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Cloud Computing – An on Demand Service Platform and Different Service Models

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ABSTRACT
Cloud computing is the latest paradigm in delivering computing resources as a service. It represents a shift away from computing as a product that is purchased, to computing as a service that is delivered to consumers over the internet from large-scale data centres or "clouds" [1]. This paper is a base paper that gives a brief introduction to the cloud computing, from what technologies cloud computing is derived, its components, its merits and demerits, also main challenges to the cloud computing. This paper also helps to categorize the various services provided by any cloud service provider in some categories depending upon the type of service.

Keywords
Cloud Computing, Service Models, P2P, SOA, SOAP, SaaS, PaaS, IaaS, HaaS, NaaS, CaaS etc.

1. INTRODUCTION
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 minimum management effort or service provider interaction [2]. These computing resources are generally offered as pay-for-use plans and hence have become attractive to cost conscious customers [3].

2. GENESIS OF CLOUD COMPUTING
Cloud computing shares its characteristics with several other computing areas and system engineering concepts [5]. Cloud computing has borrowed its basics from the following:

2.1 Cluster Computing
One way to make an application run faster is to divide its work into multiple parts, then run those parts simultaneously on a group of computers, Known as cluster computing [7]. Benefits of cluster computing includes high performance, expandability and scalability, high throughput, high availability etc [8].

2.2 Grid Computing
Grid computing is a form of distributed computing that involves coordinating and sharing computing, application, data and storage or network resources across dynamic and geographically dispersed organization [9].

2.3 Virtualization
Virtualization is the simulation of the software and/or hardware upon which other software runs. This simulated environment is called a virtual machine (VM). There are many forms of virtualization, distinguished primarily by computing architecture layer, and virtualized components may include hardware platforms, operating systems (OS) e.g. Citrix-farm, storage devices, network devices or other resources.

2.4 Client–Server Model
This model assigns one of two roles to the computers in a network: Client or server. A server is a computer system that selectively shares its resources. A client is a computer or computer program that contact with a server in order to make use of a resource. Data, CPUs, printers, and data storage devices are some examples of resources.

2.5 Peer-to-Peer Computing
A peer-to-peer (P2P) computer network is one in which each computer in the network can act as a client or server for the other computers in the network, allowing shared access to various resources such as files, peripherals, and sensors without the need for a central server or P2P computing can be simply defined as the sharing of computer resources and services by direct exchange [12]. Some of the benefits of a P2P approach include: improving scalability by avoiding dependency on centralized points, eliminating the need for costly infrastructure by enabling direct communication among clients and enabling resource aggregation [11].

2.6 Service-Oriented Architecture
Service Oriented Architecture (SOA) is an architecture approach for defining, linking, and integrating reusable business services that have clear boundaries and are self-contained with their own functionalities [13]. In other words SOA can be defined as an application architecture in which all functions or services, are defined using a description language and have invokable interfaces that are called to perform business processes. Each interaction is independent of each and every other interaction and the interconnect protocols of the communicating devices (i.e., the infrastructure components that determine the communication system do not affect the interfaces). Because interfaces are platform-independent, a client from any device using any operating system in any language can use the service. SOA is not the same as Web services, which indicates a collection of technologies, such as SOAP (Simple Object Access Protocol) and XML. SOA is more than a set of technologies and runs independent of any specific technologies.

2.7 Utility Computing
Utility computing [4] is the packaging of computing resources, such as computation, storage and services, as a metered service. This model has the advantage of a low or no initial cost to obtain computer resources;

instead, computational resources are essentially rented. This repackaging of computing services became the foundation of the shift to "on demand" computing, software as a service and cloud computing models that further propagated the idea of computing, application and network as a service.

2.8 MapReduce

MapReduce is a programming model and an associated implementation for processing and generating large data sets. Users specify a map function that processes a key/value pair to generate a set of intermediate key/value pairs, and a reduce function that merges all intermediate values associated with the same intermediate key [16].

2.9 Autonomic Computing

A computing environment with the ability to manage itself and dynamically adapt to change in accordance with business policies and objectives. Self-managing environments can perform such activities based on situations they observe in the IT environment rather than requiring IT professionals to initiate the task. These environments are self-configuring, self-healing, self-optimizing, and self-protecting [15].

3. ARCHITECTURE OF THE CLOUD COMPUTING

Cloud computing architecture refers to the components and subcomponents required for cloud computing. This section describes a layered model of cloud computing. The architecture of a cloud computing environment can be divided into four layers: the hardware/datacenter layer, the infrastructure layer, the platform layer and the application layer [6], as shown in Figure 1.

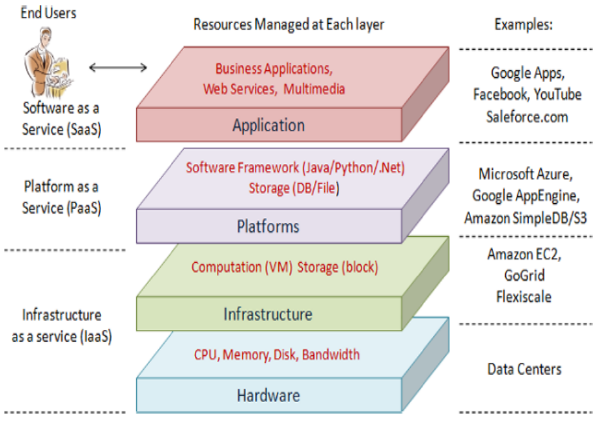

Figure 1 Cloud Computing Architecture [6]

3.1 The Hardware Layer

This layer is responsible for managing the physical resources of the cloud, including servers, routers, switches, power and cooling systems. In practice, the hardware layer is typically implemented in data centers. A data center usually contains thousands of servers that are organized in racks and interconnected through switches, routers or other fabrics [6].

3.2 The Infrastructure Layer

This layer is also known as the virtualization layer, the infrastructure layer creates a pool of storage and computing resources by partitioning the physical resources using virtualization technologies such as Xen [6], KVM [6] and VMware [6]. Typically services in this layer are such as Elastic Computing Cloud of Amazon [22].

3.3 The Platform Layer

Built on top of the infrastructure layer, the platform layer consists of operating systems and application frameworks. The purpose of this layer is to minimize the burden of deploying applications directly into VM containers [6]. The typical services in this layer are Google App Engine [22] and Azure from Microsoft [22].

3.4 The Application Layer

At the highest level of the hierarchy, the application layer consists of the actual cloud applications. Different from traditional applications, cloud applications can leverage the automatic-scaling feature to achieve better performance, availability and lower operating cost. The earliest SaaS is the Customer Relationship Management (CRM) [22] from Salesforce, which was developed based on the force.com (a PaaS in Salesforce). Some other services provided by Google on-line office such as documents, spreadsheets, presentations are all SaaS[22].

As mentioned by Qi Zhang, Lu Cheng and Raouf Boutaba, the architecture of cloud computing is modular. Each layer is loosely coupled with the layers above and below, allowing each layer to evolve separately. The architectural modularity allows cloud computing to support a wide range of application requirements while reducing management and maintenance overhead.

4. SERVICE MODELS

clouds offer services that can be grouped into the following categories:

4.1 Infrastructure as a Service (IaaS) or Hardware as a Service (HaaS)

IaaS offers the hardware so that any organization can put whatever they want onto it. Rather than to purchase servers, racks, and having to pay for the datacenter space for them, the service providers rent these resources.

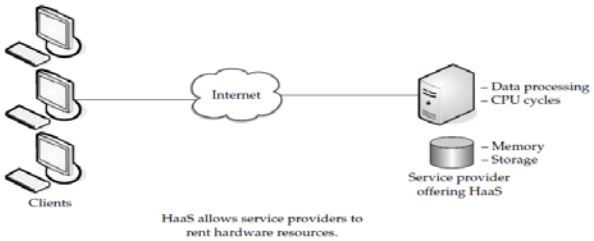

Figure 2 Infrastructure as a Service

Examples of IaaS providers include Amazon EC2 [20], GoGrid [6] and Flexiscale [6].

4.2 Platform as a Service (PaaS)

PaaS supplies all resources required to build applications and services completely from the internet, without having to download or install software.

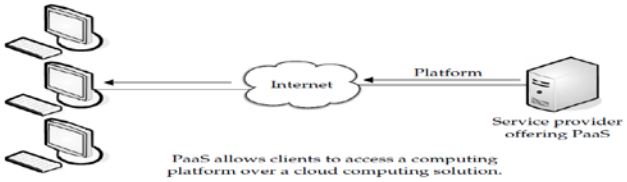

Figure 3 Platform as a service

PaaS services include application design, development, testing, deployment and hosting. PaaS providers include Google App Engine [10], Microsoft Windows Azure [6] and Force.com [6].

4.3 Software as a service (SaaS)

SaaS is the model in which an application is hosted as a service to customers who access it via internet. When the software is hosted off-site, the customer does not have to maintain it or support it. The provider does all the patching and upgrades as well as keeping the infrastructure running.

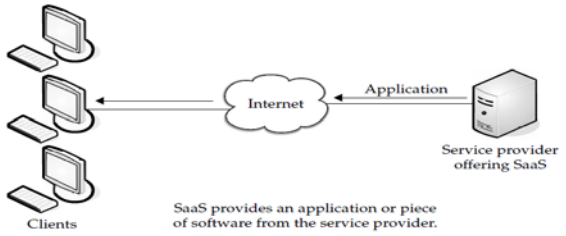

Figure 4 Software as a Service

Examples of SaaS providers include Salesforce.com [6], Rackspace [6], SAP Business ByDesign [19].

4.4 Network as a Service (NaaS)

Network as a service (NaaS), a category of cloud services where the capability provided to the cloud service user is to use network/transport connectivity services and/or inter-cloud network connectivity services. NaaS involves the optimization of resource allocations by considering network and computing resources as a unified whole. Traditional NaaS services include flexible and extended VPN, and bandwidth on demand. NaaS concept materialization also includes the provision of a virtual network service by the owners of the network infrastructure to a third party (VNP – VNO). The term "Network as a service" (NaaS) is considered to be part of the nomenclature of cloud computing, along with infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS).

4.5 Communication as a Service (CaaS)

Communications as a Service (CaaS) is an architecture for communications applications. CaaS extends the principles of software as a service (SaaS) architecture by adding a control layer based on the Session Initiation Protocol (SIP).

5. DEPLOYMENT MODELS

Each company chooses a deployment model for a cloud computing solution based on their specific business, operational, and technical requirements. There are primarily four cloud deployment models, which are discussed below:

5.1 Public Cloud

Public clouds are run by third parties, and applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks (Figure 5).

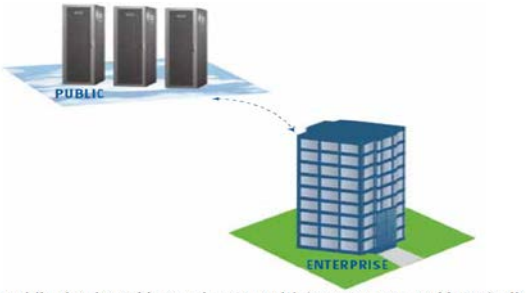

Figure 5 Public Cloud [18]

Public clouds are most often hosted away from customer premises, and they provide a way to reduce customer risk and cost by providing a flexible, even temporary extension to enterprise infrastructure [18]. Example: Amazon, Google Apps, Windows Azure [19], force.com [14].

5.2 Private Cloud

Private clouds are built for the exclusive use of one client, providing the utmost control over data, security, and quality of service (Figure 6).

Figure 6 Private Cloud [18]

The company owns the infrastructure and has control over how applications are deployed on it. Private clouds may be deployed in an enterprise datacenter, and they also may be deployed at a colocation facility [18]. Example: eBay [19].

5.3 Hybrid Cloud

Hybrid clouds combine both public and private cloud models (Fig. 7). They can help to provide on-demand, externally provisioned scale. The ability to strengthen a private cloud with the resources of a public cloud can be used to maintain service levels in the face of rapid workload fluctuations.

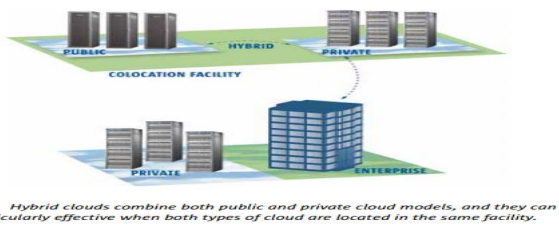

Figure 7 Hybrid cloud [18]

A hybrid cloud also can be used to handle planned workload spikes [18]. There are not many hybrid clouds actually in use today, though initial initiatives such as the one by IBM and Juniper already introduce base technologies for their realization [19].

5.4 Community Cloud

Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party and hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the cost savings potential of cloud computing are realized. Community Clouds as such are still just a vision, though there are already indicators for such development, e.g. through Zimory[19] and RightScale [19].

6. CHARACTERISTICS OF CLOUD COMPUTING

Cloud computing exhibits the following key characteristics:

6.1 Broad Network Access

Broad network access means that the hosted application should be reachable via nearly any network based appliance. These can include, but are not limited to, the following:

- Laptop
- Desktop
- Smartphone
- Tablet device

Broad network access is typically accomplished by using the built-in web browser for the device, as it is one of the most ubiquitous clients available. The advantage of this setup is that client devices can be much less powerful as “thin-clients” rather than “fat-clients”.

6.2 Rapid Elasticity

This means the service can be quickly scaled, often automatically [26], such that the capacity appears infinite to the consumer.

6.3 Multi-Tenancy

In a cloud environment, services owned by multiple providers are co-located in a single data center. The performance and management issues of these services are shared among service providers and the infrastructure provider. The layered architecture of cloud computing provides a natural division of responsibilities. The owner of each layer only needs to focus on the specific objectives associated with this layer.

6.4 Shared Resource Pooling

Resource pooling is the concept that multiple organizations can share the underlying physical cloud infrastructure. This allows significantly greater purchasing power for these companies because they can typically obtain access to a larger pool of resources rather than procuring the physical or virtual infrastructure themselves.

6.5 Maintenance

Cloud service providers do the system maintenance, and access is through APIs that do not require application installations onto PCs, thus further reducing maintenance requirements [25].

6.6 Cost Savings

By using cloud computing based services and applications companies can reduce their capital expenditures [23] and use operational expenditures for increasing their computing capabilities. This is a lower barrier to entry and also requires fewer in house IT resources to provide system support. But, there is a major issue of improving energy efficiency because it has been estimated that the cost of powering and cooling accounts for 53% of the total operational expenditure of data centers [21].

7. MAIN CHALLENGES/ISSUES TO CLOUD COMPUTING

Though cloud computing is on the verge of becoming a reality, but still there are several issues and challenges, few of them are described below:

7.1 Monitoring

Monitoring for cloud systems is active research topic in cloud computing. With the enormous size of the cloud data centers and the large number of nodes supporting any cloud offering, hardware and software failures become an unavoidable reality, for which a robust monitoring system must be in place to allow the cloud services to actively react to failures [5].

7.2 Compliance

Numerous regulations pertain to the storage and use of data requires regular reporting and audit trails. In addition to the requirements to which customers are subject, the data centers maintained by cloud providers may also be subject to compliance requirements [17].

7.3 Availability of Service

The goal of availability for cloud computing systems (including applications and its infrastructures) is to ensure its users that they can use them at any time, at any place [17].

7.4 Legal Issues

Worries stick with safety measures and confidentiality of individual all the way through legislative levels [17].

7.5 Privacy

Information stored in the cloud is looked after by the provider, meaning that consumers share control over their information with the provider. This creates a range of privacy and security issues, as well as legal concerns as to who owns and has access to the information [24]. Well-known security issues such as data loss, phishing, botnet (running remotely on a collection of machines) pose serious threats to organization's data and software [27].

7.6 Accountability

If the cloud fails, can the user access their information from somewhere else? Or if they decide to move clouds. For example, migrate from Google to Yahoo, can their data be transferred? By relying on cloud computing, the user is entrusting all of their information to a service provider. If the cloud fails, who is responsible for recovering that lost information, and for any costs or damages incurred by that loss [24]?

7.7 Service Level Agreement

Although cloud consumers do not have control over the underlying computing resources, they do need to ensure the quality, availability, reliability, and performance of these resources when consumers have migrated their core business functions onto their entrusted cloud. In other words, it is vital for consumers to obtain guarantees from providers on service delivery. Typically, these are provided through Service Level Agreements (SLAs) negotiated between the providers and consumers.

7.8 Billing

It is difficult to assess the costs involved due to the on-demand nature of the services. Budgeting and assessment of the cost will be very difficult unless the provider has some good and comparable benchmarks to offer.

7.9 Interoperability

Currently, each cloud offering has its own way on how cloud clients/applications/users interact with the cloud, leading to the "Hazy Cloud" phenomenon. This severely hinders the development of cloud ecosystems by forcing vendor locking, which prohibits the ability of users to choose from alternative vendors/offering simultaneously in order to optimize resources at different levels within an organization [27].

8. CONCLUSION

In this paper we have discussed the various technologies related to cloud computing, its architecture, service models, deployment models, merits of cloud computing, various challenges and Issues in the cloud computing. Although, Cloud Computing has emerged as a major technology to provide services over the Internet in easy and efficient way still there are many areas like energy management, security of data, cloud monitoring etc. that need the attention of the researchers to make the cloud computing technology more advantageous.

9. REFERENCE

[1] Sriram-Ilango and Ali Khajeh-Hosseini. Research Agenda in Cloud Technologies.

[2] Mell-Peter, Grance-Timothy. September 2011. The NIST Definition of Cloud Computing.

[3] Patel-Pankesh, Ranabahu-Ajith, and Sheth-Amit. Service Level Agreement in Cloud Computing.

[4] Foster-Ian, Zhao-Yong, Raicu-Ioan and Lu-Shiyong. Cloud Computing and Grid Computing 360-Degree Compared.

[5] Youseff-Lamia, Butrico-Maria, and Dilma Da Silva. Toward a Unified Ontology of Cloud Computing.

[6] Zhang-Qi, Cheng-Lu, and Boutaba-Raouf. 2010. Cloud computing: state-of-the-art and research challenges. J Internet Serv Appl (2010) 1: 7–18.

[7] Chappell, David. June 2011. Cluster Computing Today, What's Changed and Why It Matters.

[8] Baker-Mark, and Buyya-Rajkumar. Cluster Computing at a Glance.

[9] Seyyed Mohsen Hashemi, Amid Khatibi Bardsiri. Cloud Computing Vs. Grid Computing. ARPN Journal of Systems and Software. Vol. 2, No.5, May 2012. ISSN 2222-9833.

[10] Metri-Priya, and Sarote-Geeta. Privacy Issues and Challenges in Cloud computing. 2011. International Journal of Advanced Engineering Sciences and Technologies Vol No. 5, Issue No. 1, 001 – 006.

[11] Dejan S. Milojicic, Vana Kalogeraki, Rajan Lukose, Kiran Nagaraja, Jim Pruyne, Bruno Richard, Sami Rollins, and Zhichen Xu. July 10, 2002.Peer-to-Peer Computing.

[12] Barkai-David. February 2000. An Introduction to Peer-to-Peer Computing.

[13] Mohamed I. Mabrouk. 05 Sep 2008. SOA fundamentals in a nutshell,Prepare to become an IBM Certified SOA Associate.

[14] Dillon- Tharam, Chen Wu and Elizabeth Chang. 2010. Cloud Computing: Issues and Challenges. 24th IEEE International Conference on Advanced Information Networking and Applications.

[15] An architectural blueprint for autonomic computing.IBM. June 2005, Third Edition.

[16] Dean- Jeffrey and Ghemawat- Sanjay. MapReduce: Simplified Data Processing on Large Clusters. USENIX Association OSDI '04: 6th Symposium on Operating Systems Design and Implementation.

[17] Kumar-Santosh and Goudar-R. H. Cloud Computing – Research Issues, Challenges, Architecture, Platforms and Applications: A Survey. International Journal of Future Computer and Communication, Vol. 1, No. 4, December 2012.

[18] Introduction to Cloud Computing architecture, White Paper, 1st Edition, June 2009, Sun Microsystems, Inc.

[19] Keith Jeffery [ERCIM], Burkhard Neidecker-Lutz [SAP Research], The future of cloud computing opportunities for european cloud computing beyond 2010. Expert Group Report, Public Version 1.0.

[20] David Burford, CFA, MBA, MCP. February 20, 2010. LAD ENTERPRIZES, INC.

[21] By V. Krishna Reddy, B. Thirumala Rao, Dr. L.S.S. Reddy, P. Sai Kiran. Research Issues in Cloud Computing. Global Journal of Computer Science and Technology. Volume 11 Issue 11 Version 1.0 July 2011.

[22] Han Qi, Abdullah Gani. Research on Mobile Cloud Computing: Review, Trend and Perspectives.

[23] Shivangi Goyal, a comparative study of cloud computing service providers. International Journal of Advanced Research in Computer Science and Software Engineering. Volume 2, Issue 2, February 2012 ISSN: 2277 128X.

[24] L. Arockiam, S. Monikandan & G. Parthasarathy. Cloud Computing: A Survey. International Journal of Internet Computing (IJIC), ISSN No: 2231 – 6965, Volume-1, Issue-2, 2011.

[25] Introduction to Cloud Computing. Dialogic Making Innovation Thrive.

[26] Christopher Olive, Cloud Computing Characteristics Are Key. General Physics Corporation.

[27] P.Radha Krishna Reddy*, S. Pavan Kumar Reddy,G.Sireesha and U.Seshadri. The Security Issues of Cloud computing over normal & IT sector. International Journal of Advanced Research in Computer Science and Software Engineering. Volume 2, Issue 3, March 2012 ISSN: 2277 128X.