Challenges and Prosperity Research in Cloud Computing

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Abstract *— Cloud computing promotes a merge of services (i.eIaaS, PaaS, SaaS, DaaS, EaaS) to achieve rapid elasticity and data portability. It offers a cost-effective mechanism for resource utilization by avoiding capital expenditure on premises infrastructure resources and gives an efficient collaborative solution. Nevertheless, numerous users are showing major concerns for cloud computing that are being inspected through different surveys and projects; current research unveils that a lot of such problems are partially solved or some are still not decoded and require further exploration and analyses. This paper critically examines the cloud computing deployment and elaborates the issues relates to the efficient deployment of cloud computing. This paper is useful for academicians and researchers as it proposes a new research direction include computing with discussion over some new motivations and hurdles.*

Keywords*—cloud computing; architecture design; cloud services; deployment models;*

I. INTRODUCTION

Cloud computing is an on demand, resource pooling, self-service, multilevel virtualization that is independent and is ubiquitous network access which visualize the next generation computing. It is actually inspired by the grid, parallel and distributed computing over the internet deploying highly optimized data setters to provide the resources like hardware, software, data, and platform as required by any application. The concept evolved in 1950 by IBM known as RJE (Remote Job Entry process). In recent years, the popularity and swift growth in storage and processing technologies and computing resources have become cheaper. The successes of the internet have turned more powerful, efficient, thus are pervasively available than ever before. In 2006 Amazon implemented its first cloud AWS (Amazon Web Service) [1]. It offers a new style of application program that can work as a platform which supports dynamically organized services simultaneously. To understand the concepts of the cloud computing technology a performance based efficient approach will be required for new paradigms to systematize the usually shared information and to deploy & develop the affiliated changes in different user-oriented platform models [2].

II. CLOUD PLATFORMS

All This section describes how the services are accessed from the resources pooling and for providing different services to the users over different platforms. There are four platforms which are being designed to meet the needs and expectations of cloud computing technology [8] [11].

A. Public cloud

Computing infrastructure is hosted by acloud vendor on vendor premises and can be shared by various organizations. E.g. Amazon, Google, Salesforce.com,Microsoft etc.

B. Private cloud

The computing infrastructure of private cloud is not shared with other organizations, but rather is dedicated to a particular organization. It is more expensive but reliable in comparison to the public cloud. E.g.: HP data centers, IBM sun, Oracle, 3tera etc.

C. Hybrid cloud

When public & private cloud workstogether it is called hybrid cloud "Organizations may host critical applications on private clouds, whereas relatively less secure concern on public cloud".

D. Community cloud

The cloud is shared by two or more private, public or community cloud. E.g.: Group of schools comes under specific university [8].

III. FORMATION OF CLOUD COMPUTING

This part of the paper describes the organization of the technology. In simple terms "the cloud" can be predicted as a metaphor for the internet that is quite familiar cliché, but when it is integrated to the term "computing" its meaning gets bigger & hazy. Cloud computing offers the opportunity to organizations that could simply connect to the cloud and use the available resources on a PAY PER USE basis, which avoids the company's capital expenditure on additional of premises infrastructure resources and instantly scale up and scale down according to business requirements[3]. Cloud computing consists of cloud client, services, applications, platform, storage & infrastructure measured services. Cloud computing is the highly

automated utility based paradigm shift consists of optimized and efficient framework that includes servers, virtual desktops allocates services for computer network over the internet prescribing software platform and applications for easy and agile deployment of secure data management [5].

The technology provides broad network access using resource pooling, on demand self-service with rapid elasticity, resulting in continuous high availability, interoperability and standardized scalability for the hardware and software components providing data secrecy and ease for capital investment[2] [6].

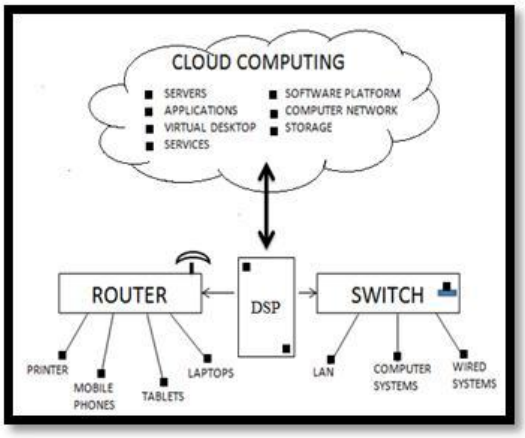

Fig.-1:Cloud Formation

IV. DEPLOYMENT MODELS & EVALUATION

Cloud computing is the type of internet-based computing, where different services such as servers, data storage modules are delivered to any organization computers and devices through the internet. The internet cloud can communicate through various devices like PC, mini note, notebook, remote desktop, remote server, database, mobile phones etc. contains three different service layers that are software, platforms and infrastructure can be defined as [1][2][8].

A. Software as a service (SaaS)

It refers to an application that can be accessed from anywhere over the world as long as you have an internet connection. They have certain features like SSL encryption, a cryptographic protocol. Ex: G-mail, yahoo-mail, Google apps, MS office 365.

B. Platform as a service (PaaS)

This service layer delivers a computing platform typically includes an operating system, programming language, etc. It is a platform for developers to write and create their own applications. For ex: AWS elastic beanstalk Google app engine, salesforce.com, windows azure, etc.

C. Infrastructure as a service (IaaS)

It provides hardware and infrastructure to the users to rent and tariff for a limited period of time. It is also known as "Hardware as a Service". Ex: firewalls Google computes engine, Amazon HP cloud, EC2 etc. The three layers are the basic service layers that were discovered in the early sixties and on analyzing modern research and study projects, some new service layers have been discovered that are listed out as [14].

D. Data as a service (DaaS)

A large amount of data over the internet is stored in an unmanaged way which requires to be maintained by applying sorting algorithms and defining data allocation methods. Thus the model work over the bulk amount of data retrieval initiates the availability, security and data management leads to concurrency & efficiency in data storage maintenance. It benefits in gaining the agility, cost-effectiveness and data quality. Ex: VMware, Citrix etc.

E. Education as a service (EaaS)

This service layer includes the e-learning and smart classes' concepts that are demonstrated as an education-oriented services. The model establishes distant learning programs that help users accessing the knowledge and services independent of their location. E.g. Educomp, Indiamart, and Microsoft smart class library etc. To meet the requirements and to efficiently use such services there are many service providers that can be listed out in the following way. See Fig.2.

TYPE OF SERVICE	SUB-SERVICES	SERVICE PROVIDERS
1) Cloud storage:	Database	• Google Big Table, • Amazon simple DB
	Network attached storage	• Nirvanix Cloud NAS, • Mobile MeiDisk
1) Cloud infrastructure:	Grid computing	• Sun grid
	Full virtualization	• Skytap, • Go Grid
	Compute	• Amazon Elastic compute cloud
2) Cloud applications:	Peer-to-peer	• BitTorrent, • SETI, • Lain-Lain
	Web applications	• Facebook
	SaaS	• Google Apps, Salesforce.com, • Lain-Lain
3) Cloud platform:	Web application framework	• Rubyan Rails • Phyton Django, • .net
	Web Hosting	• atlantic.net
	Proprietary	• Force.com

Fig. 2: Examples of Different Service Providers

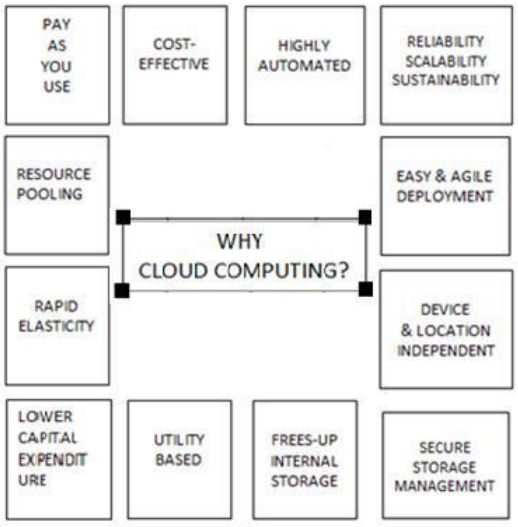

Fig.3. Features of Cloud Computing

V. EMERGING FEATURES

The section explains the analysis of features of cloud computing dividing into different zones. The features can be listed out as [2][3][7][9].

A. Performance

This concern to the how efficiently the technology would work to fulfill the user's expectations. It helps in achieving: High execution ability, increased data reliability, improved hardware & software performance, Flexibility and portability, efficient solution and software evaluation

B. Data Storage

Storing the data over the internet is a big point of concern that we are supposed to work over by allocating different hardware & software services to allocate maximum storage space. Thus, in that reference cloud computing expects: Unlimited storage capacity, Reliability, scalability & sustainability; Rapid elasticity.

C. *Security*

When a large amount of data is to be stored and a user shares its confidential & somewhat personal details then it requires a highly secured system.Thus the technology to maintain the security level provides the following facilities: Data secrecy, Continuous support, highly automated, secure storage management

D. *Deployment*

To deploy the systems and services over the internet some extraordinary characteristics are required that are: Free from maintenance, Instant software updates, Easy and agile deployment, on demand self-service.

E. Privacy Access

To define the access capabilities to distinct users some privacy measures are supposed to follow that allows the authentication to each user at different levels to achieve: Device & location independence, Broad network access, Interoperability and standardization

F. *Cost*

Cloud computing gives the opportunity to work over the internet as PAY AS YOU GO basis that acquires: Reduced software cost, Lower computing cost, Ease of capital investment, Pay as you use, Lower capital expenditure. See fig 4. It shows the features of cloud computing.

VI. ISSUES OVER CLOUD COMPUTING MODELS

Cloud computing has many upgrading fields and areas of deployment, but yet there are some major issues are associated which cannot be ignored. These major issues are [6][12][14].

A. *Reliability*

Maximizing the inherent consistency is measured by reliability which can be achieved in cloud computing, but there are some downfall areas where the reliability restricts to work efficiently;

B. Open Standard

In the growth of cloud computing technology, cloud providers play a big role by providing well-documented APIs. Being platform oriented application services require different APIs for some unique applications that regulates the growth of the computing models;

C. Data Integrity

Over the internet cloud computing has the ability to integrate a variety of data into one unit and allow users to work over according to their requirement, but as data is of different kinds it heightens the storage and maintenance issues;

D. Long Term Viability

The data we upload over the internet must not ever lose its validity no matter even if the cloud provider gets crashed or merged to some larger company;

E. *Trust*

Trust isthe unit that initiates the bond between cloud, service provider and the user to ensure that the data we upload will be secured and its privacy cannot be accessed without signed authorization;

F. *Compliance*

To upload data over the internet and for its storage some regulations and semantics are defined that each user must adopt. This agreement conveys a message to deliver the vigorous management and execution of compliance policies;

G. Data Portability

The technology is so advanced that it has the potential to transport data among different application programs computing environments or cloud services. In multi-cloud environment the data portability plays a big role in data transformation;

H. *Freedom*

Cloud computing provides the users freedom to store, access and build the data, tools, applications respectively on rent with affordable prices over the internet;

I. *Privacy*

Users store their personal data on the open platforms of the cloud, thus in concern to the data secrecy cloud computing authorizes the data accessibility and divides the privacy into different levels on the basis of 4 types of cloud and their type of services;

J. *Security*

The Cloud has a bulk amount of data that need to be secured from the unauthorized or prohibited users and is necessary to apply security measures to stop being getting hacked or infected;

K. Legal Issues

Regardless of the regulations or compliances defined by the service providers for the data storage over cloud some legislative level lawful situations also demand our attention.

VII. APPLICATION AREAS

The section demonstrates the distinct areas where cloud computing can be used to enhance the work over different fields that can be whether the green cloud computing system to achieve the energy consumption efficiencies in the data centers or any e-learning cloud system to explore the expert educational system. In network collaboration cloud computing has a major scope to enable the communication between distinct and enlarge networks that to be known as internetworking. To setup the telecom public clouds we need a cloud computing platform & services to setup efficiently reliable systems. For managing the metadata in the cloud the services are required for a better maintenance system model [6] [9]. There are many other applications as we can implement GIS using the cloud computing and there is an opportunity to work over the smart device system processing to maintain the system where different devices can communicate with each other without any human or expert interference. There are many examples of systems that uses cloud computing technology like WebSphere, IIS, database servers, cloud Middleware (like Carbon 3.0, WSO2, sky computing, SaaSGrid, Altocumulus etc.) These are mature systems nevertheless they have some areas that need to be improvised by developing new features, applications and supporting services [4] [15] [17] .

VIII. FUTURE SCOPE & OPEN RESEARCH CHALLENGES

A. Challenges

Every coin has two sides so thus every field of technology that has one face that leads to prosperity and another one rises to challenges. Cloud computing also promotes some challenges that are as follows [5] [7] [15].

Data recovery: the cloud stores data in a distributed manner that the segmentation complicates the back-up management over several platforms;

Service interoperability: cloud computing lacks in gaining the communication between services of different service platforms that emerges as a big challenge in the transpiring technology;

Data location restrictions: each user accesses different locations in the cloud to pursue work over the recommended applications, whether it is about to access infrastructure or to store data over the cloud it requires different location needs to adapt and use according to the restrictions or regulations defined;

Data access and storage model: the big vendors adapt different usage scenarios for data storage models due to diversity in users' need. Thus the flexibility provided by the vendors leads to encryption and DLP capabilities that are complicated to achieve;

Data security and privacy protection: securing the data in the cloud is the point of major concern where no loopholes are expected as cloud stores the huge amount of personal and confidential data. The increase in data over the cloud demands more powerful security measures and tools to provide access authorization to the users;

Lack of standards and vendor: most of the vendors have defined their own standards for the cloud architectures, but as the complexity increasing day by day thus now new budding service providers lacks in potential & giving quality work.

B. Open Research Challenges

Cloud computing has many challenges that further opens a mighty research area for the researchers and developers to work over the vast field. Some research areas can be demonstrated as [1] [2] [16].

Handling uncertainties: the heterogeneity in the resource accessing and application availability decreases the capability of handling such resources thus leads to uncertainty. Thus, to deal with this challenge cloud provider must be concerned with the link delays between the cloud servers and the clients;

Virtual network topology optimization: virtualization plays a big role in cloud computing technology where during the installation setup the virtual machines interact through virtual network

topologies. If VMs will use diversified and dispensed ways to communicate the switches will consume more power thus to reduce the overhead & minimize the power the utilization models are to be developed;

Public auditing: the data integrations and storage may lead to resource failure or human errors, thus a public verifier or a third party imparts the expert verifying services.

Forthe integrated data correctness managing dynamic imbalances in workload: hybrid architectures have the capability to handle crest in workload so thus it is expected from the datacenters to work with the best of its capability to handle workload. To manage the workload different methodologies are used as one is to work over the probability measures and another one is to utilize the model seasonally when the variation or imbalance is seen in workloads over time;

Virtual machines consolidation efficiency for the heterogeneous workload management: to manage the heterogeneity in workloads it is advised to stabilize and regulate the use of virtual machines helps gaining the efficiency.

C. *Future Scope*

The cloud computing has become a prominent field which gives rise to many research challenges that opens the scope for new researchers to work as efficiently as they can and also improves their capabilities showing their interests in the sub-fields of this technology [2][3][13][14].

Proactive application monitoring: the complexity of the cloud working environment is increasing that paramount the large amount of data storage and diversified applications in the first place, thus there is a need to monitor the applications to check the performance by developing some situations and regulations;

Cloud computing is becoming more robust: cloud computing is a growing field that attracts researchers to take an interest in this field. This is making this technology full-flavored and strong enough to sustain a longer life. ;

The ability to approve identities through trusts: the ingrowing interest of users to store and access data requires the authorization for the trust maintenance between users and the service providers. Thus, this property, initiates to work over the security measures for building the cloud more secure, efficient and robust[13][14].;

Metadata management: for the preservation of bulk amount of data for structuring in an efficient way, metadata (description of other data stored) management is required that can be maintained by lookup tables and database query. Thus, there is a big opportunity for the researchers to develop many new measures to improve the maintenance of data services and storage over the cloud.

IX. CONCLUSION

This paper discussed the on growing research issues that undertake the advanced scientific attributes of cloud computing with layer-wise platform description of service classification. To achieve cloud computing several measures are to be considered whether it is platform or the service-oriented followed by the service providers. It highlighted the succeeding recommendations in each community that describes prosperity and opens research challenges for new researchers & academicians. Concentrating on operational security and application level the research reveals classification of scientific issues and the environment where such situations can be handled. In building on the research undertaken this paper contributes to enlisting issues involved in a cloud deployment covering essential stereotype of the formation of the cloud accessing the platform identification. Furthermore, after analyzing the existing work, this paper presents the various open research problems in cloud computing with the associated issues and challenges. These enlisting issues and challenges involved in a cloud deployment may be concerned with the cost, efficiency or many such other factors.

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