A Survey on Cloud Computing

Tilwani Mashook[1] Harshvardhan Shani[2] Nidhi Barot[3]
[1,2]UG Student [3]Assistant Professor
[1,2,3]Department of Computer Engineering
[1,2,3]SAL Institute of Technology & Engineering Research, Gujarat, India

Abstract— Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage. The idea of cloud computing is based on a very fundamental principal of reusability of IT capabilities'. The difference that cloud computing brings compared to traditional concepts of "grid computing", "distributed computing", "utility computing", or "autonomic computing" is to broaden horizons across organizational boundaries. Advocates claim that cloud computing allows companies to avoid upfront infrastructure costs. As well, it enables organizations to focus on their core businesses instead of spending time and money on computer infrastructure. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables Information technology (IT) teams to more rapidly adjust resources to meet fluctuating and unpredictable business demand. This paper brings an introduction review on the Cloud computing and provides the state-of-the-art of Cloud computing technologies. Readers will also capture the status of cloud computing as well as its future trends.

Key words: Cloud On-Demand Self-Service, Cloud Computing

I. INTRODUCTION

Cloud computing can be defined as a model for enabling ubiquitous, convenient and on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort from the user side and minimal service provider interaction. Cloud computing is considered the evolution of a variety of technologies that have come together to change an organizations' approach for building their IT infrastructure. The cloud is where you go to use technology when you need it, for as long as you need it. You do not install anything on your desktop, and you do not pay for the technology when you are not using it.

Cloud computing is growing now-a-days in the interest of technical and business Organizations but this can also be beneficial for solving social issues. In the Recent time, E-Governance is being implemented in developing countries to improve efficiency and effectiveness of governance. This approach can be improved much by using cloud computing instead of traditional ICT. In India, economy is agriculture Based and most of the citizens live in rural areas. The standard of living, agricultural Productivity etc. can be enhanced by utilizing cloud computing in a proper Way. Both of these applications of cloud computing have technological as well as Social challenges to overcome.

Cloud users can provide more reliable, available and updated services to their clients in turn. Cloud itself consists of physical machines in the data centers of cloud providers. Virtualization is provided on top of these physical machines. These virtual machines are provided to the cloud users. Different cloud provider provides cloud services of different abstraction level. E.g. Amazon EC2 enables the users to handle very low level details where Google App-Engine provides a development platform for the developers to develop their applications. So, the cloud services are divided into many types like Software as a Service, Platform as a Service or Infrastructure as a Service. These services are available over the Internet in the whole world where the cloud acts as the single point of access for serving all customers. Cloud computing architecture addresses difficulties of large scale data processing.[1]

In brief cloud is essentially a bunch of commodity computers networked together. In same or different geographical locations, operating together to serve a Number of customers with different need and workload on demand basis with the Help of virtualization. Cloud services are provided to the cloud users as utility services like water, electricity, telephone using pay-as-you-use business model. These Utility services are generally described as XaaS (X as a Service) where X can be Software or Platform or Infrastructure etc. Cloud users use these services provided by the cloud providers and build their applications in the internet and thus deliver them to their end users. So, the cloud users don't have to worry about installing, maintaining hardware and software needed. And they also can afford these services

As they have to pay as much they use. So, the cloud users can reduce their expenditure and effort in the field of IT using cloud services instead of establishing IT Infrastructure themselves.

II. CHARACTERISTICS

We can summarize the essential characteristics of the Cloud as below:

- On-demand self-service: A service consumer can automatically make use of the computing capabilities, such as server processing time and network storage without requiring human interaction with each service's provider.
- Broad network access: Cloud capabilities (HW and SW) are available over the network and accessed through various platforms (e.g., mobile phones, laptops, and tablets).

- Resource pooling: The provider's computing resources (HW and SW) are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to users' demand. Multi-tenancy is the most important feature of the cloud-based application. It is characterized by the location independence feature in which the customer has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines.[16]
- Rapid elasticity: Capabilities can be rapidly and elastically provisioned; it can be quickly scaled out, and quickly scaled in. For the user, the capabilities available for provisioning appear to be unlimited and can be purchased in any quantity at any time.
- Measured Service: Cloud systems automatically control and optimize resources use by leveraging a metering capability in which resources' usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. The advantage here is that you are paying for exactly what you are using.[15]
- Dynamic Resource Allocation: Increased awareness of energy consumption in data centers has encouraged the practice of dynamic consolidating VMs in a fewer number of servers. In cloud infrastructures, where applications have variable and dynamic needs, capacity management and demand prediction are especially complicated. This fact triggers the need for dynamic resource allocation aiming at obtaining a timely match of supply and demand. Energy consumption reduction and better management of SLAs can be achieved by dynamically remapping VMs to physical machines at regular intervals. Machines that are not assigned any VM can be turned off or put on a low power state. In the same fashion, overheating can be avoided by moving load away from hotspots. A number of VI managers include a dynamic resource allocation feature that continuously monitors utilization across resource pools and reallocates available resources among VMs according to application needs.

III. ARCHITECTURE

The cloud providers actually have the physical data centers to provide virtualized services to their users through Internet. The cloud providers often provide separation between application and data. This scenario is shown in the given figure. The underlying physical machines are generally organized in grids and they are usually geographically distributed. Virtualization plays an important role in the cloud scenario. The data center hosts provide the physical hardware on which virtual machines resides. User potentially can use any OS supported by the virtual machines used.

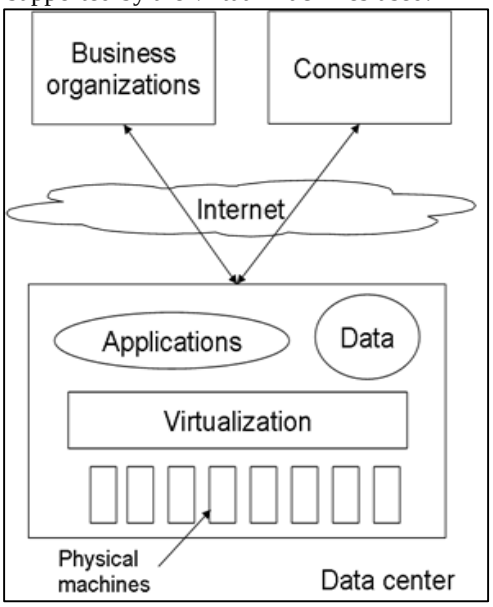

Fig. 1: Basic Cloud Computing Architecture

Operating systems are designed for specific hardware and software. It results in the lack of portability of operating system and software from one machine to another machine which uses different instruction set architecture. The concept of virtual machine solves this problem by acting as an interface between the hardware and the operating system called as system VMs [21]. Another category of virtual machine is called process virtual machine which acts as an abstract layer between the operating system and applications. Virtualization can be very roughly said to be as software translating the hardware instructions generated by conventional software to the understandable format for the physical hardware. Virtualization also includes the mapping of virtual resources like registers and memory to real hardware resources. The underlying platform in virtualization is generally referred to as host and the software that runs in the VM environment is called as the guest. Here the virtualization layer covers the physical hardware. Operating System accesses physical hardware through virtualization layer. Applications can issue instruction by using OS interface as well as directly using virtualizing layer interface. This design enables the users to use applications not compatible with the operating system. [14]

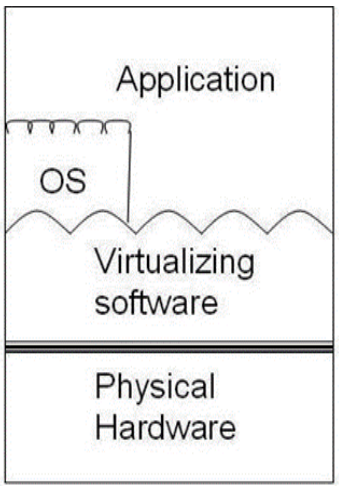

Fig. 2: Virtualization basic [21]

Cloud Storage is a service where data is remotely maintained, managed, and backed up. The service allows the users to store files online, so that they can access them from any location via the Internet. According to a recent survey conducted with more than 800 business decision makers and users worldwide, the number of organizations gaining competitive advantage through high cloud adoption has almost doubled in the last few years and by 2017, the public cloud services market is predicted to exceed $244 billion. Now, let's look into some of the advantages and disadvantages of Cloud Storage.[2]

IV. ADVANTAGES OF CLOUD STORAGE

1) Usability: All cloud storage services reviewed in this topic have desktop folders for Mac's and PC's. This allows users to drag and drop files between the cloud storage and their local storage.
2) Bandwidth: You can avoid emailing files to individuals and instead send a web link to recipients through your email.
3) Accessibility: Stored files can be accessed from anywhere via Internet connection.
4) Disaster Recovery: It is highly recommended that businesses have an emergency backup plan ready in the case of an emergency. Cloud storage can be used as a back- up plan by businesses by providing a second copy of important files. These files are stored at a remote location and can be accessed through an internet connection.[13]
5) Cost Savings: Businesses and organizations can often reduce annual operating costs by using cloud storage; cloud storage costs about 3 cents per gigabyte to store data internally. Users can see additional cost savings because it does not require internal power to store information remotely.

V. DISADVANTAGES OF CLOUD STORAGE

1) Usability: Be careful when using drag/drop to move a document into the cloud storage folder. This will permanently move your document from its original folder to the cloud storage location. Do a copy and paste instead of drag/drop if you want to retain the document's original location in addition to moving a copy onto the cloud storage folder?
2) Bandwidth: Several cloud storage services have a specific bandwidth allowance. If an organization surpasses the given allowance, the additional charges could be significant. However, some providers allow unlimited bandwidth. This is a factor that companies should consider when looking at a cloud storage provider.[7]
3) Accessibility: If you have no internet connection, you have no access to your data.
4) Data Security: There are concerns with the safety and privacy of important data stored remotely. The possibility of private data commingling with other organizations makes some businesses uneasy.
5) Software: If you want to be able to manipulate your files locally through multiple devices, you'll need to download the service on all devices.[12]

VI. SERVICES AND MODELS OF CLOUD COMPUTING

According to National Institute of Standards and technology (NIST), Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.[5]

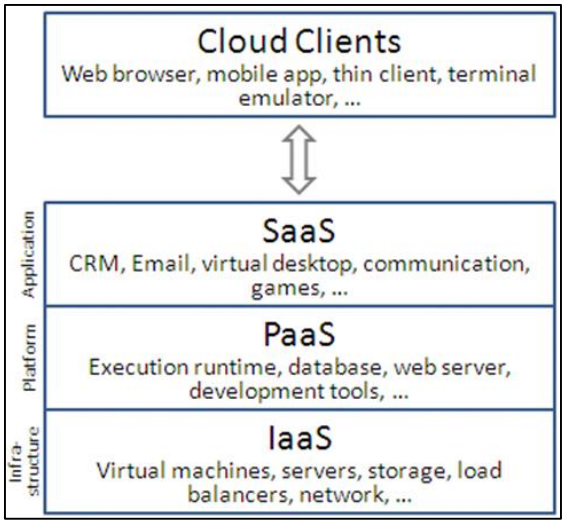

Fig. 3: Services of Cloud

A. Services

- Software as a Service (SaaS): The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user-specific application configuration settings.[9]
- Platform as a Service (PaaS): The capability provided to the consumer is to deploy onto the cloud infrastructure consumer-created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.[4]
- Infrastructure as a Service (IaaS): The capability provided to the consumer is to provision processing, storage, networks, and other fundamental computing resources where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls). [8][11]

B. Deployment Models

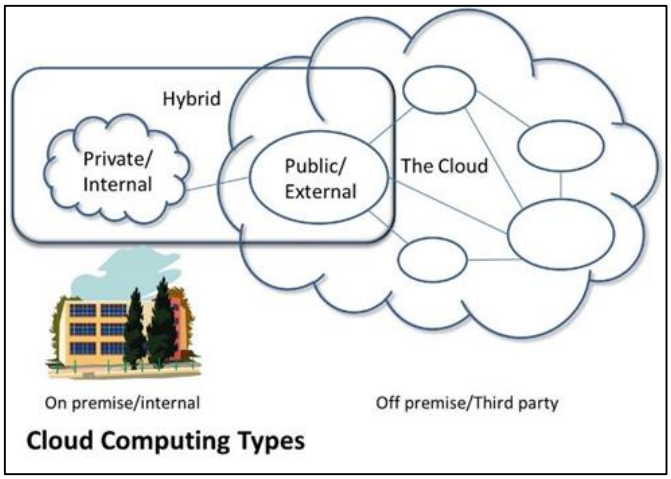

Fig. 4: Deployment Models

- Private cloud. The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises.
- Community cloud. The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed, and operated by one or more of the organizations in the community, a third party, or some combination of them, and it may exist on or off premises.[6][10]

- Public cloud. The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed, and operated by a business, academic, or government organization, or some combination of them. It exists on the premises of the cloud provider.[3]
- Hybrid cloud. The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

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