Evaloation of Cloud Computing Technology

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Abstract- *Cloud computingis basically an internet-based network made up of large number of servers-mostly based on open standards, be a model and inexpensive. It implies a serviceoriente architecture a through offering software and platforms as services, reduced can be information technology overhead for the end-user, great flexibility, to reduced total cost of ownership, on demand services and many other things. It contains vast amount of information and provided a variety of services to large number of people. The benefits of cloud computing are reduced data leakage, decrease evidence acquisition time, they eliminate or reduced service downtime. This paper is a brief survey based of readings on "cloud computing and it tries to address, related topics, challenges ahead and possible applications…*

I. INTRODUCTION

Cloud computing is an information technology (IT) paradigm that enables ubiquitous access to shared pools of configurable system resources and highlevel services that can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing relies on sharing of resources to achieve coherence and economies of scale, similar to a public utility.

Third-party clouds enable organizations to focus on their core to businesses instead of expending resources on computer infrastructure and maintenance.Advocates note that cloud computing allows companies to avoid or minimize upfront IT infrastructure costs.

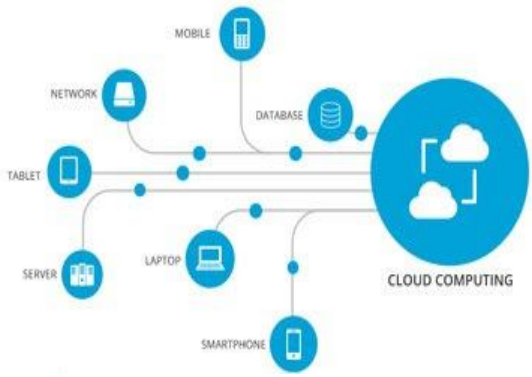


Fig (0.1) Cloud computing

Since the launch of Amazon **EC2 in 2006**, the availability of high-capacity networks, low-cost computers and storage devices as well as the widespread adoption of hardware virtualization, service-oriented architecture, and autonomic and utility computing has led to growth in cloud computing.

II. EARLY HISTORY

During **the 1960s**, the initial concepts of time-sharing became popularized via RJE (Remote Job Entry); This terminology was mostly associated with large vendors such as IBM and DEC. Full-time-sharing solutions were available by the **early 1970s** on such platformsas Multics (on GE hardware), Cambridge CTSS, and the earliest UNIX ports (on DEC hardware). Yet, the "data centre" model where users submitted jobs to operators to run on IBM mainframes was overwhelmingly predominant.

In the 1990s, telecommunications companies, who previously offered primarily dedicated point-to-point data circuits, began offering virtual private network (VPN) services with comparable quality of service, but at a lower cost. By switching traffic as they saw fit to balance server use, they could use overall network bandwidth more effectively

In July 2010, Rackspace Hosting and NASA jointly launched an open-source cloud-software initiative known as OpenStack. The OpenStack project intended to help organizations offering cloud-computing services running on standard hardware. The early code came from NASA's Nebula platform as well as from Cloud Files platform. As an open source offering and along with other open-source solutions such as CloudStack and OpenNebula, it has attracted attention by several key communities.

On March 1, 2011, IBM announced the IBMSmartCloud framework to support Smarter Planet.Among the various components of the Smarter Computing foundation, cloud computing is a critical part

On June 7, 2012, Oracle announced the Oracle Cloud.This cloud offering is poised to be the first to provide users with access to an integrated set of IT solutions, including the Applications (SaaS), Platform (PaaS), and Infrastructure (IaaS) layers.

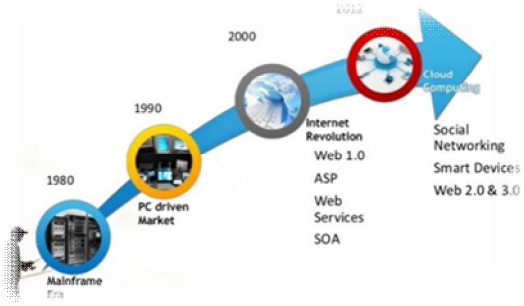


Fig (0.2) cloud computing years

III. CHARACTERISTICS OF CLOUD COMPUTING

>**Client–server model—**Client–server computing refers broadly to any distributed application that distinguishes between service providers(servers) and service requestors(clients)

> **Computer bureau**—A service bureau providing computer services, particularly from the 1960s to 1980s.

> **Grid computing**—"A form of distributed and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks."

> **Fog computing**—Distributed computing paradigm that provides data, compute, storage and application services closer to client or near-user edge devices, such as network routers. Furthermore, fog computing handles data at the network level, on smart devices and on the end-user client side (e.g. mobile devices), instead of sending data to a remote location for processing.

> **Mainframe computer**—Powerful computers used mainly by large organizations for critical applications, typically bulk data processing such as: census; industry and consumer statistics; police and secret intelligence services; enterprise resource planning; and financial transaction processing.

>**Utility computing**—The "packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility, such as electricity."

> **Peer-to-peer**—A distributed architecture without the need for central coordination. Participants are both suppliers and consumers of resources (in contrast to the traditional client–server model).

>**Cloud sandbox**—A live, isolated computer environment in which a program, code or file can run without affecting the application in which it runs.

IV. MODELS

Infrastructure as a service (IaaS)

Fig (0.3) Infrastructure services

"Infrastructure as a service" (IaaS) refers to online services that provide high-level APIs used to dereference various low-level details of underlying network infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc. A hypervisor, such as Xin, Oracle Virtual Box, Oracle VM, KVM, VMware ESX/Six, or Hyper-V, LXD, runs the virtual machines as guests. Pools of hypervisors within the cloud operational system can support large numbers of virtual machines and the ability to scale services up and down according to customers' varying requirements. Linux containers run in isolated partitions of a single Linux kernel running directly on the physical hardware. Linux groups and namespaces are the underlying Linux kernel technologies used to isolate, secure and manage the containers. Containerisation offers higher performance than virtualization, because there is no hypervisor overhead. Also, container capacity auto-scales dynamically with computing load, which eliminates the problem of overprovisioning and enables usage-based billing. IaaS clouds often offer additional resources such as a virtual machinedisk-image library, raw block storage, file or object storage, firewalls, load balancers,

IP addresses, virtual local area networks (VLANs), and software bundles.

Platform as a service (PaaS)

Fig (0.4) Platform services

The NIST's definition of cloud computing defines Platform as a Service as: The capability provided to the consumer is to deploy onto the cloud infrastructure consumer created or acquired applications created using programming languages, libraries, services, and tools supported by the provider. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but has control over the deployed applications and possibly configuration settings for the application-hosting environment.

Software as a service (SaaS)

Fig(0.5)SaaS

The NIST's definition of cloud computing defines Software as a Service as.

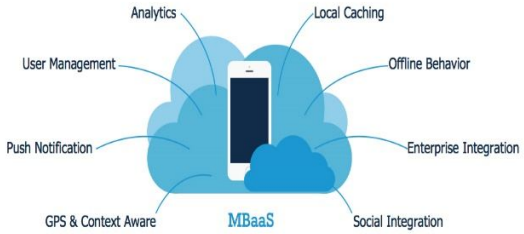
The capability provided to the consumer is to use the provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser (e.g., web-based email), or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage, or even individual application capabilities, with the possible exception of limited user specific application configuration settings.

In the **software as a service (SaaS)** model, users gain access to application software and databases. Cloud providers manage the infrastructure and platforms that run the applications. SaaS is sometimes referred to as "on-demand software" and is usually priced on a pay-per-use basis or using a subscription fee. In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients. Cloud users do not manage the cloud infrastructure and platform where the application runs. This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support. Cloud applications differ from other applications in their scalability—which can be achieved by cloning tasks onto multiple virtual machines at run-time to meet changing work demanded Load balancers distribute the work over the set of virtual machines. This process is sees only a single access-point. To accommodate a large number of cloud users, cloud applications can be multitenant, meaning that any machine may serve more than one cloud user organization

The pricing model for SaaS

Applications is typically a monthly or yearly flat fee per user, so prices become scalable and adjustable if users are added or removed at any point Proponents claim that SaaS gives a business the potential to reduce IT operational costs by outsourcing hardware and software maintenance and support to the cloud provider. This enables the business to reallocate IT operations costs away from hardware/software spending and from personnel expenses, towards meeting other goals. In addition, with applications hosted centrally, updates can be released without the need for users to install new software. One drawback of SaaS comes with storing the users' data on the cloud provider's server. As a result, there could be unauthorized access to the data.

Mobile "backend" as a service



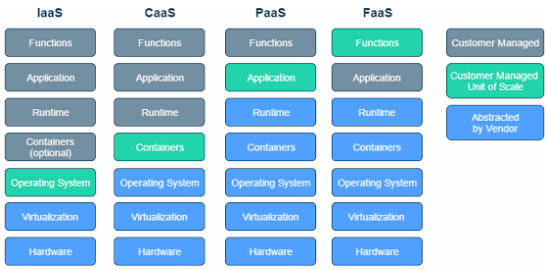
Fig(0.6) Mobile services

In the mobile "backend" as a service (m) model, also known as backend as a service (BaaS), web app and mobile app developers are provided with a way to link their applications to cloud storage and cloud computing services with application programming interfaces (APIs) exposed to their applications and custom software development kits (SDKs). Services include user management, push notifications, integration with social networking services and more. This is a relatively recent model in cloud computing with most BaaS start-ups dating from 2011 or later but trends indicate that these services are gaining significant mainstream traction with enterprise consumers.

Server less computing

Server less computing is a cloud computing code execution model in which the cloud provider fully manages starting and stopping virtual machines as necessary to serve requests, and requests are billed by an abstract measure of the resources required to satisfy the request, rather than per virtual machine, per hour. Despite the name, it does not actually involve running code without servers.Server less computing is so named because the business or person that owns the system does not have to purchase, rent or provision servers or virtual machines for the back-end code to run on.

Function as a service (FaaS)



Fig(0.7)FaaS

Function as a service (FaaS) is a service hosted remote procedure call that leverages server less computing to enable the deployment of individual functions in the cloud that run in response to events. Favas is included under the broader term server less computing, but the terms may also be used interchangeably.

V. MODELS OF CLOUDS

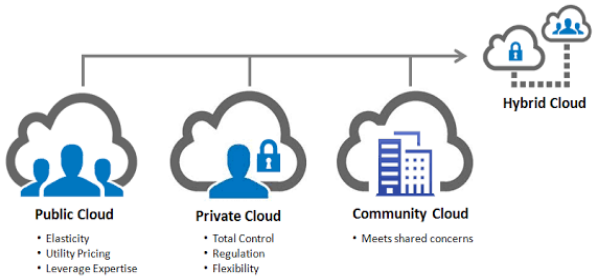


Fig (0.7) Clouds model

Private cloud

Private cloud is cloud infrastructure operated solely for a single organization, whether managed internally or by a third-party, and hosted either internally or externally.Undertaking a private cloud project requires significant engagement to virtualize the business environment, and requires the organization to revaluate decisions about existing resources. It can improve business, but every step in the project raises security issues that must be addressed to prevent serious vulnerabilities. Self-run data centre are generally capital intensive. They have a significant physical footprint, requiring allocations of space, hardware, and environmental controls. These assets have to be refreshed periodically, resulting in additional capital expenditures. They have attracted criticism because users "still have to buy, build, and manage them" and thus do not benefit from less hands-on management, essential"[lacking] the economic model that makes cloud computing such an intriguing concept".

Public cloud

A cloud is called a "public cloud" when the services are rendered over a network that is open for public use. Public cloud services may be free. Technically there maybe little or no difference between public and private cloud architecture, however, security consideration may be substantially different for services (applications, storage, and other resources) that are made available by a service provider for a public audience and when communication is effected over a non-trusted network. Generally, public cloud service providers like Amazon Web Services (AWS), Oracle, Microsoft and Google own and operate the infrastructure at their data centre and access is generally via the Internet. AWS, Oracle, Microsoft, and Google also offer direct connect services called "AWS Direct Connect",

"Oracle Fast Connect", "Azure ExpressRoute", and "Cloud Interconnect" respectively, such connections require

customers to purchase or lease a private connection to a peering point offered by the cloud provider.

Hybrid cloud

Hybrid cloud is a composition of two or more clouds (private, community or public) that remain distinct entities but are bound together, offering the benefits of multiple deployment models. Hybrid cloud can also mean the ability to connect collocation, managed and/or dedicated services with cloud resources.Gartner defines a hybrid cloud service as a cloud computing service that is composed of some combination of private, public and community cloud services, from different service providers. A hybrid cloud service crosses isolation and provider boundaries so that it can't be simply put in one category of private, public, or community cloud service. It allows one to extend either the capacity or the capability of a cloud service, by aggregation, integration or customization with another cloud service.

Varied use cases for hybrid cloud composition exist. For example, an organization may store sensitive client data in house on a private cloud application but interconnect that application to a business intelligence application provided on a public cloud as a software service. This example of hybrid cloud extends the capabilities of the enterprise to deliver a specific business service through the addition of externally available public cloud services.

Hybrid cloud adoption depends on a number of factors such as data security and compliance requirements, level of control needed over data, and the applications an organization uses. Another example of hybrid cloud is one where IT organizations use public cloud computing resources to meet temporary capacity needs that cannot be met by the private cloud.This capability enables hybrid clouds to employ cloud bursting for scaling across clouds.Cloud bursting is an application deployment model in which an application runs in a private cloud or data centre and "bursts" to a public cloud when the demand for computing capacity increases. A primary advantage of cloud bursting and a hybrid cloud model is that an organization pays for extra compute resources only when they are need Cloud bursting enables data centres to create an in-house IT infrastructure that supports average workloads, and use cloud resources from public or private clouds, during spikes in processing demands. The specialized model of hybrid cloud, which is built atop heterogeneous hardware, is called "Cross platform Hybrid Cloud". A cross-platform hybrid cloud is usually powered by different CPU architectures, for example, x86-64 and ARM, underneath. Users can transparently deploy and scale applications without knowledge of the cloud's hardware diversity. This kind of cloud emerges from the raise of ARM based system-on-chip for server-class computing.

Community cloud

Community cloud shares infrastructure between several organizations from a specific community with common concerns (security, compliance, jurisdiction, etc.), whether managed internally or by a third-party, and either hosted internally or externally. The costs are spread over fewer users than a public cloud (but more than a private cloud), so only some of the cost savings potential of cloud computing are realized.

Distributed cloud

A cloud computing platform can be assembled from a distributed set of machines in different locations, connected to a single network or hub service. It is possible to distinguish between two types of distributed clouds: public-resource computing and volunteer cloud.

- **Public-resource computing**—This type of distributed cloud results from an expansive definition of cloud computing, because they are more akin to distributed computing than cloud computing. Nonetheless, it is considered a sub-class of cloud computing, and some examples includedistributed computing platforms such as BOINC and Folding Home.
- **Volunteer cloud**—Volunteer cloud computing is characterized as the intersection of public-resource computing and cloud computing, where a cloud computing infrastructure is built using volunteered resources. Many challenges arise from this type of infrastructure, because of the volatility of the resources used to build it and the dynamic environment it operates in. It can also be called peer-to-peer clouds, or ad-hoc clouds. An interesting effort in such direction is Cloud Home, it aims to implement a cloud computing infrastructure using volunteered resources providing a business-model to incentivize contributions through financial restitution.

Multi cloud

Multicloud is the use of multiple cloud computing services in a single heterogeneous architecture to reduce reliance on single vendors, increase flexibility through choice, mitigate against disasters, etc. It differs from hybrid cloud in that it refers to multiple cloud services, rather than multiple deployment modes
(public, private, legacy).

Big Data cloud

The issues of transferring large amounts of data to the cloud as well as data security once the data is in the cloud initially hampered adoption of cloud for big data, but now that much data originates in the cloud and with the advent of bare-metal servers, the cloud has become a solution for use cases including business analytics and geospatial analysis

HPC cloud

HPC cloud refers to the use of cloud computing services and infrastructure to execute high-performance computing (HPC) applications These applications consume considerable amount of computing power and memory and are traditionally executed on clusters of computers. Various vendors offer servers that can support the execution of these applications [102] [103] [104] [105] In HPC cloud, the deployment model allows allHPC resources to be inside the cloud provider infrastructure or different portions of HPC resources to be shared between cloud provider and client on premise infrastructure. The adoption of cloud to run HPC applications started mostly for applications composed of independent tasks with no inter-process communication. As cloud providers began to offer high-speed network technologies such as Infinity Band, multiprocessing tightly coupled applications started to benefit from cloud as well.

[1]

[2] **Security and privacy**

Cloud computing poses privacy concerns because the service provider can access the data that is in the cloud at any time. It could accidentally or deliberately alter or even delete information. Many cloud providers can share information with third parties if necessary for purposes of law and order even without a warrant. That is permitted in their privacy policies, which users must agree to before they start using cloud services. Solutions to privacy include policy and legislation as well as end users' choices for how data is stored Users can encrypt data that is processed or stored within the cloud to prevent unauthorized access.

VI. ADVANTAGE OF CLOUD COMPUTING

Cost efficiency - Cloud computing is probably the most cost efficient method to use, maintain and upgrade, as explained in Traditional desktop software costs companies a lot, in terms of finance. Adding up the licensing fees for multiple users can prove to be very expensive for the establishment concerned. The cloud, on the other hand, is available at much cheaper rates and hence, can significantly lower the company's IT expenses. Besides, there are many one-time-payment, pay-as-you-go and other scalable options available, which makes it very reasonable for the company in question. Paper [6] adds up that it lowers the cost for smaller firms which intend to apply the compute-intensive techniques.

Almost Unlimited Storage. Storing information in the cloud gives you almost unlimited storage capacity.

Backup and Recovery. Since all the data is stored in the cloud, backing it up and restoring the same is relatively much easier than storing the same on a physical device. Furthermore, most cloud service providers are usually competent enoughto handle recovery of information. Hence, this makes the entire process of backup and recovery much simpler than other traditional methods of data storage.

Automatic Software Integration. In the cloud, software integration is usually something that occurs automatically. This means that Cloud users don't need to take additional efforts to customize and integrate their applications as per own preferences. This aspect usually takes care of itself.

Easy Access to Information. Once the users register in the cloud, they can access the information from anywhere, where there is an Internet connection. This convenient feature lets users move beyond time zone and geographic location issues.

Quick Deployment. Lastly and most importantly, Cloud computing gives the advantage of quick deployment. Once opting for this method of functioning, the entire system can be fully functional in a matter of a few minutes. Of course, the amount of time taken here will depend on the exact kind of technology that is needed for the business.

VII. DISADVANTAGE CLOUD COMPUTING

Technical Issues. Though it is true that information and data on the Cloud can be accessed any time and from anywhere, there are moments when the system can have some serious malfunction. Businesses should be aware of the fact that this technology is always prone to outages and other technical issues. Even the best Cloud service providers run into this kind of trouble, in spite of keeping up high standards of maintenance.

Security in the Cloud.The other major issue of Cloud is represented by security. Before adopting this technology, beneficiaries should know that they will be surrendering all their company's sensitive information to a third-party cloud service provider. This could potentially impose a great risk to the company. Hence, business need to make sure that they choose the most reliable service provider, who will keep their information totally secure.

Switching to the cloud can actually improve security for a small business, as mentioned by Michael Redding, managing director of Accenture Technology Labs. "Because large cloud computing companies have more resources, he says, they are often able to offer levels of security an average small business may not be able to afford implementing on its own servers" (Outsource IT Headaches to the Cloud (The Globe and Mail)).

Prone to attack. Storing information in the cloud could make the companies vulnerable to external hack attacks and threats, therefore there is always the lurking possibility of stealth of sensitive data.

Inflexibility. Choosing a Cloud computing vendor often means locking the business into using their proprietary applications or formats. For instance, it is not possible to insert a document created in another application into a Google Docs spreadsheet. Furthermore, a company needs to be able to add and/or subtract Cloud computing users as necessary as its business grows or contracts

VIII. CONCLUSION

We conclude that while Cloud computing technology can prove to be a great asset to companies, it could also cause harm if not understood and used properly.

We consider Cloud computing to be an opportunity for small businesses to balance the efforts implied by IT management of course limited by the disadvantages of Cloud, some of them presented in this paper. The first and most important concern is given by security issues related to having their business data in the Cloud or, in a simpler way, having their data out on the Internet. Nevertheless, the recommendation would be to begin adopting Cloud Computing for a smaller part of their business applications in order to be able to count down the benefits and also to identify the risks

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