIs, cloud community members have been slow to uniformly adopt any proprietary interface controlled by a single company.

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The Open Source community has attempted responses, but this has done little to stem the tide of API proliferation. In fact, Open Source projects have increased the tally of interfaces to navigate in a torrent of proprietary APIs.
What is needed instead is a vendor neutral, standard API for cloud computing that all vendors can implement with minimal risk and assured stability. This will allow customers to move their application stacks from one cloud vendor to another, avoiding lock-in and reducing costs.

III. VIRTUALIZATION

A typical model of a storage solution has four layers. The first layer is the physical storage devices themselves. Above this is the block aggregation layer where the logical definitions of the devices as well as servers, network components and clients fall. The third layer is handles the database and file systems. And the application layer is the processes and controls used to handle the data. Virtualization allows each layer to create the previous form into a new one. For instance, several storage devices can appear as one in the block aggregation layer.
In this paper we mainly focus on storage virtualization, the Storage virtualization can be broken up into two general classes: Block Virtualization and File Virtualization. Block Virtualization is best summed up by Storage Area Network (SAN) and Network Attached Storage (NAS) technologies: distributed storage networks that appear to be single physical devices. The SAN devices themselves typically implement another form of Storage Virtualization called RAID.

A. Storage Virtualization Benefits [1]

Optimizing Performance and Improving Storage Utilization,Understanding thin, or dynamic, provisioning,Creating a dynamic provisioning pool,Space saving and Wide striping for performance improvements Virtualization can improve several areas of managing a SAN, including:

- Providing cost-effective ways to eliminate single points of failure in the SAN
- Improving quality of service by managing and improving performance in real time
- Providing cost-effective solutions to disaster recovery and data archiving
- Improving utilization across the SAN and
- Improving scalability and flexibility on the network

B. Where Does Virtualization Happen

Storage-based virtualization does not require a specific type of host. Therefore, the storage array can support various operating systems and applications. Some of the more common virtualization techniques found on the storage array are RAIDs (Redundant Array of Independent Disks), snapshots, LUN (Logical Unit Number) masking, and mapping. Network-based virtualization is allows a truly flexible SAN solution to be realized. It can combine several LUNs from one or more arrays into a single LUN or break a single LUN from an array into smaller virtual LUNs.
Storage virtualization provides the opportunity to

a. Pool storage.

Pooling storage simply allows the host to see one single storage entity when in fact the physical space belongs to several storage devices.

b.Simplify allocation.

In a traditional storage solution, allocation management is done at each host or through different segments of the network. In a virtualized environment, the entire system is controlled by a common management interface allowing allocation and zoning to be simplified

C. Expand LUNs, and automate capacity controls.

LUNs are restricted by the physical limits of the disk drive, yet vitalizing LUNs allow those limits to be removed so that it appears that more LUNs are available than there really are. Virtualized SANs allow a greater amount of automation to capacity management functions.
Expanding LUN is starting to become a common solution to adding capacity to the environment. The conventional approach has the system administrator, or agent software, detect where free space has fallen below a specified threshold. Additional capacity is assigned appropriately using a new LUN or resizing the existing LUN. Another approach uses a sparse volume, a virtual device that the host can see. However, physical storage is not used until data is written to the virtual LUN.

IV. CDMI CONCEPT OF STORAGE VIRTUALIZATION

A. Open Cloud Computing Interface (OCCI)

The Open Cloud Computing Interface (OCCI) is a free, open, community consensus driven API, targeting cloud infrastructure services. The API shields IT data canters and cloud partners from the disparities existing between the line up of proprietary and open cloud APIs.

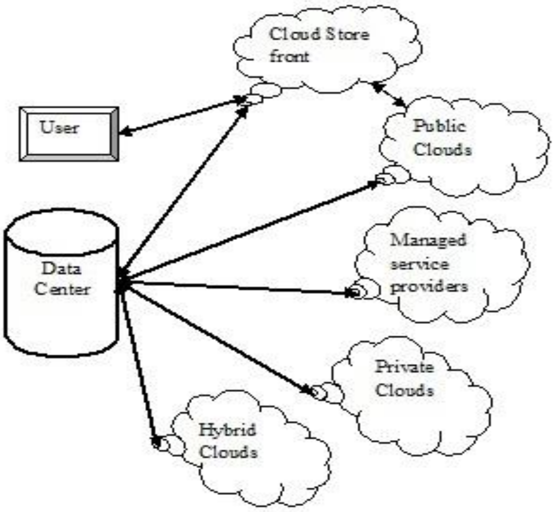

Fig2: The OCCI Application Programming Interface (API)

B. The OCCI Reference Architecture

The OCCI has adopted a Resource Oriented Architecture (ROA) to represent key components comprising cloud infrastructure services. Each resource identified by a canonical URI can have multiple representations that may or may not be hypertext e.g. HTML. The OCCI working group is planning mappings of the API to several formats. A single URI entry point defines an OCCI interface. Fig 1 shows how the components of an OCCI URI aligns to IaaS Resources

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C. How is all this managed.

IaaS offerings typically provide an interface that allows the deployment and management of virtual images onto their infrastructure. The lifecycle of these image instances, the amount of resources allocated to these instances and the storage that they use can all be managed through these interfaces.

In many cases, this interface is based on REST (REpresentational State Transfer) HTTP operations. Without the overhead of many similar protocols the REST approach allows users to easily access their services. Every resource is uniquely addressed using a Uniform Resource Identifier (URI).Based on a set of operations create, retrieve, update and delete resources can be managed.

Currently three types of resources are considered: storage, network and compute resources. Those resources can be linked together to form a virtual machine with assigned attributes. For example, it is possible to provision a machine that has 2GB of RAM, one hard disk and one network interface.

Attributes are exposed as key-value pairs and the appropriate verbs as links. The attributes may be described as a URI. Adopting URI support affords the convenience of referencing linking to other interfaces including Cloud Data Management Interface (CDMI).

Operation: *GET http://vijay.com/compute/id1313name/*

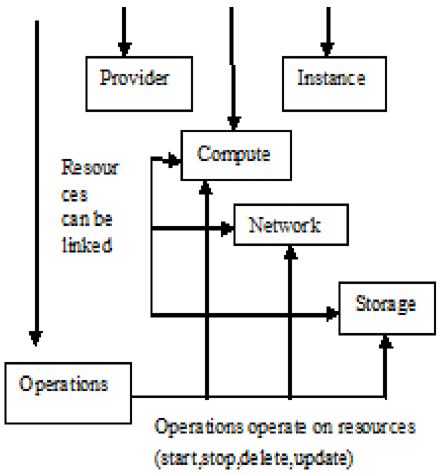

Fig3: Alignment of OCCI URI to IaaS Resources

The API implements CRUD operations: Create, Retrieve, Update and Delete. Each is mapped to HTTP verbs POST, GET, PUT and DELETE respectively. HEAD and OPTIONS verbs may be used to retrieve metadata and valid operations without the entity body to improve performance. All HTTP functionality can take full advantage of existing internet infrastructure including caches, proxies, gateways and other advanced functionality.

D. Storage for Cloud Computing

For cloud computing boot images, cloud storage is almost always offered via traditional block and file interfaces such as iSCSI or NFS. These are then mounted by the virtual machine and attached to a guest for use by cloud computing. Additional drives and file systems can be similarly provisioned.

E. Cloud Data Management Interface (CDMI)

The new Cloud Data Management Interface (CDMI) is meant to enable interoperable cloud storage and data management. In CDMI, the underlying storage space exposed by the above interfaces is abstracted using the notion of a container. A container is not only a useful abstraction for storage space, but also serves as a grouping of the data stored in it, and a point of control for applying data services in the aggregate.

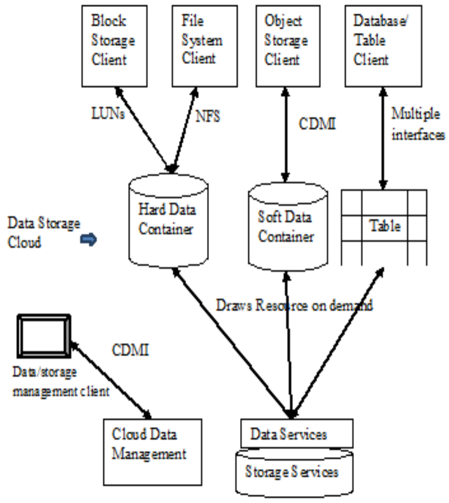

Fig 4: The Cloud Storage Reference Model

CDMI provides not only a data object interface with CRUD semantics, it also can be used to manage containers exported for use by cloud computing infrastructures as shown above in Fig 4. CDMI for Cloud Computing With a common cloud computing management infrastructure

F. CDMI and OCCI for a Cloud Computing Infrastructure

CDMI Containers are accessible not only via CDMI as a data path, but other protocols as well. This is especially useful for using CDMI as the storage interface for a cloud computing environment as shown in Fig5, The CDMI containers can be used by the Virtual Machines in the Cloud Computing Environment as virtual disks on each guest as shown. With the internal knowledge of the network and the Virtual Machine, the cloud infrastructure management application can attach exported CDMI containers to the Virtual Machines.

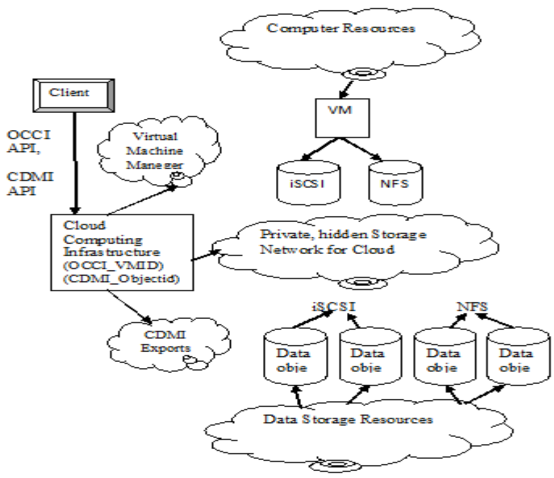

Fig 5: CDMI and OCCI in an integrated cloud computing environment

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Shown above supports both OCCI and CDMI interfaces. To achieve interoperably, CDMI provides a type of export that contains information obtained via the OCCI interface. In addition, OCCI provides a type of storage that corresponds to exported CDMI containers[4].

OCCI and CDMI can achieve interoperability initiating storage export configurations from either OCCI or CDMI interfaces as starting points. Although the outcome is the same, there are differences between the procedures using CDMI's interface over the OCCI's as a starting point. A client of both CDMI and OCCI interfaces would perform the following operations

- The Client creates a CDMI Container through the CDMI interface and exports it as an OCCI export type. The CDMI Container Object ID is returned as a result.
- The Client then creates a Virtual Machine through the OCCI interface and attaches a storage volume of type CDMI using the Object ID. The OCCI Virtual Machine ID is returned as a result.
- The Client then updates the CDMI Container object export information with the OCCI Virtual Machine ID to allow the Virtual Machine access to the container.
- The Client then starts the Virtual Machine through the OCCI interface.

V. CONCLUSION

Virtualization, in computing is the creation of a virtual i.e., rather than actual version of a storage device or network resources. by using some interfaces we can access the data in cloud.This paper gives about the cloud data management interface by using storage virtualization mechanism.The open cloud computing interface is an emerging standard for interoperable interface management in the cloud. cloud data management interface standards covers storage interface and key management, especially as they pertain to storage IaaS.In future, more emphasis is going to be in defining new interface methods and key management technique.

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