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Arcus Cloud: A Private Cloud Establishment

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Abstract: Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources like networks, servers, storage, applications, and services that can be rapidly provisioned and released with minimal management effort or service provider interaction. "Arcus Cloud" aims at establishing a private cloud that works on high speed LAN and enhances the cost efficiency pertaining to the resource requirement of an organization. Arcus Cloud provides a platform for the allocation of various resources such as storage, processor, hardware and software resources via Virtualization. LAN being the most common medium of connectivity across any organization, Arcus Cloud shall prove to be a distinct example that portrays the simplicity of establishing a Private Cloud that efficiently handles resource allocation. Arcus Cloud aims at providing on – demand services with greater flexibility, reliability, elasticity and scalability. The project aims at providing a user friendly interface for accessing various services provided by the platform, namely Arcus Cloud. Configuring and managing authentication server that ensures privacy and security of its end users is the first priority. It also gives a brief idea about the concepts of Load Balancing and Live Migration which can constitute the future modules of this project. Basically Arcus Cloud will prove to be an exceptional example at describing how efficiently a Private Cloud can be established and this Private Cloud will be highly scalable thus easy to expand as per the user requirements.

Key words: Cloud Computing, Arcus Cloud, Private Cloud, PaaS, Hypervisor, Virtualization, Virtual Machines, Authentication Server, Load Balancing, Live Migration.

I. INTRODUCTION

The basic principle of cloud computing is to assign the 'computing' to a great number of distributed computers (Virtual Machines), rather than a single local computer. The end user no longer has to wait for a particular physical system to be available; one can easily access various Virtual Machines that have been configured to support all requirements, in almost one fifth of the cost of an actual system. In the case of Arcus Cloud, each end user gets precisely the resources he requires, nothing more or nothing less. This paper introduces the background and principle of cloud computing, the character, style and actuality via the implementation of a Private Cloud. Virtualization is one of the best techniques to solve the issues of resource – hungry amenities in the IT domain. Resources such as RAM, Storage space, hardware and software resources are shared from a common 'pool of resources' termed as the 'Cloud'. PaaS: Platform as a Service, and Private Cloud setup are the core concepts discussed in this paper. Providing platform as a service through implementation of LAN based private cloud is the main goal of this paper. It also includes core understanding and back bone explaining live migration and load balancing.

The paper is organized as follows, Section I provides the Introduction, Section II explains the concept of PaaS: Platform as a Service, Section III helps the reader understand the basic Architecture of Arcus Cloud, Section IV depicts the role of Virtualization and Hypervisors as the pillars on which the project stands, Section V shows how Arcus Cloud is implemented, Section VI depicts the benefits of establishing a Private Cloud to render necessary resources for any given organization, Section VII explains the future enhancements that can be implemented in order to expand Arcus Cloud's efficiency and Section VIII concludes and summarizes the research work and implementations done so far to establish Arcus Cloud and its services.

II. PaaS: PLATFORM AS A SERVICE

Cloud computing leverages virtualization technology to achieve the goal of providing computing resources as a utility. In practice, clouds offer services that can be grouped into three categories: software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS).

PaaS refers to providing platform layer resources, including operating system support and software development frameworks. Examples of PaaS providers include Google App Engine, Microsoft Windows Azure and Force.com. Platform as a Service provides a platform to the customers to develop, run and manage the applications without the burden of building and maintaining the infrastructure. It is a way to rent the Hardware, OS, Storage and Network capability to various end – users.

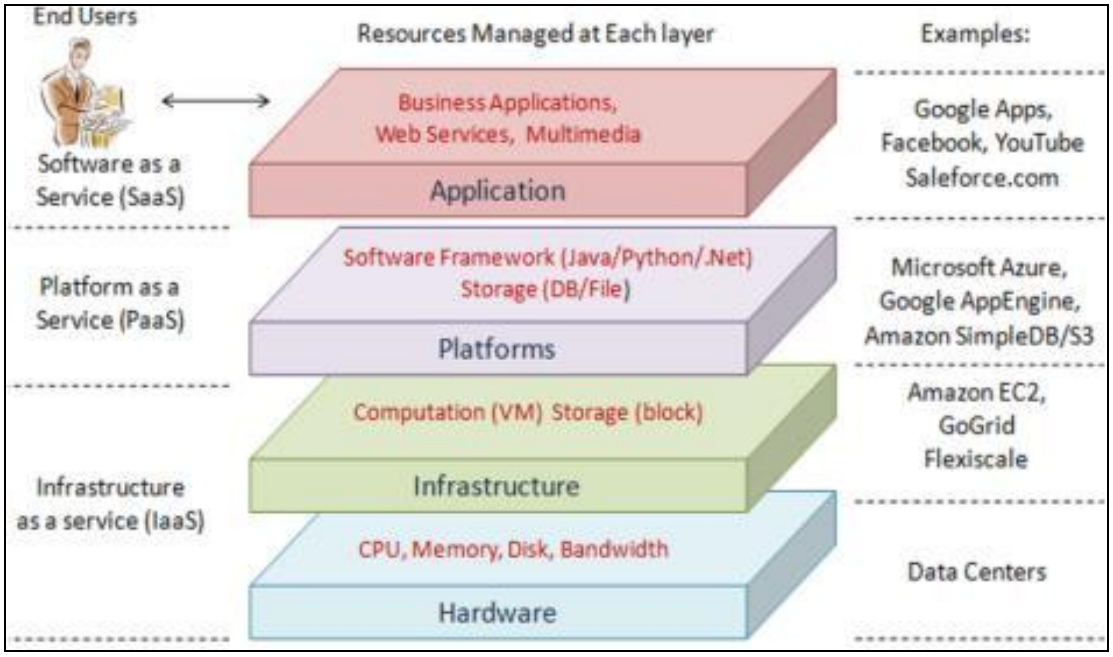

Figure 1.Cloud Computing Architecture: PaaS with respect to IaaS and SaaS

III. ARCUS CLOUD: A PRIVATE CLOUD SETUP

Arcus Cloud aims at providing the platform and infrastructure to render the Private Cloud Services. The components used to achieve this goal are: C# .Net, Visual Studio, Citrix XenServer, MySQl. In the setup various interactions are performed between Client – Server, Server – Client, Machine – Machine, Server – Server and VM – VM.Figure 2. Shows the Architecture of Arcus Cloud. The developer side comprises of configuring the Server Farm that holds the resources i.e. RAM, processor, Hardware, Network services and several Software frameworks and applications that can be remotely accessed by the client with the help of Arcus Cloud End – user – Interface. The client can freely register for the basic services, while in the case of advanced services, the charges will be on prepaid basis. Authentication server is a network service which Arcus Cloud End – user – Interface uses to verify the credentials of the users. It is primarily used to ensure the security and privacy of the users. Hence, the cloud services are rendered in a secure environment. The credentials entered while Logging – In will be authenticated by the Authentication Server and thereby granting the user access to Arcus Cloud Services.

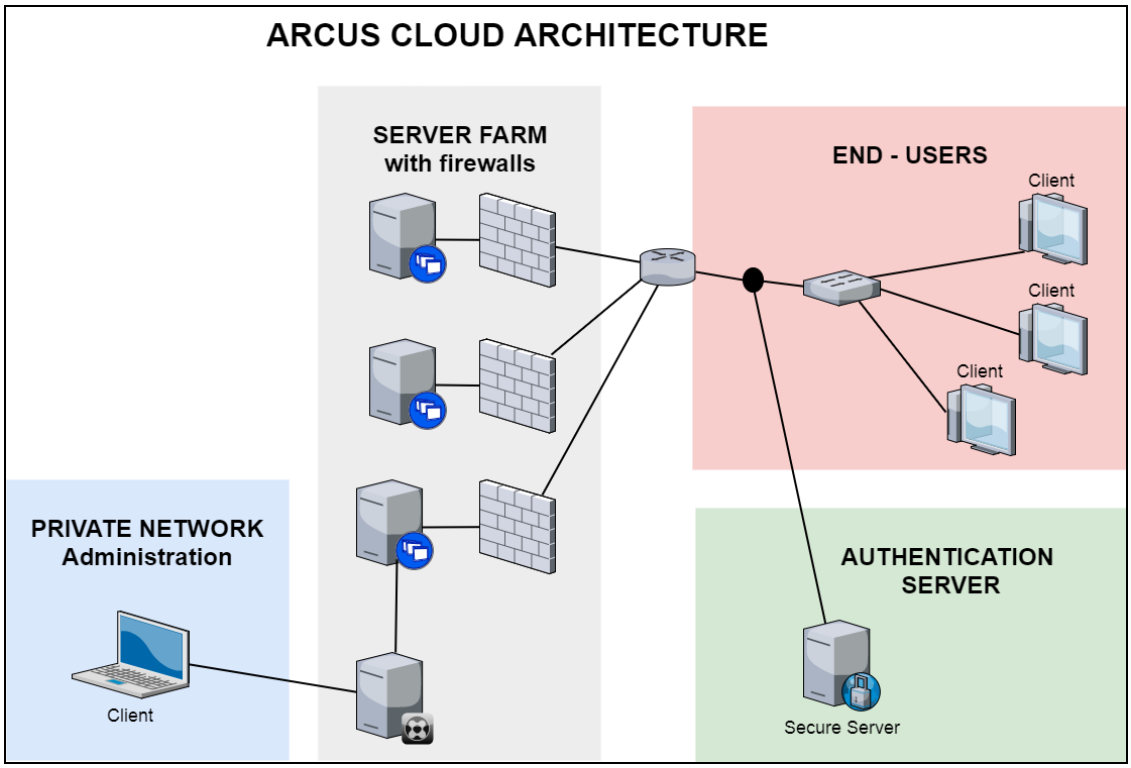

Figure 2.Arcus Cloud Architecture

IV. VIRTUALIZATION THROUGH HYPERVISORS

Virtualization makes it possible for the software to run multiple operating systems and multiple applications on the same server at the same time. Virtualization enables servers, workstations, storage and other systems independent of the physical hardware layer [3]. Moreover, virtualization avails to create a virtual version of the resource such as a server, a storage device, a network or even an operating system where the framework resources gets divided into one or more execution environments. Any application needs a model of computation, a model of storage, and a model of communication. The statistical multiplexing necessary to achieve elasticity and the appearance of infinite capacity available on demand requires automatic allocation and management. [11] In practice, this is done with virtualization of some sort.

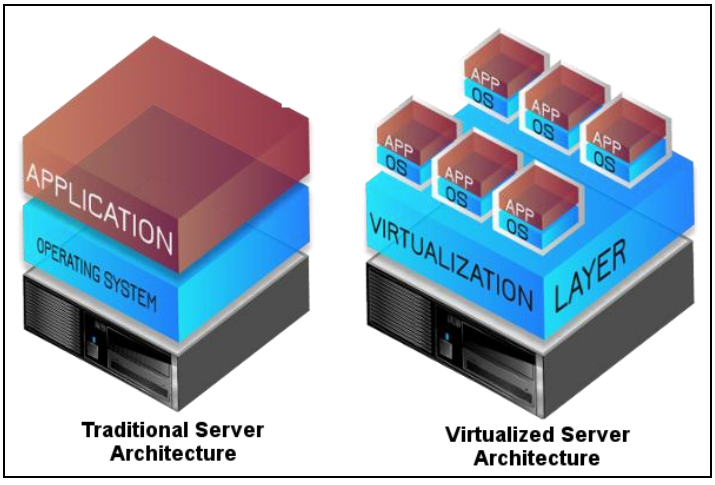

Figure 3.Comparison between Traditional Server and Virtualized Server.

As depicted clearly by the figure above, Virtualization essentially allows multiple OS to run on a single Machine and thus making multi – tasking possible. But, to achieve Virtualization, Hypervisors are a necessity. Virtualization is associated with a number of computing technologies such as Storage Virtualization, Server Virtualization, Operating System – Level Virtualization and Network Virtualization [5].

A Hypervisor enables multiple operating systems to share single hardware. Hypervisor is a component that creates and runs virtual machines for rendering software, hardware or a firmware to the end - users. Hypervisor acts as an interface between the Guest OS and the Host OS. Xen is the Hypervisor used by Arcus Cloud for Virtualization.

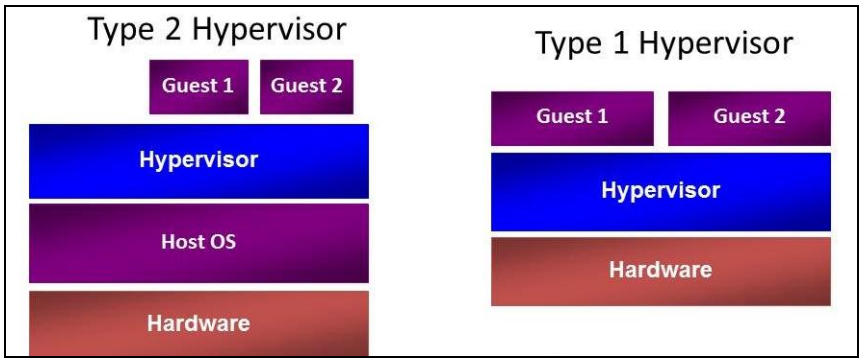

Figure 4.Types of hypervisors

A. Type – 1 Hypervisor: Bare-metal installation hypervisor

The benefit that this hypervisor provides is that it will interact directly with the hardware. The resources are then para – virtualized and delivered to the running VMs.

B. Type – 2 Hypervisor: Hosted hypervisor

The software is not configured on the bare-metal, but it is loaded on top of a live operating system. For example, a server which runs Windows Server 2008 could be having VMware Workstation configured on top of that Operating System. Fig 3 shows the place of Type I and Type II hypervisors [6].

V. IMPLEMENTATION

Implementation of Arcus cloud comprises of establishing a Private cloud across a network of high speed LAN in an organization. This is achieved by setting up multiple servers that host the Virtual Machines and allocate corresponding resources accordingly. The Authentication server checks the credentials of the end user, thus ensuring security of operation. The establishment of Arcus Cloud can be efficiently summarized through the procedures mentioned henceforth:

A. *Server Setup*

Two Servers have been configured to provide Virtual machine access that suffices the corresponding user requirements such as RAM, Storage, Processor, Frameworks, other hardware and networking support. In basic terms these servers act as resource providers so that separate machines, frameworks and development environment need not be provided to several users within the organization. Virtualization is the process handled by these Servers with the help of Xen Hypervisor.

B. VM and Resource Availability

The two Servers have been setup to provide various resources such as dedicated storage and RAM allocated to each VM (UBUNTU/Windows XP). These VMs are robust, easy to use and thus were selected as the preferred VM choice. The end – user gets a cutting edge experience as if he were using an actual computer. And these VMs can hold various IDEs and Frameworks which can be allocated to various users as requested. There is no need for 'resource – redundancy', that is, providing separate resources to every user. And, each user's data is kept in the dedicated storage allocated to him, while simply rendering a common work – place via the VMs.

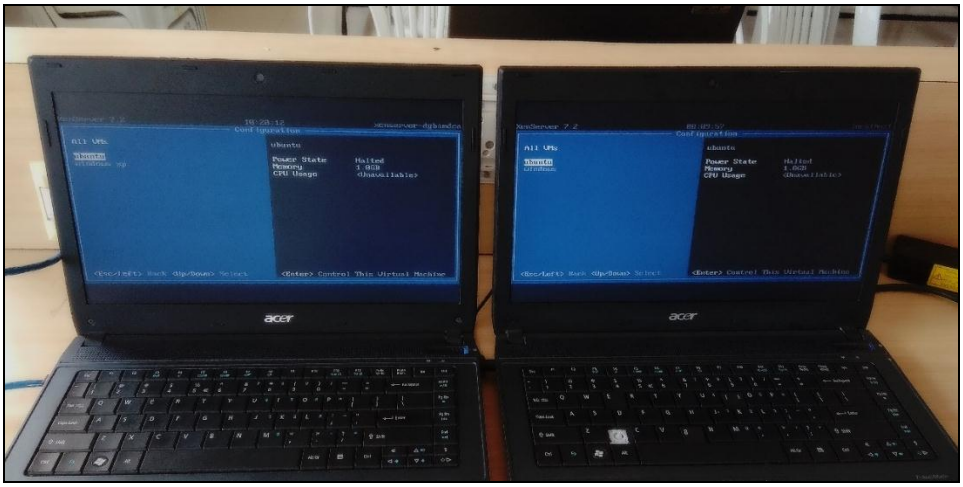

Figure 5.The Servers that render the Virtual Machines and the respective resources

Table 1. Configurations of the two Servers created

OS	UBUNTU 12.04 LTS
Processor	Intel Core TM i5-3220M
LCD	LCD Panel 35.56 cm Wide
Graphics	Intel HD 4000
Memory (RAM)	4GB DDR3 Memory
Storage	500 GB HDD
WLAN/Bluetooth	Acer Nplify 802.11 a/g/nBT2.1
Battery	6-Cell-Li-ion battery
Virtual Machines provided	UBUNTU, Windows XP

Resource Availability in the form of frameworks can be exemplified by stating, that with the help of Arcus Cloud, the given organization need not get the licenses to access various frameworks such as .NET, Arcus Cloud renders .NET development environment as a Service. This availability of .NET can be made possible across a huge number of end users and thus this procedure of granting access to a licensed framework is termed as Bulk Licensing.

C. End – User Registration

A Registration form is created for the user to fill up their details. The details will be stored in the database, MySQL. These details entered by the user include the 'User Name' and 'Password' that will be used for authentication in the log – in stage.

D. Logging in – into Arcus Cloud's Interface

The Interface created to provide the Private Cloud services from ARCUS Cloud – server is highly user friendly. It is responsible for providing the cloud services once the user has successfully logged in using the correct credentials. The interface provides the user access to the respective Virtual Machine that supports all of his resource requirements. This interface acts as the front – end that is accessible to the end – user and he does not need to worry how the services get rendered from the back – end, i.e. the two Servers and the Authentication Server.

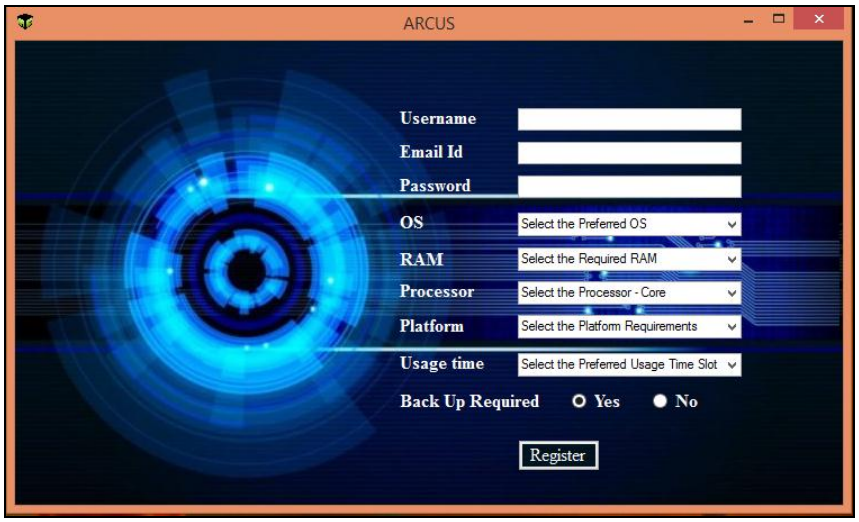

Figure 6.Registration portal

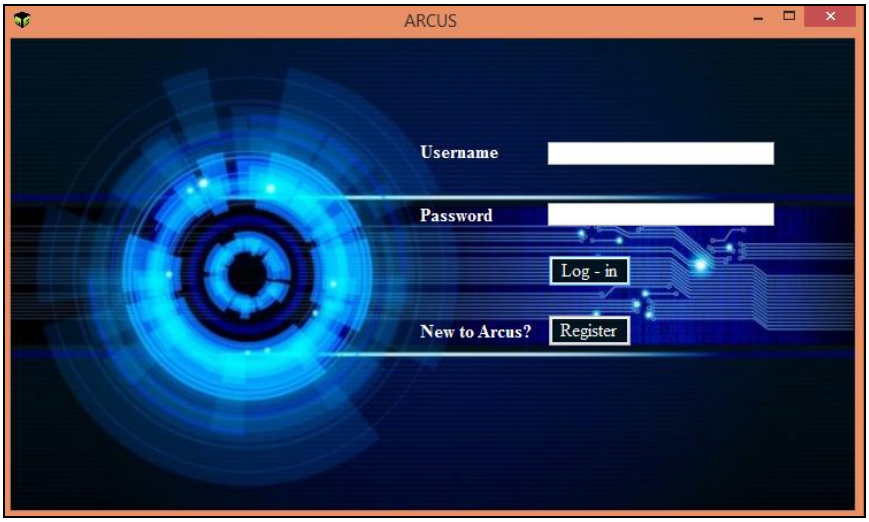

Figure 7.Log – In portal

E. Authentication Server

Authentication server is a network service which applications use to verify the credentials of the users. It is primarily used for ensuring the security and privacy of the users. Hence, the cloud services to be used are secure [7]. Figure below shows the basic layout of the Authentication Server's interface (in the form of a screen shot), when the server is started. The Server status is also visible in the Authentication Server's Interface.

F. Accessing Remote Virtual Machine and Resources

The final result can be seen when he user logs – in successfully and is granted access to the remote Virtual Machine that he can use like an actual Physical Machine to provide him with all the necessary resources such as storage, RAM, hardware and software amenities and so on. The Figure below depicts the end user's Interface that provides him with a remote Virtual Machine to work on.

Figure 8. Authentication Server

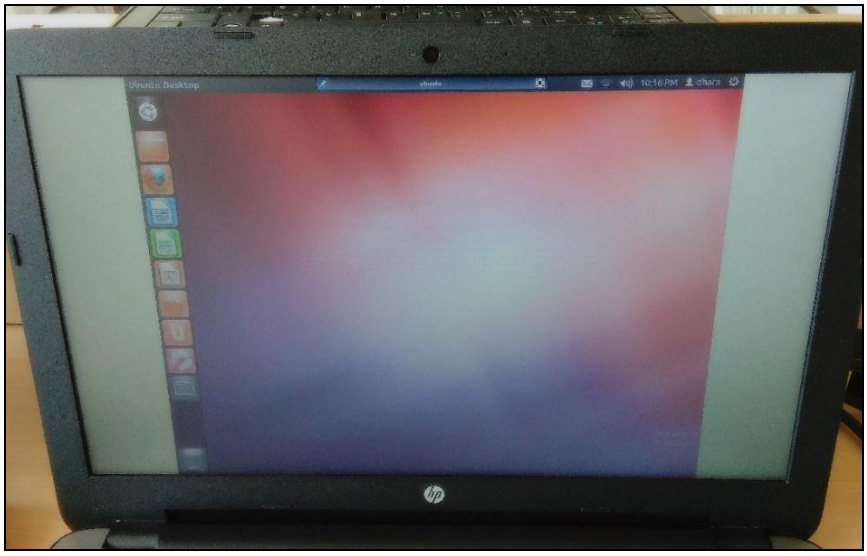

Figure 9.Remote Virtual Machine Access

VI. BENEFITS

A. Highly Inexpensive

Since the cloud's special fault tolerance can be built by very inexpensive nodes and tools, the centered management of cloud is highly in expensive when compared to running private Data Centers and dedicated machines for every singular purposes of a given organization. The versatility can increase the utilization rate of the available resources compared with traditional system, so users can fully enjoy the low cost advantage [9]. Bulk Licensing as explained in Section V, subsection B. VM and Resource Availability – is the main reason why Arcus Cloud will be capable of providing cost effectiveness.

B .Scalable

Cloud can be expanded as per the size of the end – user group, the expansion will require addition of resources and servers. A cloud set up is highly scalable and can provide a better computing platform to large enterprises with great computation and storage requirements.

C. High Reliability

Cloud uses data multi-transcript fault tolerant, the computation node isomorphism exchangeable and so on to ensure the high reliability of the service [9]. Using cloud computing is more reliable than local computer. Using cloud computing is more reliable than local computer.

D. Versatility

Cloud computing doesn't aim at certain special application. It can produce various applications supported by cloud, and one cloud can support different applications running it at the same time.

E. On demand service

Cloud does not statically allot resources to its users, it dynamically allots the required resources to the end – users, on demand. Thus, ensuring zero wastage of the resources.

F. Efficient Data Storage and rendering

Cloud computing provides a compelling platform for hosting large-scale data-intensive applications [8]. From storing the data to transmitting it securely to the Authenticated Location, Cloud Computing can be the one – stop solution. Also, Cloud Computing leverages MapReduce frameworks such as Hadoop for scalable and fault-tolerant data processing [8].

VII. FUTURE ENHANCEMENTS

A. Load Balancing

Load Balancing would help in reducing costs and maximize the availability of allocable resources. It will help in transferring the computation loads across the cloud servers. Load Balancing is done using a model in the Live Migration process wherein the load is balanced amongst the servers as per the usage and VM downtime. The load is partitioned in order to increase the throughput of the system. The software, network and file status is monitored and controlled by clusters thus offering a higher chance for the VM's to migrate. Load Balancing for the whole cloud can be handled dynamically via virtualization where remapping is done on the physical resources. Various algorithms can be implemented through which Load Balancing can be achieved.

B. Live Migration

Virtualization can provide significant benefits in cloud computing by enabling virtual machine migration to balance load across the data center. In addition, virtual machine migration enables robust and highly responsive provisioning in data centers [8]. Through Live Migration we wish to give our users the flexibility to move a VM from one host to another with ease. Live Migration is defined as a process by which the memory of a virtual machine is moved from source to destination with no impact on the machine availability for the users. Live Migration enables one to implement higher level of mobility, security and flexibility in the cloud. When the virtual machine is running on the source node and without distorting any network connections the virtual machine is moved to the destination. This procedure is termed as "live" because the original virtual machine is running simultaneously when the migration process takes place. Live Migration takes very less time.

VIII. CONCLUSION

The rise of cloud computing is rapidly changing the landscape of information technology, and ultimately turning the long-held promise of utility computing into a reality. PaaS is attractive to business owners as it eliminates the requirement for users to plan ahead for provisioning, and allows enterprises to start from the small and increase resources only when there is a rise in service demand. From the proposed work we conclude that it is possible to create a private cloud with the use of existing resources and such system can be extended as and when required if one can provide enough hardware. As discussed is implementation section such virtualized environment provides scalable and highly available systems to end user with added security like authentication server. We recommend private organizations to adopt this model and utilize their resources in more efficient manner. So, Private Cloud Architecture is one of the most preferable options that have benefits far beyond the reach of the conventional medium of computation, storage, networking and resource allocation.

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