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Resource Optimization in Virtual-Cloud Infrastructure for Effective IT Governance

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Abstract - Nowadays, Cloud computing is core technology used in IT Goverance due to its agility and efficient Resource Utilizations. Majorily, IT system focuses on On-Demand Business services to end users by using flexible cloud computing models in terms of their ease in deployment strategy. The Cloud computing deployment involves various components like servers, network attached storage and network devices [3]. But also, cloud computing faces unresolved security threats, that affects both cloud provider and cloud user. To resolve the security issues and on-demand services, the technology adopted is Virtualization, the hard core of cloud computing. Virtualization seperates single physical machine into multple Virtual Machines (VMs) with minimal cost [21]. Due to this advantage, the virtualization can be adopted to run multiple operating systems on a single machine by sharing all the resources that belong to the hardware, which supports on-demand facility to end users. This paper focuses on the foundations of virtualization and its deployment strategy in terms of resource optimization in cloud computing. So that, the virutalization provides on-demand services to end users, which is the major motto of IT Systems. It also helps the cloud infrastructure deployment in technology enabled process.

Keywords: Cloud Computing, Virtualization, IT Goverance, Cloud Infrastructure

I. INTRODUCTION

A. Importance of cloud computing in IT Governance:

IT Governance defines the organization principles and rules which includes the techniques and policies that are to be followed by an IT company to make effective decisions regarding performance predictability, applying policies relating to using services, organizational issues and how people must work together to achieve business goals.IT dosen't stand alone in the governance process .The best IT Governanceis achieved only when IT and the business work together.

The Cloud technology has evovled from systems which are considered as simple data storage devices to systems with efficient resorce utilization and management of resource access across a range of devices [5]. Wireless connectivity to the cloud through mobiles, tablets and other devices enables the bussinesses to be available online all the time.The data is now no longer confined to a single system as the required data such as important files; documents etc are easily accessible remotely with high level of security. The varying capabilities and benefits of cloud as next generation distributed computing systems, attracted many corporate clients and vendors across IT industry to use the best of cloud such as infrastructure outsourcing, software as a service, platform as a service, infrastructure as a service etc [9].

B. Virtualization

The Virtualization infratructure provides the capability to run more than one application or operating system on a single physical system.The Virtual Machines (VMs) running on the single host computer can run different operating systems,such as Windows,Linux ,Unix etc and also has their own set of virtual hardware resources ,such as CPU,RAM,Hard Disk etc there by providing an illusion as if these applications are running individually on different operating systems installed on different physical machines.

The benefits of Virtualization technology made many IT organizations to take up the virtual machine solution to efficiently utilize resources and improve their performance.Server Consolidation allows IT professionals to utilize server resources to maximum extent and simultaneously isolates virtual machines by allowing them to run different operating systems and applications.Virtual Machine technology enables software developers to quickly test their developed applications on different operating systems without the problem of setting up the environment for testing.

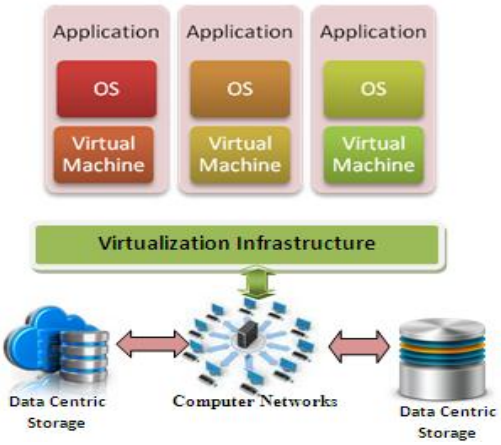

Fig.1 Utilization of Virtualization for resource constraints

C. Importance of cloud computing via virtualization

Cloud Computing is the delivery of computing resources,data and storage resources as a service to end users over a network.Certain operating systems,hardware systems etc provide cloud services. Cloud computing is accessed through the internet and can make use of virtualization. Virtualization is using computer resources to imitate other computer resources or whole computers. It separates resources and services from the underlying physical delivery environment.

The implementation of Virtualized environments in cloud based applications in today's business environments , provides enormous services to the end users such as availability, increased efficiency, maximum resource utilization with low cost etc.Each with their own benefits,Virtualization acts as a base for cloud computing and increases the value of cloud computing.Cloud based applications performs effectively when integrated with virutalized environments [12]. To maximize computing and infrastructure resources, Virtualization and Cloud Computing is the best solution for achieving.

II. CLOUD COMPUTING VS. VIRTUALIZATION

Cloud Computing and Virtualization are not synonymous. There are number of components used to build the cloud infrastructure. The cloud computing enables virtualization of machines independent of physical location. At the lowest layer, there are hardware components such as servers, storage and network components. It can be described as a service where virtualization is part of a physical infrastructure. All the concepts or operations applicable on the single machine are applicable to virtual machines deployed on the cloud.The Virtualization is a subset of the Cloud. Cloud Computing is inclusive of Virtualization and a way to implement it. However, Cloud can be implemented without Virtualization

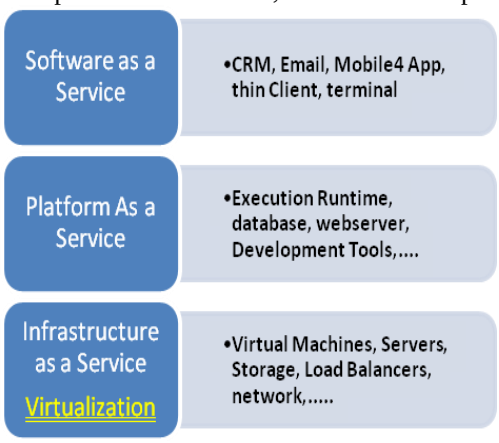

Fig.2 Virtualization implementation as a service in Cloud

The term cloud computing has become a buzzword in the tech industry, which refers to automated control, built on top of a virtualized infrastructure consisting of storage, compute and network components [18]. The cloud computing and virtualization are integrated together and defined below

- Cloud computing gives the organization access to complex applications and computing resources via the Internet.
- Virtualization manipulates hardware and cloud computing manipulates the result.
- It is the delivery of shared computing resources, software or data as a service (SaaS) on-demand through the Internet.

A. Advantages of Cloud Computing and Virtualization

Cloud computing provides numerous benefits both to end users and businesses of all sizes. It set up as a virtual office that provides the flexibility of connecting the IT business all over the world. One of its cost-saving, hardware-reducing, and energy-saving techniques used by cloud providers is virtualization. Now, cloud computing is certainly a powerful,

transformational change in the information technology industry. The benefits are real, and quite substantial. With the near-constant conversation about cloud computing, though, it's possible we might have lost sight of some of the other benefits of virtualization technology [14]. Public cloud computing has many benefits, but there are also ways you can continue to benefit from virtualization in your own datacenter and on your desktop. There are also enhancements to virtualization you can expect in the future. These will continue to help you save time, energy and money. The above figure provides the core benefits of virtualization, as frequently applied to the realm of cloud computing.

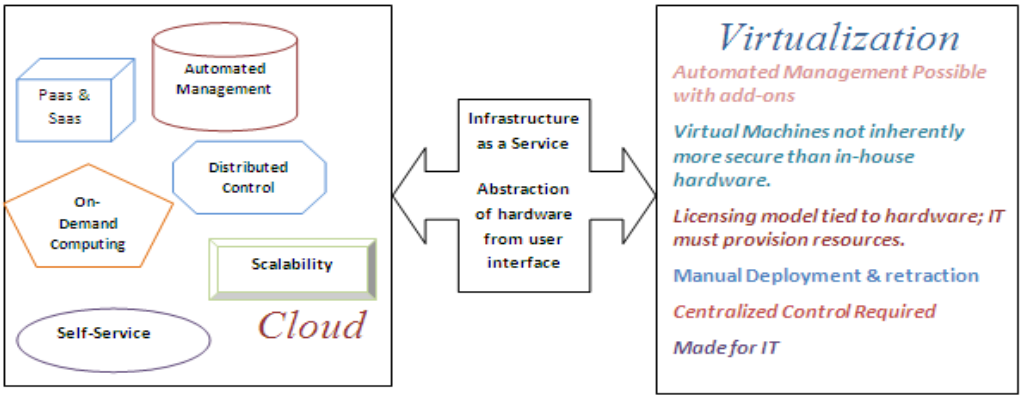

Fig.3. Advantages of Cloud Computing and Vitualization

III. IMPLEMENTATIONAL ARCHITECTURE - VIRTUALIZATION

IT Applications has major impact on Virtualization services to run better, faster, cheapter with increased flexibility. Virtualization is implemented as top service to user for providing more infrastructural resources.Cloud Experimentation is deployed on top of Virtualization, which enables public cloud services to users with reference architectures. Cloud Foundation Layer supports business applications like finance, health, and stock markets via scalable reference architecture. Cloud Exploitation helps the users with choice to select their own cloud environment and begin broad based deployment.Hyper Cloud with integration with virtualization offers dynamic sharing of application, sharing of resources, capacity arbitrage and self-serive application provisioning.

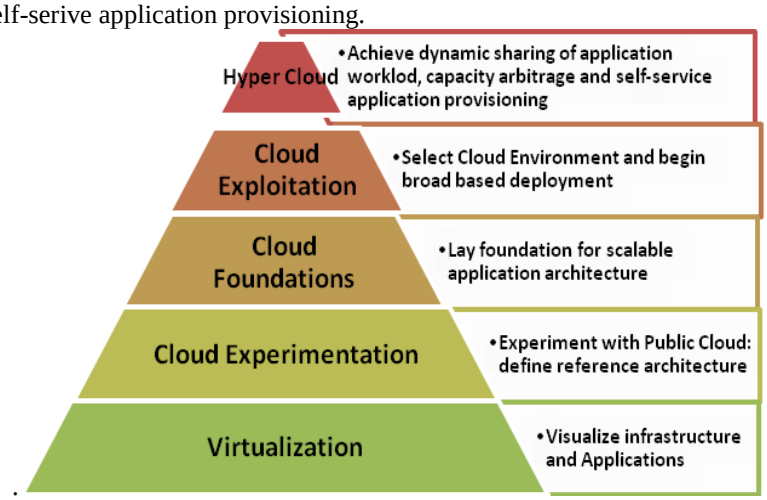

Fig.4. Layered Architecture for Virtualization Implementation

Cloud adoption employs virtualization based infrastructure in the first level, it also provides seamless portability of applications and shared server infrastructure [24].Virtualization is taken to a cloud model, either internally or externally, based on controlled and bounded deployments utilizing Amazon Elastic Compute Cloud (EC2) for compute capacity and as the reference architecture. The foundations of cloud includes IT Systems, controls, rules, regulations and IT practices in its deployment. The broad-based deployments in cloud allow on-demand users to advance the volume of cloud applications. The multiple utility clouds balances the workloads dynamically. The cloud applications are distributed based on criteria's like its capacity, cost, and other critieria.

A.Cross Platform Architecture for Virutal-Cloud Infrastructure

Cloud Computing is growing and every solution provider wants to be part of the hype. This new trend promises to abstract IT professionals from the underlying nuts and bolts of server virtualization, storage allocation, scalability, availability, and operational overhead. It also aims to deliver on-demand, self-servicing capacity to reliably run applications through a simple administration console that allows you to monitor service levels and react accordingly.
Virtualization technologies enable to get benefited from virtual machines that can improve scalability besides bestowing other advantages like security, cost effectiveness etc. Many tools have been tested for their performance in terms of fast Fourier transform, ping pong bandwidth, ping pong latency, and speed of the hypervisors [10].

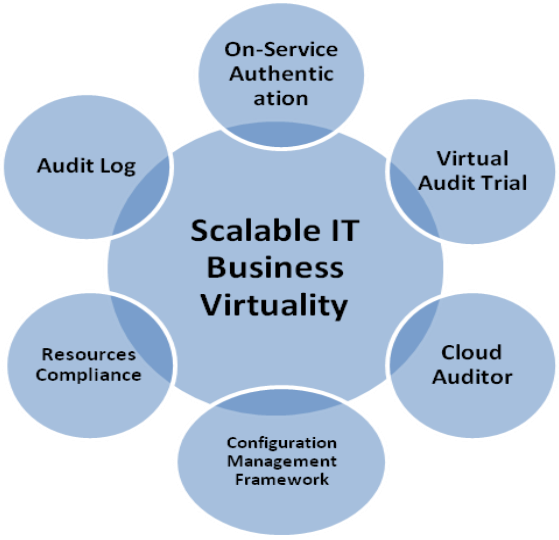

Fig.5 Virtual –Cloud Computing Framework

B.Implementation of Virtualization in Cloud Infrastructure

A cloud management platform enables you to run a multitenant environment using the resources from the virtual infrastructure and security technologies at every level. Although clouds are built with IaaS, PaaS, and SaaS service layers, infrastructure services are the most typical private cloud services offered today. The Vrtualization can be implemented via five steps and mentioned below.

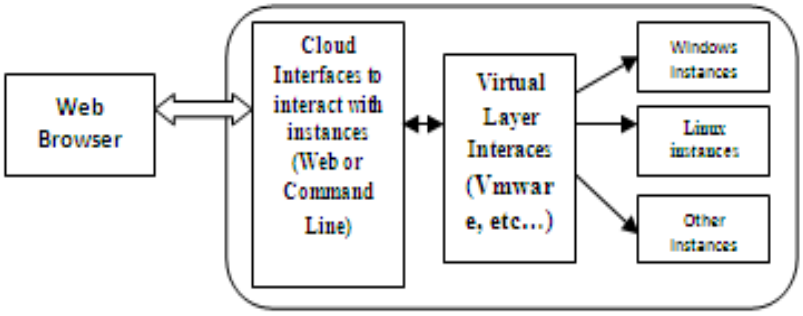

Fig.6. Cloud Infrastructural Environment

In the Cloud architecture, the networking is performed by networking devices and not by the software running on the server. This requires the Ethernet switches that are connected to the servers (e.g., the top-of-rack switches) to be virtualization aware. As the market for virtualized infrastructures (not just hosted cloud infrastructures) is potentially very large, commercial Ethernet switch vendors are moving in this direction already. The Virtual Network Link (VN-link) technology is supported, where it is used to simplify the software switch and offload switching functionality to a physical switch, but this requires some changes to the Ethernet format.

Fig.7. Procedure to implement Virtualization

Step 1: Implement Pervasive Virtualization

Virtualization is the foundation for an agile, scalable cloud—and the first practical step—for building cloud infrastructure [14]. Virtualization abstracts and isolates the underlying hardware as virtual machines (VMs) in their own runtime environment and with multiple VMs for computing, storage, and networking resources in a single hosting environment. These virtualized resources are critical for managing data, moving it into and out of the cloud, and running applications with high utilization and high availability.

Step 2: Select Your Cloud Management Platform

Decisions can be made on the following for choosing platform.

- Use a virtualization management platform that can also be used or extended easily for the cloud.
- Augment existing tools with an expanded set of cloud management capabilities on top of your existing virtualization management platform.
- Add a new cloud management platform (CMP) that can run the cloud and your existing virtualization environment

Step 3: Automate Workflows and Other System Capabilities
Automation is a key capability of elastic, high-performing cloud environments. By eliminating or minimizing manual processes and requiring minimal human control points, you can optimize and manage resources faster, deliver services, manage service life cycle, and respond to changing conditions.
Step 4: Automate Services End to End
Automation software has two main jobs: aligning service requests with available resources and monitoring the health of the physical and virtualized environment. To accomplish this, the software manages across different systems to:

- Connect and automate workflows to deliver a specified service.
- Manage configuration, capacity, metering, and chargeback.
- Track and report on cloud performance and availability.
- Monitor and manage power, including energy consumption and cooling requirements.
- Monitor security threats and adherence to security policies, including access, authorization, and identity management.
- Take effective actions and make adjustments based on feedback from monitoring tools.
- Predict potential issues so they can be addressed before they become major issues.

Step 5: Implement Cloud Security
Cloud security must be adaptive to an environment in which workloads are decoupled from the physical hardware and delivered from a fabric of pooled resources [20]. At the same time, security must protect the physical boundaries of the network edge. One way to do this is to provide security as a set of on-demand, scalable services

IV. ANALYTICAL RESULTS

After the virtualization solution has been designed, the next step is to implement and test a prototype of the design before putting the solution into production. Aspects of the solution that should be evaluated include the following:Adoption of virtualization in clouds exhibits more advantages compared to regular cloud deployment. The virtuality of cloud computing was deployed and tested by various cloud services like EC2, Amazon, etc for on-demand users [15]. Various critieria's are considered for evaluation of Virtualization and shown in the below table.1

Table 1 Comparison between Regular Cloud Infrastructure and Virtual-Cloud Infrastructure

Design Issues	Existing System	Virtualization
Physical to Virtual Conversion	Existing servers and desktops may need to be migrated to guest OSs.	It allows the OS Migrated quickly and automatically. It is compatible with the OSs running on the physical machines.
Introspection	Additional Security Monitoring devices need to be added.	Virtualization solution gives the necessary capability to monitor security events occurred within the guest OS.
Authentication	It cannot be readily compromising or circumvented.	It supports token based authentication.
Connectivity	All the resources cannot be connected to any other resources.	Users can connect to all resources with protection in traffic flow.
Applications	Platform Dependent	It does not interfere with the use of applications or servers within the guest OS.
Management	No automatic updation	Administrators can configure and manage the solution effectively and securely
Performance	Inadequate Performance during peak usage.	Adequate performance during normal and peak usage via simulated traffic generators.
Security of the implementation	Has less vulnerability assessments	Virtualization components must be updated continuously for sound security practices.

A highly virtualized environment is similar to a RAID array in that it is fault tolerant and highly recoverable. Workloads, entire virtual machines, and virtualized storage resources can be automatically and instantly relocated to safe areas of the network when problems arise. This shifting of resources to maintain uninterrupted service occurs at a level that is essentially transparent to the end user [11]. However, depending on the quality of IT implementation and the level of integration of the virtual machine (VM) manager software, the end user may experience momentary latency issues while this migration takes place.

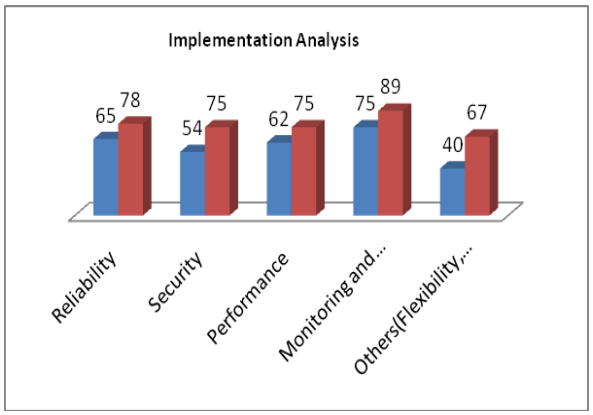

Fig.8. Feature Comparison between Regular Cloud and Virtual-Cloud

Before making these types of decisions, of course, IT and Facilities management should always fully consider the possible impacts to business continuity if the physical infrastructure system or component being considered fails or becomes unavailable. This means IT management systems and policies should be reviewed and monitored to ensure they are capable of providing the level of service and fault tolerance that permits having less redundancy in the physical infrastructure.

V. CONCLUSION

Virtualization is a technology to helping IT organizations optimize their application performance in a cost-effective manner, but it can also present its share of application delivery challenges that cause some security risks. Virtualization is the simulation of the software and/or hardware upon which other software runs. The recent increase in the use of virtualization products and services has been driven by many benefits. One of the most common reasons for adopting virtualization is its operational efficiency: IT Governace can use their existing hardware (and new hardware purchases) more efficiently by putting more loads on each computer. In general, servers using full virtualization can use more of the computer's processing and memory resources than servers running a single OS instance and a single set of services. Virtualization adds layers of technology, which can increase the security management burden by necessitating additional security controls. Also, combining many systems onto a single physical computer can cause a larger impact if a security compromise occurs. Further, some virtualization systems make it easy to share information between the systems; this convenience can turn out to be an attack vector if it is not carefully controlled. In some cases, virtualized environments are quite dynamic, which makes creating and maintaining the necessary security boundaries more complex.

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BIOGRAPHY

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