

Cloud Computing- Overview, Challenges & Trend in the Market.

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Abstract: Cloud computing is a set of IT services that are provided to a customer over a network on a leased basis with the ability to scale up or down their service requirements. Cloud Computing services are delivered by a third party provider who owns the Infrastructure. It is a rapidly developing technology which has brought significant changes & opportunities to various sectors across the Globe. However adopting a cloud computing may have positive as well as negative effects on the data security of service customers. As part of the broader Information and Communications Technology (ICT) picture, use of cloud-based technology is an asset for companies worldwide. The cloud continues to enhance competitiveness and has transformed business operations – from logistics and finance to customer relations and human resources. During this paper, we describe about Cloud Technology, Architecture of Cloud, Cloud Deployment Models, Cloud Service Models, Cloud Trends, Security Challenges in Cloud, Legal issues in Cloud, Cloud Service Providers & Benefits of Cloud Computing.

Keywords: Information and Communications Technology (ICT), Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS)

I. Introduction

The cloud is a technology which offers resources, processing power, data storage, application software, backup facilities, development tools and more, in the form of services accessible through the Internet. Cloud computing has transformed business processes both nationally and across international emerging markets.

These cloud trends shift by a range of organizations, has resulted in the requirement of providers to invest in cloud infrastructure and data center related offerings, such as security and management services. Cloud computing continues to grow and its trends are likely to transform the IT landscape. Amazon Web Services, Microsoft Azure & Google Cloud are the Major Players in the Market.



Figure 1: Cloud Computing [15]

II. Cloud Computing Architecture

Cloud computing architecture refers to the components and subcomponents required for cloud computing. These components typically consist of a front end platform (fat client, thin client, mobile device), back end platforms (servers, storage), a cloud based delivery, and a network (Internet, Intranet, Intercloud). Combined, these components make up cloud computing architecture.

III. Cloud Computing Deployment Models

The picture below shows the conceptual deployment models.

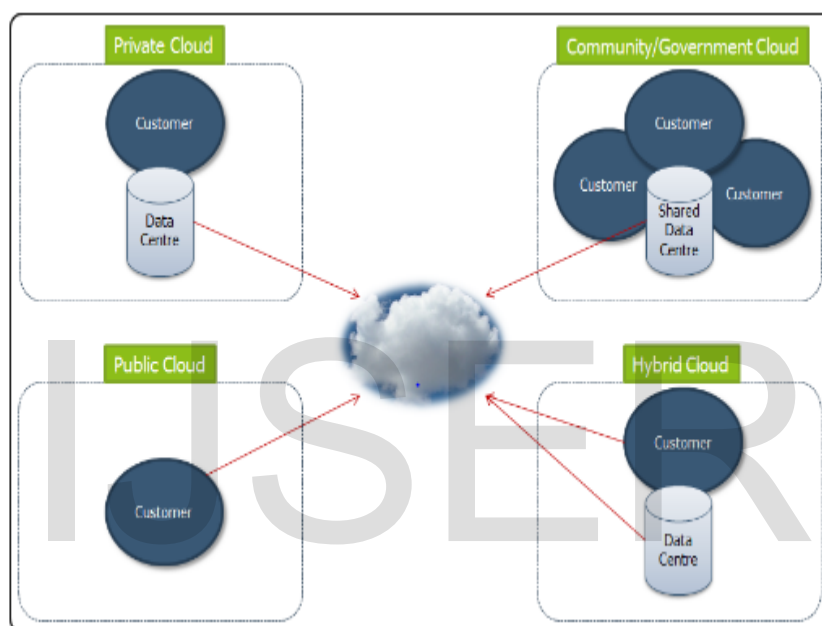


Figure 2: Cloud Computing Conceptual Deployment Models [16]

Public: The most common and well-known deployment model is Public Cloud. A Public Cloud is a huge data centre that offers the same services to all its users. The services are accessible for everyone and much used for the consumer segment.

Examples of public services are Facebook, Google and LinkedIn. For consumers, Public Cloud offerings are usually free of charge, for professionals there is usually a per-per-use (or user) pricing model. The Public Cloud is always hosted by a professional Cloud supplier.

Private: The other commonly used deployment model is Private Clouds. There are lots of discussions for how strict the definition of Private Clouds should be. In general a customer's internally hosted data centre is regarded as a Private Cloud. If we add virtualization and automation, such a setup may very well be regarded as a Private Cloud.

A professional Cloud vendor may also offer a Private Cloud to their customers by supporting a separate hardware environment in the data centre. A Private Cloud is

therefore mostly suited for sensitive data, where the customer is dependent on a certain degree of security.

Virtual Private: This is a virtual, and not physically, separated Cloud offering normally run in a Public Cloud centre. Access is given through a secure connection, i.e. VPN, and access may also be restricted by the physical location of the user, i.e. within the customer’s firewalls.

Hybrid: The Hybrid Cloud is a combination of both Private and Public. This is a setup that is much used for large companies. Vital data is usually preferred in a Private Cloud and supporting services in Public, for instance search, email, blogs, CRM etc. In other words strategic applications are run separately.

Community: A way to preserve the benefits of economy of scales with the Private Cloud is a Community Cloud. This is cooperation between users who share some concerns like security, application types, legislative issues and efficiency demands. In other words, a Community Cloud is a closed Private Cloud for a group of users.

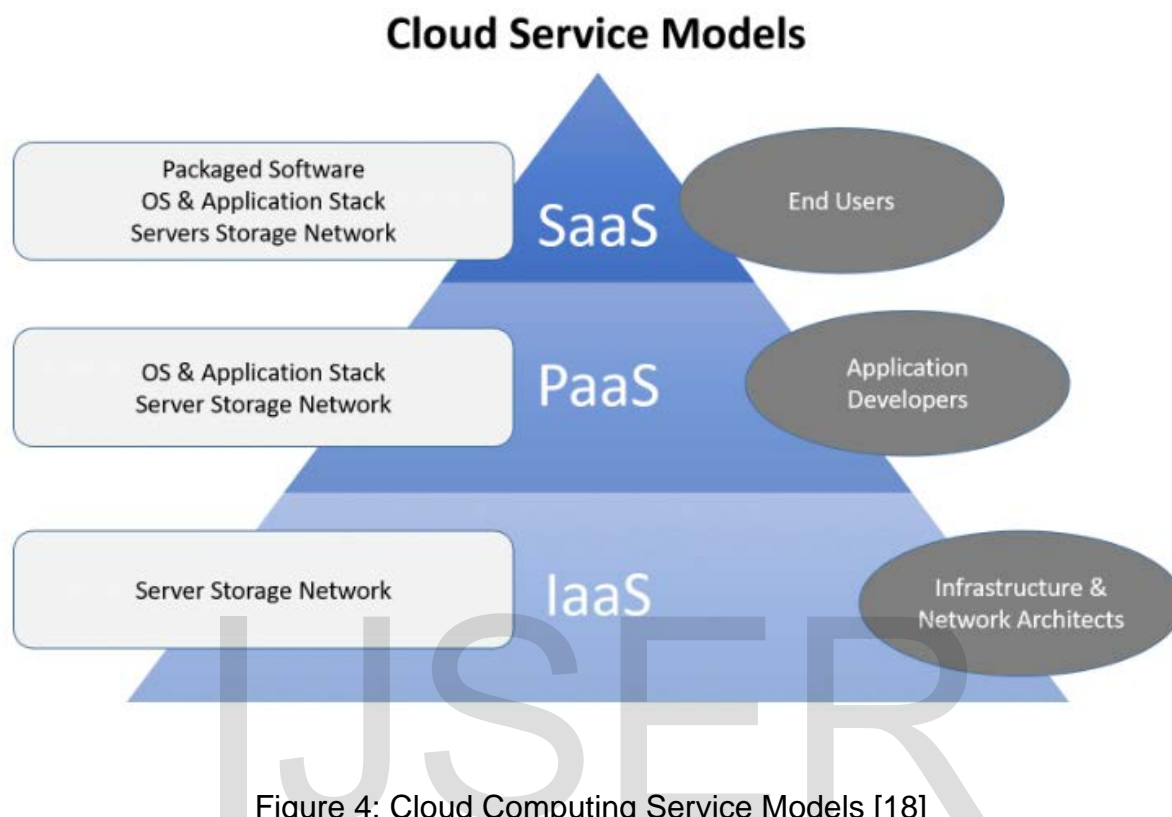
The picture below gives an overview of deployment models.

	Type	Properties
1.	Private cloud	<ul style="list-style-type: none"> • Outsource or own • Lease or buy • Separate or virtual data center
2.	Community cloud	<ul style="list-style-type: none"> • Private cloud for a set of users with specific demands • Several stakeholders
3.	Public cloud	<ul style="list-style-type: none"> • Mega scaleable infrastructure • Available for all
4.	Hybrid cloud	<ul style="list-style-type: none"> • Combination of two clouds • Usually private for sensitive data and strategic applications

Figure 3: Cloud Computing Deployment Models [17]

IV. Cloud Computing Service Models

Cloud service models focus on providing some type of offering to their clients.



Software as a Service: It is a type of cloud that offers an application to customer or organizations through a web browser. The data for the app runs on a server on the network, not through an app on the user's computer. Software is usually sold via subscription

Examples of SaaS are Salesforce, Google Docs, Office 365 etc.

Infrastructure as a Service: This provides the hardware and usually virtualized OS to their customers. Software is charged only for the computing power that is utilized, usually CPU hours used a month.

Examples of IaaS are Amazon EC2, Rackspace, Google Compute Engine etc.

Cloud Platform as a Service: This provides networked computers running in a hosted environment, and also adds support for the development environment. PaaS offerings generally support a specific program language or development environments. Deploying your app in this environment, you can take advantage of dynamic scalability, automated database backups without need to specifically code for it. PaaS are billed as an additional cost on top of the IaaS charges.

Examples of PaaS are Google App Engine, Cloud Foundry, Engine Yard Etc.

V. Cloud Trends 2019: Machine Learning (ML) And Artificial Intelligence (AI)

Machine learning is moving into the cloud space and has become so user-friendly, that developers can integrate it into cloud-hosted applications. A Gartner report says advanced machine learning technologies will play an important role in the tech space in the coming ten years. Machine learning offers radical computational power, data in bulk, and unparalleled advances in deep neural networks. These all help enterprises with smart machine technologies to access data, align with new situations and solve other data issues.

Machine learning generates enough information to stop anomalous action and deliver automated security operations. Now, neural networks and advanced predictive algorithms are easy to create at a much lower cost. Security analytics engines consume data from network gear in search of anomalies that point out threats. By fixing a baseline for normal, these engines detect unusual behaviours and track any malicious activity. With the improvement of these platforms, they will be able to detect attacks in earlier stages and prevent them before they turn into active breaches.

VI. Security Challenges

a. Data Security concern

Multiple serious threats like virus attack and hacking of the client's site are the biggest cloud computing data security issues. Entrepreneurs have to think on these issues before adopting cloud computing technology for their business. Since you are transferring your company's important details to a third party so it is important to ensure yourself about the manageability and security system of the cloud.

b. Selecting the perfect cloud set-up

Choosing the appropriate cloud mechanism as per the needs of your business is very necessary. The main secret behind successful implementation of the cloud is picking up the right cloud. If you are not selecting the right cloud then maybe you have to face some serious hazards. Some companies having vast data so they prefer private clouds while small organisations usually use public clouds. A few companies like to go for a balanced approach with hybrid clouds. Choose a cloud computing consulting service which is aware and clearly disclose the terms and conditions regarding cloud implementation and data security.

c. Real time monitoring requirements

In some agencies, it is required to monitor their system in real time. It is compulsory term for their business that they continuously monitor and maintain their inventory system. Banks and some government agencies need to update their system in real time but cloud service providers are unable to match this requirement. This is really a big challenge for cloud services providers.

d. Resolving the stress

Every organisation wants to have a proper control and access over the data. It is not easy to handover your precious data to a third party. The main tension between enterprise and executives is they desire to control over the new modes of operations while using technology. These tensions are not unsolvable, but they do suggest that providers and clients alike must deliberately address a suite of cloud challenges in the planning, contracting and managing the services.

e. Reliability on new technology

It is a fact of human nature that we trust on the things present in front of our eyes. Normally entrepreneurs feel hesitation in letting out the organisational information to any unknown service provider. They think that information stored in their office premises is more secure and easily accessible. By using cloud computing they have fear of losing control over the data. They think that data is taken from them and handover to an unknown third party. Security threads are increase as they do not know and where is the information stored and processed. These frights of the unknown service providers must very amicably be dealt with and eliminated form their minds.

f. Dependency on service providers

For uninterrupted services and proper working it is necessary that you acquire a vendor services with proper infrastructural and technical expertise. An authorized vendor who can meet the security standards set by your company's internal policies and government agencies. While selecting the service provider you must carefully

read the service level agreement and understand their policies and terms and provision of compensation in case of any outage or lock in clauses.

g. Cultural obstacles

High authority of the company and organisational culture has also become a big obstacle in the proper implementation of the cloud computing. Top authority never wants to store the important data of the company somewhere else where they are not able to control and access the data. They have misconceptions in their minds that cloud computing puts the organisation at the risk by seeping out important details. Their mindset is such that the organization on risk averse footing, which makes it more reluctant to migrate to a cloud solution.

h. Cost barrier

For efficient working of cloud computing you have to bear the high charges of the bandwidth. Business can cut down the cost on hardware but they have to spend a huge amount on the bandwidth. For smaller application cost is not a big issue but for large and complex applications it is a major concern. For transferring complex and intensive data over the network it is very necessary that you have sufficient bandwidth. This is a major obstacle in front of small organisations, which restrict them for implementing cloud technology in their business.

i. Lack of knowledge and expertise

Every organisation does not have sufficient knowledge about the implementation of the cloud solutions. They have not expertise staff and tools for the proper use of cloud technology. Delivering the information and selection the right cloud is quite difficult without right direction. Teaching your staff about the process and tools of the cloud computing is a very big challenge in itself. Requiring an organisation to shift their business to cloud based technology without having any proper knowledge is like asking for disaster. They would never use this technology for their business functions.

j. Consumption basis services charges

Cloud computing services are on-demand services so it is difficult to define specific cost for a particular quantity of services. These types of fluctuations and price

differences make the implementation of cloud computing very difficult and complicated. It is not easy for a normal business owner to study consistent demand and fluctuations with the seasons and various events. So it is hard to budget for a service that could consume several months of budget in a few days of heavy use.

k. Alleviate the threats risk

It is very complicated to certify that the cloud service provider meet the standards for security and threat risk. Every organisation may not have enough mechanism to mitigate these types of threats. Organisations should observe and examine the threats very seriously. There are mainly two types of threat such as internal threats, within the organisations and external threats from the professional hackers who seek out the important information of your business. These threats and security risks put a check on implementing cloud solutions.

l. Unauthorised service providers

Cloud computing is a new concept for most of the business organisations. A normal businessman is not able to verify the genuineness of the service provider agency. It's very difficult for them to check the whether the vendors meet the security standards or not. They have not an ICT consultant to evaluate the vendors against the worldwide criteria. It is necessary to verify that the vendor must be operating this business for a sufficient time without having any negative record in past. Vendor continuing business without any data loss complaint and have a number of satisfied clients. Market reputation of the vendor should be unblemished.

m. Hacking of brand

Cloud computing carries some major risk factors like hacking. Some professional hackers are able to hack the application by breaking the efficient firewalls and steal the sensitive information of the organisations. A cloud provider hosts numerous clients; each can be affected by actions taken against any one of them. When any threat came into the main server it affects all the other clients also. As in distributed denial of service attacks server requests that inundate a provider from widely distributed computers.

n. Recovery of lost data

Cloud services faces issue of data loss. A proper backup policy for the recovery of data must be placed to deal with the loss. Vendors must set proper infrastructures to efficiently handle with server breakdown and outages. All the cloud computing service providers must set up their servers at economically stable locations where they should have proper arrangements for the backup of all the data in at least two different locations. Ideally they should manage a hot backup and a cold backup site.

o. Data portability

Every person wants to leverage of migrating in and out of the cloud. Ensuring data portability is very necessary. Usually, clients complain about being locked in the cloud technology from where they cannot switch without restraints. There should be no lock in period for switching the cloud. Cloud technology must have capability to integrate efficiently with the on premises. The clients must have a proper contract of data portability with the provider and must have an updated copy of the data to be able to switch service providers, should there be any urgent requirement.

p. Cloud management

Managing a cloud is not an easy task. It consist a lot of technical challenges. A lot of dramatic predictions are famous about the impact of cloud computing. People think that traditional IT department will be outdated and research supports the conclusions that cloud impacts are likely to be more gradual and less linear. Cloud services can easily change and update by the business users. It does not involve any direct involvement of IT department. It is a service provider's responsibility to manage the information and spread it across the organisation. So it is difficult to manage all the complex functionality of cloud computing.

q. Dealing with lock-ins

Cloud providers have important additional incentives to attempt to exploit lock-ins. A prefixed switching cost is always there for any company receiving external services. Exit strategies and lock-in risks are primary concerns for companies looking to exploit cloud computing.

r. Transparency of service provider

There is no transparency in the service provider's infrastructure and service area. You are not able to see the exact location where your data is stored or being processed. It is a big challenge for an organisation to transfer their business information to such an unknown vendor.

s. Transforming the data into virtual set-up

Transition of business data from a premise set up to a virtual set up is a major issue for various organisations. Data migration and network configuration are the serious problems behind avoiding the cloud computing technology.

t. Popularization of cloud computing

The idea of cloud has been famous that there is a rush of implementing virtualization amongst CIOs. This has led to more complexities than solutions. These are some common problems regarding the cloud computing execution in real life. But the benefits of cloud computing are more vast in compare to these hazards. So you should find the perfect solutions and avail the huge benefits of cloud technology in your business. It can take business to the new heights!!

VII. Legal Issues

- a. U.S Data Breach Notification Requirements
- b. U.S Federal Law Compliance
- c. International Data Privacy Compliance

VIII. Cloud Service Providers

- a. Amazon Web Services
- b. Kamatera
- c. Microsoft Azure
- d. Google Cloud Platform
- e. Adobe
- f. VMware
- g. IBM Cloud
- h. Rackspace
- i. Red Hat
- j. Salesforce
- k. Oracle Cloud

I. SAP

m.Verizon Cloud

n.Navisite

o.Dropbox

p.Egnyte

IX. Benefits

As an emerging IT delivery Model, cloud computing can significantly reduce IT costs & complexities. The buzz surrounding cloud is based mostly on a new kind of user experience – particularly in the consumer web space - for search, social networking and retail. Many of us use cloud delivery models everyday without knowing it when we share photos online, download music or access bank accounts using our Mobile phones.

From a technology perspective , cloud computing is loosely defined as a style of computing where dynamically scalable resources (such as CPU, storage or bandwidth) are provided as a service over the internet. The process is typically automated and takes minutes.

Enterprises adopt cloud models to improve employee productivity, deploy new products and services faster and reduce operating costs – These typically include development & test, Virtual desktop and analytics.

Cloud brings lot of benefits for any enterprises.

- a. Increase ability to move quickly and easily on the IT datacenter resources and innovation.
- b. Enable self service portal and thus ensure VM in less lead times.
- c. SLA's are met as the VM lead times and down times are significantly reduced.
- d. Trial and error configuration tests can be done at ease.
- e. Complete control over cloud usage for Admins.
- f. Scalability and flexibility allow the IaaS cloud to almost deliver the promise of unlimited IT services on demand.
- g. Pay for only what they use and are not charged when their service demands decrease.
- f. Significant reduction in costs for IT Datacenter.
- g. Private cloud enables dynamic sharing of the resources available in IT datacenter so that demands can be met cost-effectively.
- h. Considerable increase in the utilization of resources of IT datacenter.
- i. Increase in operational efficiency of the resources in the IT datacenter.
- j. Achieve a greener datacenter (server consolidation & virtualization enables over committed machines)
- k. Reducing the number of administrators required top manage a more diverse IT resource pool.
- l. Reduction in physical server count.
- m. Consolidation of Enterprise application licenses.
- n. End to End application provisioning.

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