A Review on Cloud Computing- An Emerging Technology

Rohini Sharma

Abstract- Cloud computing focuses on delivery of reliable, secure, fault tolerant, sustainable, and scalable infrastructures for hosting internet-based application services. Cloud computing 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. The aim of this paper is to introduces the background and service model of cloud computing and also introduces the existing security issues in cloud computing.

Keywords-Cloud computing, Architecture, Deployment Models, Benefits, Security issues

1. INTRODUCTION

Cloud computing is emerging Internet-based computing technology that provides different Infrastructure, software and Platforms on-demand and pay-as-you-go basis. Concept of this new trend started from 1960 used by telecommunication companies until 1990 offered point to point data circuits and then offered virtual private networks. But due to network traffic and make network bandwidth more efficient introduced cloud to both servers and infrastructure. Amazon played vital role for development of cloud computing by making modern data centers. In 2007 Google, IBM and many remarkable universities and companies adopted it. And in 2008 Gartner highlighted its characteristics for customer as well service providers [1].

Cloud Computing offers a lot of benefits for end customers: high-end machines, incredible amounts of storage, high availability and everything available at the touch of a button. Clouds that do not only offer storage but also computations that can be outsourced in form of virtual machines (VMs). In the most flexible and general cloud computing model ("Infrastructure as-a Service", IaaS), customers are able to run entire Virtual Machines (VMs) inside the Cloud. VM images function as templates from which a virtually unlimited number of VM instances can be instantiated. Infrastructure-as-a-Service (IaaS), provides Virtual Machines (VMs) fully satisfying the user requests in terms of resources. The resources of the providers are usually hosted in the form of a data center. A service provider should have distributed data centers throughout the world so as to provide services to the customers.

Rohini Sharma is currently pursuing masters degree program in Computer Science engineering in Punjab Technical University, India, PH-9463234552. E-mail: rohinisharma90@yahoo.com

1.1 Benefits

- No up-front investment: Cloud computing uses a pay-as you-go pricing model. A service provider does not need to invest in the infrastructure to start gaining benefit from cloud computing. It simply rents resources from the cloud according to its own needs and pay for the usage.
- Lowering operating cost: Resources in a cloud environment can be rapidly allocated and de-allocated on demand. Hence, a service provider no longer needs to provision capacities according to the peak load. This provides huge savings, since resources can be released to save on operating costs when service demand is low.
- Highly scalable: Infrastructure providers pool large amount of resources from data centers and make them easily accessible. A service provider can easily expand its service to large scales in order to handle rapid increase in service demands (e.g., flash-crowd effect). This model is sometimes called surge computing [6].

The major benefit of cloud computing exists for industry, government and the general public alike. We already see the consumer extensively using cloud computing with such services as Google Mail, Amazon and many others.

1.2 Characteristics of Cloud Computing:

The Essential Cloud Characteristics are:

- On-demand self-service;
- Broad network access ;
- Resource pooling ;
- Location independence;
- Rapid elasticity ;
- Measured service. [2]

2. LITERATURE REVIEW

Amoretti et al. [3] presented a framework and a middleware that enables highly dynamic and adaptive cloud, characterized by peer providers and by services that can be replicated by means of code mobility mechanism. Zhang et al. [4] proposed an intelligent workload factoring

service for enterprise customers to make the best use of public cloud services along with their privately-owned (legacy) data centers. The core technology of the intelligent workload factoring system is a fast frequent data item detection algorithm, which enables factoring incoming request only. The National Institute of Standards and Technology (NIST) have been very involved in setting a framework for cloud computing use by the government. Cloud computing is a model for enabling 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 [1].This cloud model promotes availability and is defined in terms of 1) essential characteristics, 2) service models and 3) deployment models.

3. CLOUD COMPUTING ARCHITECTURE

Cloud computing architecture comprised of two components (hardware and application). These two components have to work together seamlessly or else cloud computing will not be possible. Cloud computing requires an intricate interaction with the hardware which is very essential to ensure uptime of the application. If application fails, the hardware will not be able to push the data and implement certain processes. On the other side, hardware failure will mean stoppage of operation. Applications built on Cloud Architectures are such that the underlying computing infrastructure is used only when it is needed (for example to process a user request), draw the necessary resources on demand (like compute servers or storage), perform a specific job, then relinquish the unneeded resources and often dispose themselves after the job is done. While in operation the application scales up or down elastically based on resource needs.

3.1 Architectural layers of cloud computing

- Software as a Service (SaaS) – Use provider's applications over a network. Software as a service referred to as "software on demand," is software that is deployed over the internet and/or is deployed to run behind a firewall on a local area network or personal computer. With SaaS, a provider licenses an application to customers either as a service on demand, through a subscription, in a "pay-as-you-go" model, or at no charge. This approach to application delivery is part of the utility computing model where all of the technology is in the "cloud" accessed over the Internet as a service. SaaS was initially widely deployed for sales force automation and Customer Relationship Management (CRM). Now it has become common place for many business tasks, including computerized billing, invoicing, human resource management, financials, content management, collaboration, document management, and service desk management.

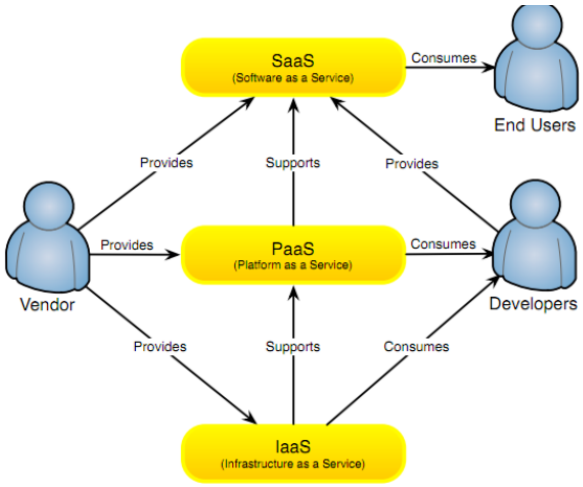

Fig1 Architectural Layers [5]

- Platform as a Service (PaaS) – Deploy customer-created applications to a cloud. Platform as a Service (PaaS) is a way to rent hardware, operating systems, storage and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones. Platform as a Service (PaaS) is an outgrowth of Software as a Service (SaaS), a software distribution model in which hosted software applications are made available to customers over the Internet. PaaS has several advantages for developers. With PaaS, operating system features can be changed and upgraded frequently. Geographically distributed development teams can work together on software development projects. Services can be obtained from diverse sources that cross international boundaries. Initial and ongoing costs can be reduced by the use of infrastructure services from a single vendor rather than maintaining multiple hardware facilities that often perform duplicate functions or suffer from incompatibility problems. Overall expenses can also be minimized by unification of programming development efforts. On the downside, PaaS involves some risk of "lock-in" if offerings require proprietary service interfaces or development languages. Another potential pitfall is that the flexibility of offerings may not meet the needs of some users whose requirements rapidly evolve.
- Infrastructure as a Service (IaaS) – Rent processing, storage, network capacity, and other fundamental computing resources. The Infrastructure as a Service is a provision model in which an organization outsourcers the equipment used to support operations, including storage, hardware, servers and networking components. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis. Characteristics and components of IaaS include:

- Utility computing service and billing model.
- Automation of administrative tasks.
- Dynamic scaling.
- Desktop virtualization.
- Policy-based services.
- Internet connective

Infrastructure-as-a-Service like Amazon Web Services provides virtual server instances with unique IP addresses and blocks of storage on demand. Customers use the provider's application program interface (API) to start, stop, access and configure their virtual servers and storage. In the enterprise, cloud computing allows a company to pay for only as much capacity as is needed, and bring more online as soon as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed it's sometimes referred to as utility computing. Infrastructure as a Service is sometimes referred to as Hardware as a Service (HaaS).

4. CLOUD DEPLOYMENT MODELS

The Cloud Deployment Models are:

- Private cloud: enterprise owned or leased. Private cloud (also called internal cloud or corporate cloud) is a marketing term for a proprietary computing architecture that provides hosted services to a limited number of people behind a firewall. Advances in virtualization and distributed computing have allowed corporate network and datacenter administrators to effectively become service providers that meet the needs of their "customers" within the corporation. Marketing media that uses the words "private cloud" is designed to appeal to an organization that needs or wants more control over their data than they can get by using a third-party hosted service such as Amazon's

  Elastic Compute Cloud (EC2) or Simple Storage Service (S3).

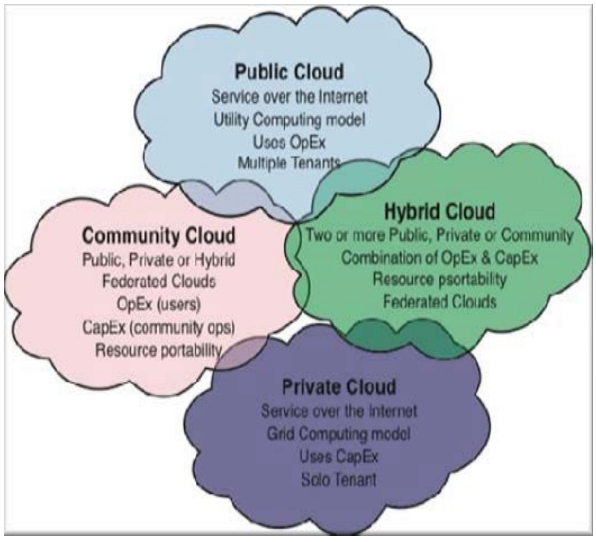

Fig2 Deployment Models

- Community cloud: shared infrastructure for specific community. A community cloud may be established where several organizations have similar requirements and seek to share infrastructure so as to realize some of the benefits of cloud computing. With the costs spread over fewer users than a public cloud (but more than a single tenant) this option is more expensive but may offer a higher level of privacy, security and/or policy compliance.
- Public cloud: sold to the public, mega-scale infrastructure. Public cloud is one based on the standard cloud computing model, in which a service provider makes resources, such as applications and storage, available to the general public over the Internet. Public cloud services may be free or offered on a pay-per-usage model.
- Hybrid cloud: composition of two or more cloud types. A hybrid cloud is a Cloud Computing environment in which an organization provides and manages some resources in-house and has others provided externally. For example, an organization might use a public cloud service, such as Amazon Simple Storage Service (Amazon S3) for archived data but continue to maintain in-house storage for operational customer data. Ideally, the hybrid approach allows a business to take advantage of the scalability and cost-effectiveness that a public cloud computing environment offers without exposing mission-critical applications and data to third-party vulnerabilities. [7]

5. COMMERCIALLY AVAILABLE CLOUD SERVICES

- Google: The core of Google's business is all in Cloud Computing. Services delivered over network connections include search, e-mail, online mapping,

office productivity (including documents, spreadsheets, presentations, and databases), collaboration, social networking and voice, video, data services. Users can subscribe to these services for free or pay for increased levels of service and support.

- Amazon: As the world's largest online retailer, the core of Amazon's business is ecommerce. While ecommerce itself can be considered Cloud Computing, Amazon has also been providing capabilities which give IT department's direct access to Amazon compute power. Key examples include S3 (Simple Storage Services) and EC2. Any internet user can access storage in S3 and access stored objects from anywhere on the Internet. EC2 is the Elastic Compute Cloud, a virtual computing infrastructure able to run diverse applications ranging from web hosts to simulations or anywhere in between. This is all available for a very low cost per user.
- Microsoft: Traditionally Microsoft's core business has been in device operating systems and device office automation software. Since the early days of the Internet Microsoft has also provided web hosting, online e-mail and many other cloud services. Microsoft now also provides office automation capabilities via a cloud ("Office Live") in an approach referred to as "Software Plus Services" vice "Software as a Service" to allow synchronous/asynchronous integration of online Cloud documents with their traditional offline desktop-resident versions.
- Salesforce.com: The core mission of Salesforce.com has been in delivery of capabilities centered on customer relationship management. However, in pursuit of this core Salesforce.com has established themselves as thought leaders in the area of Software as a Service and is delivering an extensive suite of capabilities via the Internet. A key capability provided is the site Force.com, which enables external developers to create add-on applications that integrate into the main Salesforce.com application and are hosted on the infrastructure Salesforce.com.
- VMware: Provides several technologies of critical importance to enabling cloud computing, and has also started offering its own cloud computing on demand capability called vCloud. This type of capability allows enterprises to leverage virtualized clouds inside their own IT infrastructure or hosted with external service providers.

6. CLOUD COMPUTNG SECURITY ISSUES

Security is very crucial factor. First thing that people think is to avoid the private data in cloud. In the last few years, cloud computing has grown from being a promising business concept to one of the fastest growing segments of the IT industry. Now, recession-hit companies are increasingly realizing that simply by tapping into the cloud they can gain fast access to best-of-breed business applications or drastically boost their infrastructure resources, all at negligible cost. But as more and more information on individuals and companies is placed in the cloud, concerns are beginning to grow about just how safe an environment it is.

- Security

Where is your data more secure, on your local hard driver or on high security servers in the cloud? Some argue that customer data is more secure when managed internally, while others argue that cloud providers have a strong incentive to maintain trust and as such employ a higher level of security. However, in the cloud, your data will be distributed over these individual computers regardless of where your base repository
of data is ultimately stored. Industrious hackers can invade virtually any server, and there are the statistics that show that one-third of breaches result from stolen or lost laptops and other devices and from employees' accidentally exposing data on the Internet, with nearly 16 percent due to insider theft.

- Privacy

Different from the traditional computing model, cloud computing utilizes the virtual computing technology, users' personal data may be scattered in various virtual data center rather than stay in the same physical location, even across the national borders, at this time, data privacy protection will face the controversy of different legal systems. On the other hand, users may leak hidden information when they accessing cloud computing services. Attackers can analyze the critical task depend on the computing task submitted by the users.

- Reliability

Servers in the cloud have the same problems as your own resident servers. The cloud servers also experience downtimes and slowdowns, what the difference is that users have a higher dependent on cloud service provider (CSP) in the model of cloud computing. There is a big difference in the CSP's service model, once you select a particular CSP, you may be locked-in, thus bring a potential business secure risk.

- Legal Issues

Regardless of efforts to bring into line the lawful situation, as of 2009, supplier such as Amazon Web Services provide to major markets by developing restricted road and rail network and letting users to choose "availability zones" . On the other hand, worries stick with safety measures and confidentiality from individual all the way through legislative levels.

- Open Standard

Open standards are critical to the growth of cloud computing. Most cloud providers expose APIs which are typically well-documented but also unique to their implementation and thus not interoperable. Some vendors have adopted others' APIs and there are a number of open standards under development, including the OGF's Open Cloud Computing Interface. The Open Cloud Consortium (OCC) is working to develop consensus on early cloud computing standards and practices.

- Compliance

Numerous regulations pertain to the storage and use of data require regular reporting and audit trails, cloud providers must enable their customers to comply appropriately with these regulations. Managing Compliance and Security for Cloud Computing, provides insight on how a top-down view of all IT resources within a cloud-based location can deliver a stronger management and enforcement of compliance policies. In addition to the requirements to which customers are subject, the data centers maintained by cloud providers may also be subject to compliance requirements.

- Freedom

Cloud computing does not allow users to physically possess the storage of the data, leaving the data storage and control in the hands of cloud providers. Customers will contend that this is pretty fundamental and affords them the ability to retain their own copies of data in a form that retains their freedom of choice and protects them against certain issues out of their control whilst realizing the tremendous benefits cloud computing can bring .

- Long-term Viability

You should be sure that the data you put into the cloud will never become invalid even your cloud computing provider go broke or get acquired and swallowed up by a larger company. "Ask potential providers how you would get your data back and if it would be in a format that you could import into a replacement application. [4pdf]

7. CONCLUSION

In this paper we discuss about the emerging technology and its architecture including various Layers. Cloud computing is a new term that is introduced in business environment where users can interact directly with the virtualized resources and safe the cost for the consumers. In this paper the benefits and security issues are addressed as well. There are some security measures and some are under research that Provide Security on each layer that we discuss in this paper. Security in cloud computing consist of security abilities of web browsers and web service structure. The cloud is a big target for malicious individuals and may have disadvantages because it can be accessed through an unsecured internet connection. The deployment models are also discussed that help in retrieving the information. SAAS, PAAS, IAAS are the three models for cloud computing. It opens up the world of computing to a broader range of uses and increases the ease of use by giving access through any internet connection. However, with this increased ease also come drawbacks. You have less control over who has access to your information and little to no knowledge of where it is stored. You also must be aware of the security risks of having data stored on the cloud.

There are various technological perspectives for cloud analytics and various cloud services that can be envisaged in future, as the development of cloud computing technology is still at an early stage.

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