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One Day National Conference
On

DEMOGRAPHIC DEVIDEND: CHALLENGES AND OPPORTUNITIES FOR INDIA

Organized By

The Department of Economics

Saturday, 17th December 2016

One Day National Conference on

"Demographic Dividend: Challenges and Opportunities for India"

17th December, 2016

Chief Editor

Prin. Dr. Ajay M. Bhamare

RADAV COLLEGE, BHANDUP (EAST), MUMBAI

शरयू प्रकाशन

Sharayu Prakashan

B-7/501, Vijay Park, Kasarvadavali, Ghodbunder Road,
Thane (West) 400615.
Emai-ashtikarcd@gmail.com, Mob. 9967357415

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Cloud Computing-Issues and Challenges

Dr. Neelam Yadav
Assistant Professor
L.S.Raheja College of Arts and Commerce
Juhu Road, Santacruz (W)
09987100483
EMAIL ID: neelam.yd83@gmail.com

ABSTRACT:

Cloud computing is the latest effort 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". It is the development of parallel computing, distributed computing, grid computing and virtualization technologies which define the shape of a new era. In this paper, we aim to focus the challenges and issues of cloud computing. We identified several challenges from the cloud computing adoption perspective and we also highlighted the cloud interoperability issue that deserves substantial further research and development. In this paper, we investigate several cloud computing system providers about their concerns on security and privacy issues.

KEYWORDS: Cloud Architecture, Cloud Computing, Security Issues, Cloud Security, Data Protection.

INTRODUCTION: Cloud computing is a complete new technology. It is the development of parallel computing, distributed computing grid computing, and is the combination and evolution of Virtualization, Utility computing, Software-as-a-Service (SaaS), Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS). Cloud computing is an architecture for providing computing service via the internet on demand and pay per use access to a pool of shared resources namely networks, storage, servers, services and applications, without physically acquiring them. So it saves managing cost and time for organizations. Many industries, such as banking, healthcare and education are moving towards the cloud due to the efficiency of services provided by the pay-per-use pattern based on the resources such as processing power used, transactions carried out, bandwidth consumed, data transferred, or storage space occupied etc. Cloud computing is a completely internet dependent technology where client data is stored and maintain in the data center of a cloud provider like Google, Amazon, Salesforce.som and Microsoft etc.Cloud computing is a set of IT services that are provided to a customer over a network on a leased basis and with the ability to scale up or down their service requirements. Usually Cloud Computing services are delivered by a third party provider who owns the infrastructure.Cloud Computing holds the potential to eliminate the requirements for setting up of high-cost computing infrastructure for IT-based solutions and services that the industry uses. It promises to provide a flexible IT architecture, accessible through internet from lightweight portable devices.This would allow multi-fold increase in the capacity and capabilities of the existing and new software.This new economic model for computing has found fertile ground and is attracting massive global investment.

In a cloud computing environment, the entire data resides over a set of networked resources, enabling the data to be accessed through virtual machines. Despite the potential gains achieved from the cloud computing, the organizations are slow in accepting it due to security issues and challenges associated with it. Limited control over the data may incur various security issues and threats which include data leakage, insecure interface, sharing of resources, data availability and inside attacks. There are various research challenges also there for adopting cloud computing such as well managed service level agreement (SLA), privacy, interoperability and reliability.

This research paper presents what cloud computing is, the various cloud models and the overview of the cloud computing architecture. This research paper also analyzes the key research challenges present in cloud computing and offers best practices to service providers as well as enterprises hoping to leverage cloud service to improve their bottom line in this severe economic climate.

CLOUD COMPUTING BUILDING BLOCKS

A. DEPLOYMENT MODELS: In the cloud deployment model, networking, platform, storage, and software infrastructure are provided as services that scale up or down depending on the demand. The Cloud Computing model has four main deployment models which are:

1. **Private Cloud:** Private cloud is a new term that some vendors have recently used to describe offerings that emulate cloud computing on private networks. It is set up within an organization's internal enterprise datacenter. In the private cloud, scalable resources and virtual applications provided by the cloud vendor are pooled together and available for cloud users to share and use. It differs from the public cloud in that all the cloud resources and applications are managed by the organization itself, similar to Intranet functionality. Utilization on the private cloud can be much more secure than that of the public cloud because of its specified internal exposure. Only the organization and designated stakeholders may have access to operate on a specific Private cloud. One of the best examples of a private cloud is Eucalyptus Systems.
2. **Public Cloud:** Public cloud describes cloud computing in the traditional mainstream sense, whereby resources are dynamically provisioned on a fine-grained, self-service basis over the Internet, via web applications/web services, from an off-site third-party provider who shares resources and bills on a fine-grained utility computing basis. It is typically based on a pay-per-use model, similar to a prepaid electricity metering system which is flexible enough to cater for spikes in demand for cloud optimization . Public clouds are less secure than the other cloud models because it places an additional burden of ensuring all applications and data accessed on the public cloud are not subjected to malicious attacks. Examples of a public cloud include Microsoft Azure, Google App Engine. Hybrid Cloud: Hybrid cloud is a private cloud linked to one or more external cloud services, centrally managed, provisioned as a single unit, and circumscribed by a secure network . It provides virtual IT solutions through a mix of both public and private clouds.
3. **Hybrid Cloud:** provides more secure control of the data and applications and allows various parties to access information over the Internet. It also has an open architecture that allows interfaces with other management systems. Hybrid cloud can describe configuration combining a local device, such as a Plug computer with cloud services. It can also describe configurations combining virtual and physical, collocated assets -for example, a mostly

virtualized environment that requires physical servers, routers, or other hardware such as a network appliance acting as a firewall or spam filter. An example of a Hybrid Cloud includes Amazon Web Services (AWS).

4. **Community Cloud:** Infrastructure shared by several organizations for a shared cause and may be managed by them or a third party service provider and rarely offered cloud model. These clouds are normally based on an agreement between related business organizations such as banking or educational organizations. A cloud environment operating according to this model may exist locally or remotely. An example of a Community Cloud includes Facebook.

B. SERVICE MODELS According to the different types of services offered, cloud computing can be considered to consist of four layers: software as a service (SAAS), platform as a Service (PAAS), and infrastructure as a Service (IAAS)and data as a service (Daas).

1. **Software-as-a-Service (SaaS):**SaaS can be described as a process by which Application Service Provider (ASP) provide different software applications over the Internet. This makes the customer to get rid of installing and operating the application on own computer and also eliminates the tremendous load of software maintenance; continuing operation, safeguarding and support . SaaS vendor advertently takes responsibility for deploying and managing the IT infrastructure (servers, operating system software, databases, data center space, network access, power and cooling, etc) and processes (infrastructure patches/upgrades, application patches/upgrades, backups, etc.) required to run and manage the full solution. SaaS features a complete application offered as a service on demand. In SaaS, there is the Divided Cloud and Convergence coherence mechanism whereby every data item has either the ―Read Lock‖ or ―Write Lock‖. Two types of servers are used by SaaS: **the Main Consistence Server (MCS) and Domain Consistence Server (DCS).** Cache coherence is achieved by the cooperation between MCS and DCS. In SaaS, if the MCS is damaged, or compromised, the control over the cloud environment is lost. Hence securing the MCS is of great importance.Examples of SaaS includes: Salesforce.com, Google Apps.
2. **Platform as a Service (PaaS):** PaaS is the delivery of a computing platform and solution stack as a service without software downloads or installation for developers, IT managers or end-users. It provides an infrastructure with a high level of integration in order to implement and test cloud applications. The user does not manage the infrastructure (including network, servers, operating systems and storage), but he controls deployed applications and, possibly, their configurations. Examples of PaaS includes: Force.com, Google App Engine and Microsoft Azure.
3. **Infrastructure as a Service (IaaS):** Infrastructure as a service (IaaS) refers to the sharing of hardware resources for executing services using Virtualization technology. Its main objective is to make resources such as servers, network and storage more readily accessible by applications and operating systems. Thus, it offers basic infrastructure on-demand services and using Application Programming Interface (API) for interactions with hosts, switches, and routers, and the capability of adding new equipment in a simple and transparent manner. In general, the user does not manage the underlying hardware in the cloud infrastructure, but he controls the operating systems, storage and deployed applications. The service provider owns the equipment and is responsible for housing, running and maintaining it. The client typically pays on a per-use basis. Examples of IaaS include Amazon Elastic Cloud Computing (EC2), Amazon S3, GoGrid.

4. **Data as a Service (DaaS):** The delivery of virtualized storage on demand becomes a separate Cloud service - data storage service. Notice that DaaS could be seen as a special type IaaS. The motivation is that on-premise enterprise database systems are often tied in a prohibitive upfront cost in dedicated server, software license, post-delivery services and in-house IT maintenance. DaaS allows consumers to pay for what they are actually using rather than the site license for the entire database. In addition to traditional storage interfaces such as RDBMS and file systems, some DaaS offerings provide table-style abstractions that are designed to scale out to store and retrieve a huge amount of data within a very compressed timeframe, often too large, too expensive or too slow for most commercial RDBMS to cope with. Examples of this kind of DaaS include Amazon S3, Google BigTable, and Apache HBase, etc.

COMPARISION BETWEEN CLOUD AND GRID COMPUTING A comparison can be summaries as follows:

1) Construction of the grid is to complete a specified task, such as biology grid, Geography grid, national educational grid, while Cloud computing is designed to meet general application and there are not grid for a special field.

2) Grid emphasizes the "resource sharing" to form a virtual organization. Cloud is often owned by a single physical organization (except the community Cloud, in this case, it is owned by the community), who allocates resources to different running instances.

3) Grid aims to provide the maximum computing capacity for a huge task through resource sharing. Cloud aims to suffice as many small-to-medium tasks as possible based on users' real-time requirements. Therefore, multi-tenancy is a very important concept for Cloud computing.

4) Grid trades re-usability for (scientific) high performance computing. Cloud computing is directly pulled by immediate user needs driven by various business requirements.

5) Grid strives to achieve maximum computing. Cloud is after on-demand computing – Scale up and down, in and out at the same time optimizing the overall computing capacity.

RESEARCH CHALLENGES IN CLOUD COMPUTING Cloud Computing research addresses the challenges of meeting the requirements of next generation private, public and hybrid cloud computing architectures, also the challenges of allowing applications and development platforms to take advantage of the benefits of cloud computing. The research on cloud computing is still at an early stage. Many existing issues have not been fully addressed, while new challenges keep emerging from industry applications. Some of the challenging research issues in cloud computing are given below.

- Service Level Agreements (SLA's)
- Cloud Data Management & Security
- Data Encryption
- Migration of virtual Machines
- Interoperability
- Access Controls
- Energy Management
- Multi-tenancy

- Server Consolidation
- Reliability & Availability of Service
- Common Cloud Standards
- Platform Management

1. **Service Level Agreements (SLA's):** Cloud is administrated by service level agreements that allow several instances of one application to be replicated on multiple servers if need arises; dependent on a priority scheme, the cloud may minimize or shut down a lower level application. A big challenge for the Cloud customers is to evaluate SLAs of Cloud vendors. Most vendors create SLAs to make a defensive shield against legal action, while offering minimal assurances to customers. So, there are some important issues, e.g., data protection, outages, and price structures that need to be taken into account by the customers before signing a contract with a provider . The specification of SLAs will better reflect the customers' needs if they address the required issues at the right time. Some of the basic questions related to SLA are uptime i.e. are they going to be up 99.9% of the time or 99.99% of the time? And also how does that difference impact your ability to conduct the business? Is there any SLA associated with backup, archive, or preservation of data? If the service account becomes inactive then do they keep user data? If yes then how long?, So it's an important research area in cloud computing.

2. **Cloud Data Management:** Cloud data can be very large (e.g. text-based or scientific applications), unstructured or semi-structured, and typically append-only with rare updates Cloud data management an important research topic in cloud computing. Since service providers typically do not have access to the physical security system of data centers, they must rely on the infrastructure provider to achieve full data security. Even for a virtual private cloud, the service provider can only specify the security setting remotely, without knowing whether it is fully implemented. The infrastructure provider, in this context, must achieve the objectives like confidentiality, auditability. Confidentiality, for secure data access and transfer, and auditability, for attesting whether security setting of applications has been tampered or not. Confidentiality is usually achieved using cryptographic protocols, whereas auditability can be achieved using remote attestation techniques. However, in a virtualized environment like the clouds, VMs can dynamically migrate from one location to another; hence directly using remote attestation is not sufficient. In this case, it is critical to build trust mechanisms at every architectural layer of the cloud. Software frameworks such as MapReduce and its various implementations such as Hadoop are designed for distributed processing of data-intensive tasks; these frameworks typically operate on Internet-scale file systems such as GFS and HDFS. These file systems are different from traditional distributed file systems in their storage structure, access pattern and application programming interface. In particular, they do not implement the standard POSIX interface, and therefore introduce compatibility issues with legacy file systems and applications. Several research efforts have studied this problem

3. **Data Encryption:** Encryption is a key technology for data security. Understand data in motion and data at rest encryption. Remember, security can range from simple (easy to manage, low cost and quite frankly, not very secure) all the way to highly secure (very complex, expensive to manage, and quite limiting in terms of access). You and the provider of your Cloud computing solution have many decisions and options to consider. For example, do the Web services APIs that you use to access the cloud, either programmatically, or with clients written to those APIs, provide SSL encryption for access, this is generally considered to be a standard. Once the object arrives at the cloud, it is decrypted, and stored. Is there an option to encrypt it prior to storing? Do you want to worry about encryption before you upload the file for cloud computing or do you prefer that the cloud

computing service automatically do it for you? These are options, understand your cloud computing solution and make your decisions based on desired levels of security.

4. **Migration of Virtual Machines:** Applications are not hardware specific; various programs may run on one machine using virtualization or many machines may run one program. Virtualization can provide significant benefits in cloud computing by enabling virtual machine migration to balance load across the data center. In addition, virtual machine migration enables robust and highly responsive provisioning in data centers. Virtual machine migration has evolved from process migration techniques. More recently, Xen and VMWare have implemented —live|| migration of VMs that involves extremely short downtimes ranging from tens of milliseconds to a second. The major benefit of VM migration is to avoid hotspots; however, this is not straightforward. Currently, detecting workload hotspots and initiating a migration lacks the agility to respond to sudden workload changes. Moreover, the in memory state should be transferred consistently and efficiently, with integrated consideration of resources for applications and physical servers

5. **Interoperability:** This is the ability of two or more systems work together in order to exchange information and use that exchanged information. Many public cloud networks are configured as closed systems and are not designed to interact with each other. The lack of integration between these networks makes it difficult for organizations to combine their IT systems in the cloud and realize productivity gains and cost savings. To overcome this challenge, industry standards must be developed to help cloud service providers design interoperable platforms and enable data portability. Organizations need to automatically provision services, manage VM instances, and work with both cloud-based and enterprise-based applications using a single tool set that can function across existing programs and multiple cloud providers. In this case, there is a need to have cloud interoperability. Efforts are under way to solve this problem. For example, the Open Grid Forum, an industry group, is working on the Open Cloud Computing Interface, which would provide an API for managing different cloud platforms. Until now it has remained a challenging task in cloud computing.

6. **Access Controls**: Authentication and identity management is more important than ever. And, it is not really all that different. What level of enforcement of password strength and change frequency does the service provider invoke? What is the recovery methodology for password and account name? How are passwords delivered to users upon a change? What about logs and the ability to audit access? This is not all that different from how you secure your internal systems and data, and it works the same way, if you use strong passwords, changed frequently, with typical IT security processes, you will protect that element of access.

7. **Energy Resource Management:** Significant saving in the energy of a cloud data center without sacrificing SLA are an excellent economic incentive for data center operators and would also make a significant contribution to greater environmental sustainability. It has been estimated that the cost of powering and cooling accounts for 53% of the total operational expenditure of data centers. The goal is not only to cut down energy cost in data centers, but also to meet government regulations and environmental standards. Designing energy-efficient data centers has recently received considerable attention. This problem can be approached from several directions. For example, energy efficient hardware architecture that enables slowing down CPU speeds and turning off partial hardware components has become commonplace. Energy-aware job scheduling and server consolidation are two other ways to reduce power consumption by turning off unused machines. Recent research has also begun to study energy-efficient network protocols and infrastructures. A key challenge in all the above methods is to achieve a good trade-off between energy savings and application performance. In this respect, few researchers have recently started to investigate

coordinated solutions for performance and power management in a dynamic cloud environment. The Global Energy Management Center(GEMC) can help companies monitor energy consumption patterns from multiple sources. These patterns can be further analyzed for usage, cost, and carbon footprint in a number of ways that help in optimizing energy. The center is uniquely positioned to service the clients across the globe by deploying a Remote Control Unit that has the capabilities to communicate to a cloud-based architecture

8. **Multi-tenancy:** There are multiple types of cloud applications that users can access through the Internet, from small Internet-based widgets to large enterprise software applications that have increased security requirements based on the type of data being stored on the software vendor's infrastructure. These application requests require multi-tenancy for many reasons, the most important is cost. Multiple customers accessing the same hardware, application servers, and databases may affect response times and performance for other customers. For application-layer multi-tenancy specifically, resources are shared at each infrastructure layer and have valid security and performance concerns. For example, multiple service requests accessing resources at the same time increase wait times but not necessarily CPU time, or the number of connections to an HTTP server has been exhausted, and the service must wait until it can use an available connection or—in a worst-case scenario— drops the service request.

9. **Server Consolidation:** The increased resource utilization and reduction in power and cooling requirements achieved by server consolidation are now being expanded into the cloud. Server consolidation is an effective approach to maximize resource utilization while minimizing energy consumption in a cloud computing environment. Live VM migration technology is often used to consolidate VMs residing on multiple underutilized servers onto a single server, so that the remaining servers can be set to an energy-saving state. The problem of optimally consolidating servers in a data center is often formulated as a variant of the vector binpacking problem, which is an NP-hard optimization problem. Various heuristics have been proposed for this problem. Additionally, dependencies among VMs, such as communication requirements, have also been considered recently. However, server consolidation activities should not hurt application performance. It is known that the resource usage (also known as the footprint) of individual VMs may vary over time. For server resources that are shared among VMs, such as bandwidth, memory cache and disk I/O, maximally consolidating a server may result in resource congestion when a VM changes its footprint on the server. Hence, it is sometimes important to observe the fluctuations of VM footprints and use this information for effective server consolidation. Finally, the system must quickly react to resource congestions when they occur.

10. **Reliability & Availability of Service:** The challenge of reliability comes into the picture when a cloud provider delivers on-demand software as a service. The software needs to have a reliability quality factor so that users can access it under any network conditions (such as during slow network connections). There are a few cases identified due to the unreliability of on-demand software. One of the examples is Apple's MobileMe cloud service, which stores and synchronizes data across multiple devices. It began with an embarrassing start when many users were not able to access mail and synchronize data correctly. To avoid such problems, providers are turning to technologies such as Google Gears, Adobe AIR, and Curl, which allow cloud based applications to run locally, some even allow them to run in the absence of a network connection. These tools give web applications access to the storage and processing capabilities of the desktop, forming a bridge between the cloud and the user's own computer. Considering the use of software such as 3D gaming applications and video conferencing systems, reliability is still a challenge to achieve for an IT solution that is based on cloud

computing.

11. **Common Cloud Standards:** Security based accreditation for Cloud Computing would cover three main areas which are technology, personnel and operations. Technical standards are likely to be driven by organizations, such as, Jericho Forum1 before being ratified by established bodies, e.g., ISO2 (International Standard Organization). On the personnel side, the Institute for Information Security Professionals3 (IISP) is already offering formal accreditation for the security professionals. For the operational elements, there are some workable solutions such as tweaking the ISO 27001 and using it as the default measurement standard within the framework of the SAS 704. Currently, one of the main problems is that there are many fragmented activities going in the direction of Cloud accreditation, but a common body for the coordination of those activities is missing. The creation of a unified accreditation body to certify the Cloud services would also be a big challenge.

12. **Platform Management:** Challenges in delivering middleware capabilities for building, deploying, integrating and managing applications in a multi-tenant, elastic and scalable environments. One of the most important parts of cloud platforms provide various kind of platform for developers to write applications that run in the cloud, or use services provided from the cloud, or both. Different names are used for this kind of platform today, including on-demand platform and platform as a service (PaaS). This new way of supporting applications has great potential. When a development team creates an on-premises application (i.e., one that will run within an organization), much of what that application needs already exists. An operating system provides basic support for executing the application, interacting with storage, and more, while other computers in the environment offer services such as remote storage.

APPLICATIONS: There are a few applications of cloud computing as follows:

1) Cloud computing provides dependable and secure data storage center.

2) Cloud computing can realize data sharing between different equipments.

3) The cloud provides nearly infinite possibility for users to use the internet.

4) Cloud computing does not need high quality equipment for the user and it is easy to use.

BUILDING CLOUDS: In this section we describe work that helps building cloud offerings. This requires management software, hardware provision, simulators to evaluate the design, and evaluating management choices.

Sotomayor et al. presents two tools for managing cloud infrastructures: OpenNebula, a virtual infrastructure manager, and Haizea, a resource lease manager. To manage the virtual infrastructure, OpenNebula provides a unified view of virtual resources regardless of the underlying virtualisation platform, manages the full lifecycle of the VMs, and support configurable resource allocation policies including policies for times when the demand exceeds the available resources. Sotomayor et al. argue that in private and hybrid clouds resources will be limited, in the sense that situations will occur where the demand cannot be met, and that requests for resources will have to be prioritised, queued, pre-reserved, deployed to external clouds, or even rejected. They propose advance reservations to have resources available to serve higher prioritised requests that are expected to be shortly arriving. This can be solved with resource lease managers such as the proposed Haizea, something like a futures market for cloud computing resources, which pre-empts resource usage and puts in places advance resource reservations, so that highly prioritised demand can be served promptly. Haizea can act as a scheduling backend for OpenNebula, and together they advance other virtual infrastructure managers by giving the functionality to scale out to external clouds, and providing support for scheduling groups of VMs, such that either the entire group of VMs are provided resources or no member of the group. In combination they can provide resources by best-effort, as done by Amazon EC2, by immediate provision, as done by Eucalyptus, and in addition using advance reservations.

Song et al. have extended IBM data centre management software to be able to deal with cloud-scale data centres, by using a hierarchical set up of management servers instead of a central one. As even simple tasks such as discovering systems or collecting inventory can overwhelm a single management server when the number of managed components or endpoints increases, they partition the endpoints to balance the management workload. Song et al. chose a hierarchical distribution of management components, as a centralised topology will in any possible implementation result in bottlenecks, and because P2P structuring exhibits complexities that are not easy to understand. For resilience, the management t components have backup servers which are notified with the changes from the original server. Once this notification no longer arrives, the backup server will replace the original server's task until it comes back to operation. In a case study, Song et al. show that this solution scales "almost linearly" to 2048 managed endpoints with 8 managing servers. However, cloud-scale solutions might need to manage a number of virtual machines that is one or two orders of magnitude larger, and in the future will become even larger. It is left for future work to test if the solution will be feasible and scale for such numbers of managed endpoints.

Vishwanath et al. describe the provision of shipping containers that contain building blocks for data centres. The containers described are not serviced over their lifecycle, but allow for graceful failure of components until performance degrades below a certain threshold and the entire container gets replaced. To achieve this, Vishwanath et al. start with overprovisioning the demand at the start, or by putting cold nodes into the container which are not powered on once there is demand due to failure in some of the other components. This work aims at supporting the design of shipping containers with respect to costs, performance, and reliability. For reliability, Markov chains are used to calculate the expected mean time to failure over the lifecycle. For performance and cost, these Markov chains are extended into Markov reward models. These happen under the assumption of exponential failure times, and need to be evaluated against real data. The shipping containers could be used for selling private clouds in a box. Sriram [44] discusses some of the issues with scaling the size of data centres used to provide cloud computing services. He presents the development and initial results of a simulation tool for predicting the performance of cloud computing data centres which incorporates normal failures, failures that occur frequently due to the sheer number of components and the expected average lifecycle of each component and that are treated as the normal case rather than as an exception. Sriram shows that for small data centres and small failure rates the middleware protocol does not play a role, but for large data centres distributed middleware protocols scale better.

CloudSim, another modelling and simulation toolkit has been proposed by **Buyya et al.** CloudSim simulates the performance of consumer applications executed in the cloud. The topology contains a resource broker and the data centres where the application is executed. The simulator can then estimate the performance overhead of the cloud solution. CloudSim is built on top of a grid computing simulator (GridSim) and looks at the scheduling of the execution application, and the impact of virtualisation on the application's performance. AbdelSalam et al. [46] seek to optimise change management strategies, which are necessary for updates and maintenance, for low energy consumption of a could data centre. However, this work simply derives the actual load from the Service Level Agreements (SLA) negotiated with current customers. AbdelSalam then show that the number of servers currently required is proportional to the load, and identifies the number of idle servers as those available after all SLAs are fulfilled on a minimum set of servers. These are suggested as candidates for pending change management requests. One of the key aspects of cloud computing is elasticity, however, which will make it difficult to estimate the load from the SLAs in place. It is a challenge to develop such placement algorithms that the existing load can always be shrunk to a subset of the available servers while still fulfilling all SLAs, and cost factors will seek to minimise idle servers. Further work is necessary that takes these requirements into account and develops guidelines for both saving energy consumption and enabling seamless change management in cloud data centres. In summary, several projects research into the way future clouds can be built. Given the methodology we chose earlier, the papers discussed in this section differ too much to conclude with a single research direction in which academia is heading when looking into building future clouds. In fact, it seems there are many more research directions we will be facing when it comes to building new cloud facilities. All papers in this section for example, looked only at IaaS level clouds. To date, no paper could be found that describes technologies for building clouds at another level.

CONCLUSION:

Cloud Computing, envisioned as the next generation architecture of IT Enterprise is a talk of the town these days. The way cloud has been dominating the IT market, a major shift towards the cloud can be expected in the coming years. Cloud computing offers real benefits to companies seeking a competitive edge in today's economy. Many more providers are moving into this area, and the competition is driving prices even lower. Attractive pricing, the ability to free up staff for other duties, and the ability to pay for —as needed|| services will continue to drive more businesses to consider cloud computing. Mobile cloud computing is expected to emerge as one of the biggest market for cloud service providers and cloud developers. Although Cloud computing can be seen as a new phenomenon which is set to revolutionize the way we use the Internet, there is much to be cautious about. There are many new technologies emerging at a rapid rate, each with technological advancements and with the potential of making human's lives easier. However, one must be very careful to understand the security risks and challenges posed in utilizing these technologies. Cloud computing is no exception. Cloud service providers need to inform their customers on the level of security that they provide on their cloud. This research effort presents an overview of Cloud Computing, building blocks of Cloud Computing which includes different models of cloud computing, overview of Cloud Computing architecture and Cloud Computing entities. Furthermore, research challenges which are currently faced in the Cloud computing were also highlighted. Cloud computing has the potential to become a frontrunner in promoting a secure, virtual and economically viable IT solution in the future. As the development of cloud computing technology is still at an early stage, this research effort will provide a better understanding of the design challenges of cloud computing, and pave the way for further research in this area.

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Patrons

Dr. Sanjay Deshmukh
Hon'ble Vice Chancellor, University of Mumbai

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Shri Mahesh Kapoor
Hon. Vice President, Uttari Bharat Sabha

Dr. T. A. Shiware
Director of Wilson College

Prin. Dr. Ajay M. Bhamare
Conference Chairperson

Uttari Bharat Sabha's

RAMANAND ARYA D.A.V. COLLEGE

Bhandup (E), Mumbai- 400042

Tel. No. 022-25662921, email: info@radav.org. Website: www.radav.org

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SHARAYU PRAKASHAN
B-7/501, Vijay Park, Kasarvadavli, Ghodbunder Road, Thane(W) 400 615
Mobile:- +91 9967357415
Email: ashtikarcd@gmail.com Website: www.mngtguru.com