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Cloud Computing: Current and Future

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Abstract— **Cloud computing are distributed processing, parallel processing and the development of grid computing, the concept was jointly proposed by Google and IBM in 2007. Cloud computing refers to a network that distributes processing power, applications, and large systems among many computers. Social media channels and many other applications use cloud computing as their platform. Cloud computing, the aim is to hide the complexity of IT infrastructure management from its users. At the same time, cloud computing platforms provide massive scalability, 99.999% reliability, high performance, and specifiable configurability. These capabilities are provided at relatively low costs compared to dedicated infrastructures. Cloud computing is a complex infrastructure of software, hardware, processing, and storage that is available as a service. This paper discuss regarding the study of the basic concepts of cloud computing technology, core technology, several different types of clouds services, target dimensionand challenges of cloud computing in current and future.**

***Keywords*— Cloud computing, grid computing, platform, IT infrastructure, software, hardware and processing.**

I. INTRODUCTION

Cloud Computing is one of the methods for distributed data processing and storage. With the use of cloud technology **solving**
computing tasks requiring large computational resources in parallel on multiple computers. Therefore, the main research area of grid system is scientific investigation and technical development. In cloud computing, the stress is laid on the independence from a platform and the ability to work with dynamic and scalable databases. The concept of cloud computing makes it possible to choose the best combination of computational capabilities and required cost [14] .

The difference between cloud computing and relational databases is that in the first case, the data is distributed geographically which leads to transit delays. Therefore, at present it is appropriate to use cloud computing where there are no complex queries [6].

Cloud computing is efficient from an economic point of view because it allows one not to pay for hardware, software, and its maintenance, and to avoid data storage costs and management. As well, it significantly reduces the time required to build and deploy applications. Cloud computing is particularly suitable for use in small and midsized business.

data is processed and stored on the Internet all the time. Data appears on client devices (PCs, notebooks, netbooks, Smartphone's, etc.) temporarily as needed. The concept of cloud computing is supported by many users, but has received criticism from people who see in this technology the loss of user control over computing processes.

The term "cloud computing" means computing with the use of the internet for searching for computational resources and databases. The term "cloud" means a set of internet resources. There are ten basic principles that define the specific characteristics of cloud computing: a user-centric system, friendliness to users, openness, transparency, interoperability, construction of task representations, division of tasks in accordance with their specifics, evolution, balance, and security [14].

The architecture of cloud computing is based on some important factors, the most significant of which is that users are always able to get the resources they need.
Cloud computing, as well as grid computing, allows solving computing tasks on remote computers. The main differences from common grid systems are in their aims and organizations of work. Grid computing should be used for

Refer to [4] cloud computing seems to offer some incredible benefits for communicators: the availability of an incredible array of software applications, access to lightning-quick processing power, unlimited storage, and the ability to easily share and process information. All of this is available through in browser any time we can access the internet. Cloud computing platforms provide easy access.

Cloud computing is a metaphor for the internet [4], its breadth and range are much more significant and ground-breaking. Cloud computing is a complex infrastructure of software, hardware, processing, and storage that is available as a service. Cloud computing portends a major change in how to store information and run applications. Instead of running programs and data on an individual desktop computer, everything is hosted in the "cloud"—a nebulous assemblage of computers and servers accessed via the Internet. Cloud computing lets you access all your applications and documents from anywhere in the world, freeing you from the

confines of the desktop and making it easier for group members in different locations to collaborate.

Cloud Computing is the applications delivered as services over the internet and the hardware and systems software in the data canters that provide those services. The services themselves have long been referred to as *Software as a Service* (SaaS). The data canters hardware and software is what will call a *Cloud* [11].

II. CLOUD OVERVIEW

What is Cloud Computing? Although many formal definitions have been proposed in both academia and industry, the one provided by U.S. NIST (*National Institute of Standards and Technology*) appears to include key common elements widely used in cloud computing community;

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. This cloud model promotes availability and is composed of five essential characteristics, threeservice models, and four deployment models(Mell & Grance, 2009).

The management of cloud computing is performed centrally. The central server defines the balance between system capabilities and user needs, control traffic, and avoid congestion in the network.

Every level is regarded IT as a service, i.e. Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Many technologies are integrated and extended in cloud computing platform, such as virtual machine, on-demand and pay-by-use model, distributed file system, parallel computing, grid computing, huge data storing and searching, distributed resources management, and so on.[6]. Google is one of the most famous cloud computing providers. Many people are using the Google's cloud services, such as Gmail, Docs, Maps and so on. As show in TABLE **1**, All these services are built on its powerful cloud computing platform.

Depending on the type of service models provided capability, there are four services where clouds are used:

IaaS (*Infrastructure as a service*); Infrastructure means a set of hardware components such as storage capacity, CPU cycles, memory capacity, network bandwidth and so on. These components are delivered as services over the internet by an amount of leading companies since they have superfluous hardware investment, such as BT, Telsrta, and T-System.

PaaS (*Platform as a Service*); Cloud systems can offer an additional abstraction level: instead of supplying a virtualized infrastructure, they can provide the software platform where systems run on. The sizing of the hardware resources demanded by the execution of the services is made in a transparent manner. Thisis denoted as Platform as a Service (PaaS). A well-known example is the Google Apps Engine. An examples of PaaS Amazon EC2, force.com.

SaaS(Software *as a Service*); Cloud consumers release their applications on a hosting environment, which can be accessed through networks from various clients (e.g. web browser, PDA, etc) by application users. Cloud consumers do not have control over the Cloud infrastructure that often employs a multi-tenancy system architecture, namely, different cloud consumers' applications are organized in a single logical environment on the SaaS cloud to achieve economies of scale and optimization in terms of speed, security, availability, disaster recovery, and maintenace. Examples of SaaS include SalesForce.com, Yahoo Mail, Google Docs.

StaaS (*Storage as a Service*); it facilitates cloud applications to scale beyond their limited servers. StaaS allows users to store their data at remote disks and access them anytime from any place.Cloud storage systems are expected to meet several rigorous requirements for maintaining users' data and information, including high availability, reliability, performance, replication and data consistency; but because of the conflicting nature of these requirements, no one system implements all of them together.

TABLE 1.

CLOUD COMPUTING SERVICE TYPES WITH EXAMPLES [8].

IT as a Service			
IaaS	**PaaS**	**SaaS**	**StaaS**
Infrastructure as a service	**Platform** as a service	**Software** As a service	**Storage** as a service
IT Services: ▪ **Servers** ▪ **Network** ▪ **Storage** ▪ **Management** ▪ **Reporting**	Application building blocks and standards	Applications	Storage Services: ▪ Primary ▪ Backup ▪ Erchive ▪ DR
Examples: BT Telstra T-Systems (ItaaS)	Examples: Amazon EC2 Force.com Navitaire	Examples: Yahoo!E-mail SalesForce.com Google apps	Examples: Amazon S3 Nirvanix

For years of development and enhancement, an amount of companies have been spawned, developed and matured in the field of Cloud service provisions. According to their provisions, services could be divided into four categories such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS) and Storage as a Service (StaaS). TABLE **1** shows several Cloud service in terms of their provided service categories and examples.

Cloud computing refers to those the applications delivered as services over the Internet and the hardware and system software in the data centres that provide the services. The data centres hardware and software is what called the cloud.

In Deployment models there are:

1. Private Cloud
2. Community Cloud
3. Public Cloud
4. Hybrid Cloud

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When a cloud is made available in a pay-as-you-go manner to the general public, it called a Public Cloud, public cloud applications, storage, and other resources are made available to the general public by a service provider; the term Private Cloud to refer to internal data centres of a business or other organization, not made available to the general public. Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party and hosted internally or externally [7]; Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc); Hybrid cloud is a composition of two or more clouds (private, community, or public).
Some target dimension of Cloud computing are briefly mentioned below.

III. TARGET DIMENSION OF CLOUD COMPUTING

In this section we are discuss a target dimensions of cloud computing, such as cost savings or increasing flexibility – were defined to group and structure the cloud characteristics as a **Error! Reference source not found.**.

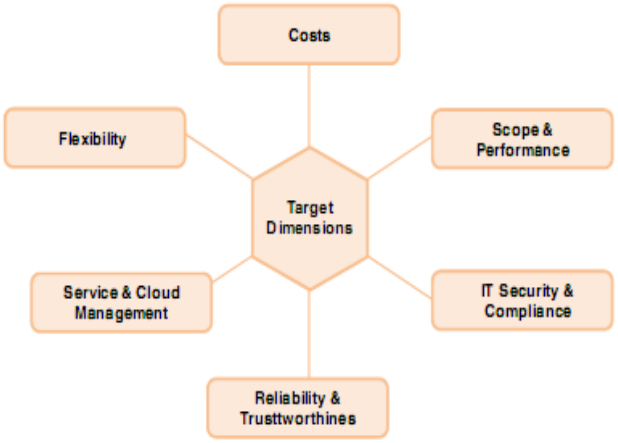

Fig.1.Target Dimensions in Cloud Computing [13]

Each target dimensions represents a general objective which the costumer pursues and which characteristics his Cloud or IT strategy. Four target dimensions (*costs, IT security & compliance, scope & performance, reliability &trustworthiness*) have been discussed in [13].

Flexibility; A related advantage of cloud computing, identified in science and industry, is the gain flexibility compared to traditional solutions [13].
The flexibility describes the ability to respond quickly to changing capacity requirements. Resources, for examples can be allocated and de-allocated as required, whereas requirements can sometimes vary greatly.

Costs; the decision to choose Cloud Computing and a particular provider is often guided by monetary considerations [7] and linked with the slogan "pay-as-you-use". Customers who decide to use Cloud services benefit mostly by small capital commitment, low acquisition costs for required servers, licenses or necessary hardware space and the reduced complexity of IT operations. Despite similar services on the IaSS level the pricing and billing models often differentiate between each provider.

Scope and Performance; to select the Cloud provider which meets the requirements best, knowledge about their service and performance is of crucial importance[7]. Here it is essential to consider features regarding performance (latency, or transaction speed), capacity limits (e.g. maximum number of accounts or storage space), service complexity (how many functions are available) and degree of customization (how far the service can be adapted).

IT security and compliance; the decision on selecting a provider in the Cloud is very often influenced by company requirements in the areas of security, compliance and privacy [15]. Companies have to be sure that their data and applications, even operated in the Cloud, meet both required compliance guidelines and are adequately protected against unauthorized access.

Reliability and Trustworthiness, this target dimension describes how certain the customer can be that the service from the Cloud has the guaranteed availability [16]. It is important to know what commitment the provider makes, mostly as Service Level Agreements (SLAs). Moreover, the reliability with which these commitments are kept is of great importance. In contrast to the commitment the trustworthiness describes the provider's infrastructural features, which may be evidence of a high reliability. These include disaster recovery, redundant sites or certifications.

Service and Cloud Management; the service and cloud management includes features of the provider that are substantial for appropriate Cloud service operations. These includes the offered support and functions for controlling and monitoring as well as the individualization of the web interface[17]. The manageability (usability) of services, especially in a distributed IT architecture, and the Cloud governance, dealing with requirements and responsibilities by the customer are essential features of this target dimension.

IV. ADVANTAGES OF CLOUD COMPUTING

Here are the benefits of using cloud storage and of applications that take advantage of storage in the cloud [1][8].
Ease of management: The maintenance of the software, hardware and general infrastructure to support storage is drastically simplified by an application in the cloud. Applications that take advantage of storage in the cloud are often far easier to set up and maintain than deploying an equivalent service on premise. At the customer site, often all that is needed to manage your storage implementation is a simple web browser leaving the headaches to the service provider.
Cost effectiveness: For total cost of ownership, cloud storage is a clear winner. Elimination of the costly systems and the people required to maintain them typically provides organizations with significant cost savings that more than offset the fees for cloud storage. The costs of being able to provide high levels of availability and the scalability an

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organization needs are also unmatched. The economies of scale achieved by data centers simply can't be matched by all but the very largest of organizations. It needs no buying expensive hardware but to lease equipments for cloud computing.

Lower impact outages and upgrade: Typically cloud computing provides cost effective redundancies in storage hardware. This translates into uninterrupted service during a planned or unplanned outage. This is also true for hardware upgrades which for the end user will no longer be visible.

Disaster preparedness: Offsite storage isn't new. Keeping important data backed up off site has been the foundation of disaster recovery since the inception of the tape drive. Cloud storage services not only keep your data off premise, but they also make their living at ensuring that they have redundancy and systems in place for disaster recovery.

Security: Cloud computing provides the most reliable and secure data storage centre. Users do not have to worry about data loss, virus attack and other problems. The "Cloud" manages information by a professional team. Besides, strict rights management strategy can helpto share data.

Super Computing Power: Thousands of computers form a super server in cloud services, which provided users with powerful computing and data processing capacity. That's hard realizing for a personal computer.

V. DISADVANTAGES

Except the advantages there are disadvantages regarding the cloud computing, such as:

Possible downtime. Cloud computing makes the small business dependent on the reliability of Internet connection. When it's offline, the connection also offline.And even the most reliable cloud computing service providers suffer server outages now and again.

Security issues. How safe the data? Cloud computing means Internet computing. So we should not be using cloud computing applications that involve using or storing data that you are not comfortable having on the Internet. That being said, established, reliable cloud computing vendors will have the latest, most sophisticated data security systems possible as they want our business and realize that data security is a big concern.

Cost. At first glance, a cloud computing application may appear to be a lot cheaper than a particular software solution installed and run in-house, but we need to be sure to comparing apples and apples. Does the cloud application have all the features that the software does and if not, are the missing features important?

Inflexibility. Be careful when we're choosing a cloud computing vendor that we're not locking our business into using their proprietary applications or formats. we can't insert a document created in another application into aGoogle Doc spreadsheet, for instance. Also make sure that we can add and subtract cloud computing users as necessary as our business grows or contracts.

VI. QUESTIONS THE CLOUDS OF FUTURE

The developers of clouds computing system would be wise to design their next generation of systems to be deployed into Cloud Computing. In general, the emphasis should be horizontal scalability to hundreds or thousands of virtual machines over the efficiency of the system on a single virtual machine. There are specific implications as well:

- **Applications Software** of the future will likely have a piece that runs on clients and a piece that runs in theCloud. The cloud piece needs to both scale down rapidly as well as scale up, which is a new requirement for software systems. The client piece needs to be useful when disconnected from the Cloud, which is not the case for many Web 2.0 applications today. Such software also needs a pay-for-use licensing model to match needs of Cloud Computing.
- **Infrastructure Software** of the future needs to be cognizant that it is no longer running on bare metal but on virtual machines. Moreover, it needs to have billing built in from the beginning, as it is very difficult to retrofit an accounting system.
- **Hardware Systems** of the future need to be designed at the scale of a container (at least a dozen racks) rather than at the scale of a single 1U box or single rack, as that is the minimum level at which it will be purchased. Cost of operation will match performance and cost of purchase in importance in the acquisition decision. Hence, they need to strive for energy proportionality [9] by making it possible to put into low power mode the idle portions of the memory, storage, and networking, which already happens inside a microprocessor today. Hardware should also be designed assuming that the lowest level software will be virtual machines rather than a single native operating system, and it will need to facilitate flash as a new level of the memory hierarchy between DRAM and disk. Finally, we need improvements in bandwidth and costs for both datacenter switches and WAN routers.

While we are optimistic about the future of Cloud Computing, we look to see will grow and what it will look like in five years:

1. **Applications Software** needs to both scale down rapidly as well as scale up, which is a new requirement. Such software also needs a pay-for-use licensing model to match needs of Cloud Computing.
2. **Infrastructure Software** needs to be aware that it is no longer running on bare metal but on VMs. Moreover, it needs to have billing built in from the beginning.
3. **Hardware Systems** should be designed at the scale of a container (at least a dozen racks), which will be is the minimum purchase size. Cost of operation will match performance and cost of purchase in importance, rewarding energy proportionality such as by putting idle portions of the memory, disk, and

network into low power mode. Processors should work well with VMs, flash memory should be added to the memory hierarchy, and LAN switches and WAN routers must improve in bandwidth and cost.

VII. CONCLUSION AND FUTURE WORK

Cloud computing is a new technology widely studied and researched in recent years. Now there are many cloud platforms both in industry and in academic circle. How to understand and use these platforms is a big issue. Focused on the aspects such as the architectures, characteristics, application, deployment model and so on. A detailed study of the basic concepts of cloud computing technology, core technology, several different types of clouds services, target dimension and challenges of cloud computing has been presented in this paper.

In the future as cloud computing develops, it is cheap and convenient for more information processing of academic , industry and individuals to move to the cloud. Cloud infrastructure provides educational institutions, educators and students with various information services, while the next step in further research we will implement the application of cloud computing in academic environment.

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