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An Enterprise Model - Cloud Computing

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Abstract

Cloud computing is becoming an increasingly popular enterprise model in which computing resources are made available on-demand to the users as needed. The unique value proposition of cloud computing creates new opportunities to align IT and business goals. Cloud computing use the internet technologies for delivery of IT-enabled capabilities 'as a service' to any needed users i.e. through cloud computing we can access anything that we want from anywhere to any computer without worrying about anything like storage, cost, management and so on. Despite the fact that cloud computing offers huge opportunities to the IT industry, the development of cloud computing technology is currently at its infancy, with many issues still to address.

Keywords: Cloud computing-Introduction, Cloud services, Types of cloud, characteristics, conclusion.

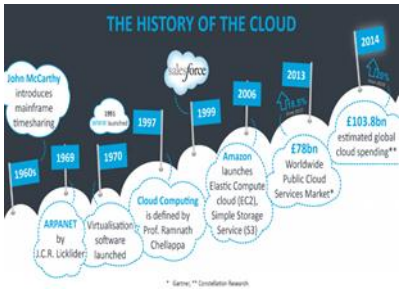
1. Introduction

Cloud computing is an information technology (IT) paradigm that enables ubiquitous access to shared pools of configurable system resources and higher-level 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 businesses instead of expending resources on computer infrastructure and maintenance. Advocates note that cloud computing allows companies to avoid or minimize up-front IT infrastructure costs. Proponents also claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and that it enables IT teams to more rapidly adjust resources to meet fluctuating and unpredictable demand. Cloud providers typically use a "pay-as-you-go" model, which can lead to unexpected operating expenses if administrators are not familiarized with cloud-pricing models.

HISTORY:

While the term "cloud computing" was popularized with Amazon.com releasing its Elastic Compute Cloud product in 2006, references to the phrase "cloud computing" appeared as early as 1996, with the first known mention in a Compaq internal document.

The cloud symbol was used to represent networks of computing equipment in the original ARPANET by as early as 1977, and the CSNET by 1988 — both predecessors to the Internet itself. The word *cloud* was used as



a metaphor for the Internet and a standardized cloud-like shape was used to denote a network on telephony schematics. With this simplification, the implication is that the specifics of how the end points of a network are connected are not relevant for the purposes of understanding the diagram

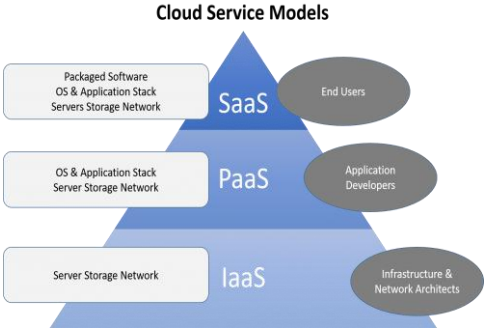
The term *cloud* was used to refer to platforms for distributed computing as early as 1993, when Apple spin-off

General Magic and AT&T used it in describing their (paired) Telescript and PersonaLink technologies. In *Wired's* April 1994 feature "Bill and Andy's Excellent Adventure II", Andy Hertzfeld commented on Telescript, General Magic's distributed programming language:"The beauty of Telescript ... is that now, instead of just having a device to program, we now have the entire Cloud out there, where a single program can go and travel to many different sources of information and create sort of a virtual service. No one had conceived that before. The example Jim White uses now is a date-arranging service where a software agent goes to the flower store and orders flowers and then goes to the ticket shop and gets the tickets for the show, and everything is communicated to both parties."

TYPES OF SERVICE:

1. Infrastructure as a service (IaaS):

"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 Xen, Oracle VirtualBox, Oracle VM, KVM, VMware ESX/ESXi, 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 cgroups 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 over-provisioning and enables usage-based billing. IaaS clouds often offer additional resources such as a virtual-machine disk-image library, raw block storage, file or object storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs), and software bundles. The NIST's definition of cloud computing describes IaaS as "where the consumer is able to deploy and run arbitrary software, which can include operating systems and applications. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage, and deployed applications; and possibly limited control of select networking components (e.g., host firewalls)."IaaS-cloud providers supply these resources on-demand from their large pools of equipment installed in data centers. For wide-area connectivity, customers can use either the Internet. To deploy their applications, cloud users install operating-system images and their application software on the cloud infrastructure In this model, the cloud user patches and maintains the operating systems and the application software. Cloud providers typically bill IaaS services on a utility computing basis: cost reflects the amount of resources allocated and consumed.



2. Platform as a service (PaaS):

The NIST's definition of cloud computing defines Platform as a Service 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.PaaS vendors offer a development environment to application developers. The provider typically develops toolkit and standards for development and channels for distribution and payment. In the PaaS models, cloud providers deliver a computing platform, typically including operating system, programming-language execution environment, database, and web server. Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers. With some PaaS offers like Microsoft Azure, Oracle Cloud Platform and Google App Engine, the underlying computer and storage resources scale automatically to match application demand so that the cloud user does not have to allocate resources manually. The latter has also been proposed by an architecture aiming to facilitate real-time in cloud environment Even more specific application types can be provided via PaaS, such as media encoding as provided by services like bitcodin.com or media.io. Some integration and data management providers have also embraced specialized applications of PaaS as delivery models for data solutions. Examples include iPaaS (Integration Platform as a Service) and dPaaS (Data Platform as a Service). iPaaS enables customers to develop, execute and govern inte-

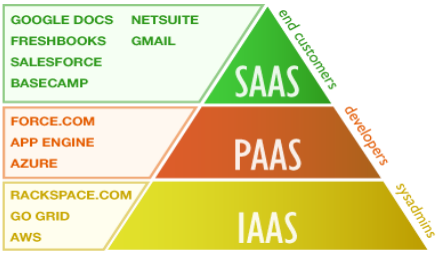
gration flows. Under the iPaaS integration model, customers drive the development and deployment of integrations without installing or managing any hardware or middleware. dPaaS delivers integration—and data-management—products as a fully managed service. Under the dPaaS model, the PaaS provider, not the customer, manages the development and execution of data solutions by building tailored data applications for the customer. dPaaS users retain transparency and control over data through data-visualization tools. Platform as a Service (PaaS) consumers do not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage, but have control over the deployed applications and possibly configuration settings for the application-hosting environment.

A recent specialized PaaS is the Blockchain as a Service (BaaS), that some vendors such as IBM Bluemix and Oracle Cloud Platform have already included in their PaaS offering.

3. Software as a service (SaaS):

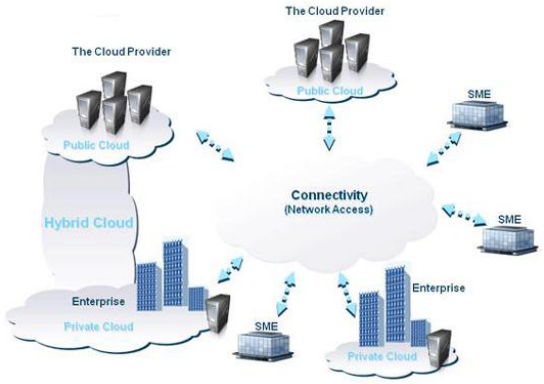
The NIST's definition of cloud computing defines Software as a Service

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 demand. Load balancers distribute the work over the set of virtual machines. This process is transparent to the cloud user, who 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.



Types of cloud:

Cloud computing comes in three forms: public clouds, private clouds, and hybrids clouds. Depending on the type of data you're working with, you'll want to compare public, private, and hybrid clouds in terms of the different levels of security and management required.



Public Clouds:

A public cloud is basically the internet. Service providers use the internet to make resources, such as applications (also known as Software-as-a-service) and storage, available to the general public, or on a ‘public cloud. Examples of public clouds include Amazon Elastic Compute Cloud (EC2), IBM’s Blue Cloud, Sun

Cloud, Google AppEngine and Windows Azure Services Platform.

For users, these types of clouds will provide the best economies of scale, are inexpensive to set-up because hardware, application and bandwidth costs are covered by the provider. It's a pay-per-usage model and the only costs incurred are based on the capacity that is used.There are some limitations, however; the public cloud may not be the right fit for every organization. The model can limit configuration, security, and SLA specificity, making it less-than-ideal for services using sensitive data that is subject to compliancy regulations.

Private Clouds:

Private clouds are data center architectures owned by a single company that provides flexibility, scalability, provisioning, automation and monitoring. The goal of a private cloud is not sell "as-a-service" offerings to external customers but instead to gain the benefits of cloud architecture without giving up the control of maintaining your own data center.

Private clouds can be expensive with typically modest economies of scale. This is usually not an option for the average Small-to-Medium sized business and is most typically put to use by large enterprises. Private clouds are driven by concerns around security and compliance, and keeping assets within the firewall.

Hybrid Clouds:

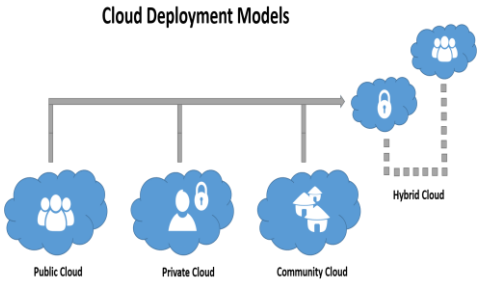
By using a Hybrid approach, companies can maintain control of an internally managed private cloud while relying on the public cloud as needed. For instance during peak periods individual applications, or portions of applications can be migrated to the Public Cloud. This will also be beneficial during predictable outages: hurricane warnings, scheduled maintenance windows, rolling brown/blackouts.

The ability to maintain an off-premise disaster recovery site for most organizations is impossible due to cost. While there are lower cost solutions and alternatives the lower down the spectrum an organization gets, the capability to recover data quickly reduces. Cloud based Disaster Recovery (DR)/Business Continuity (BC) services allow organizations to contract failover out to a Managed Services Provider that maintains multi-tenant infrastructure for DR/BC, and specializes in getting business back online quickly.

A. Characteristics:

Cloud computing exhibits the following key characteristics:

- Agility for organizations may be improved, as



cloud computing may increase users' flexibility with re-provisioning, adding, or expanding technological infrastructure resources.
- Cost reductions are claimed by cloud providers. A public-cloud delivery model converts capital expenditures (e.g., buying servers) to operational expenditure. This purportedly lowers barriers to entry, as infrastructure is typically provided by a third party and need not be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is "fine-grained", with usage-based billing options. As well, less in-house IT skills are required for implementation of projects that use cloud computing. The e-FISCAL project's state-of-the-art repository contains several articles looking into cost aspects in more detail, most of them concluding that costs savings depend on the type of activities supported and the type of infrastructure available in-house.
- Device and location independence enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect to it from anywhere.
- Maintenance of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places (e.g., different work locations, while travelling, etc.).
- Multitenancy enables sharing of resources and costs across a large pool of users thus allowing for:

  - centralization of infrastructure in locations with lower costs (such as real estate, electricity, etc.)
  - peak-load capacity increases (users need not engineer and pay for the resources and equipment to meet their highest possible load-levels) utilisation and efficiency improvements for systems that are often only 10–20% utilised.
- Performance is monitored by IT experts from the service provider, and consistent and loosely coupled architectures are constructed using web services as the system interface.
- Resource pooling is the provider's computing resources are commingle to serve multiple consumers using a multi-tenant model with different physical and virtual resources dynamically assigned and reassigned according to user demand. There is a sense of location independence in that the consumer generally have no control or knowledge over the exact location of the provided resource.
- Productivity may be increased when multiple users can work on the same data simultaneously, rather than waiting for it to be saved and emailed. Time may be saved as information does not need to be re-entered when fields are matched, nor do users need to install application software upgrades to their computer.
- Reliability improves with the use of multiple redundant sites, which makes well-designed cloud computing suitable for business continuity and disaster recovery.
- Scalability and elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis in near real-time without users having to engineer for peak loads. This gives the ability to scale up when the usage need increases or down if resources are not being used.

Security can improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because service providers are able to devote resources to solving security issues that many customers cannot afford to tackle or which they lack the technical skills to address. However, the complexity of security is greatly increased when data is distributed over a wider area or over a greater number of devices, as well as in multi-tenant systems shared by unrelated users. In addition, user access to security audit logs may be difficult or impossible. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security.

B. 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.

According to the Cloud Security Alliance, the top three threats in the cloud are Insecure Interfaces and API's, Data Loss & Leakage, and Hardware Failure—which accounted for 29%, 25% and 10% of all cloud security outages respectively. Together, these form shared technology vulnerabilities. In a cloud provider platform being shared by different users there may be a possibility that information belonging to different customers resides on same data server. Additionally, Eugene Schultz, chief technology officer at Emagined Security, said that hackers are spending substantial time and effort looking for ways to penetrate the cloud. "There are some real Achilles' heels in the cloud infrastructure that are making big holes for the bad guys to get into". Because data from hundreds or thousands of companies can be stored on large cloud servers, hackers can theoretically gain control of huge stores of information through a single attack—a process he called "hyperjacking". Some examples of this include the Dropbox security breach, and iCloud 2014 leak. Dropbox had been breached in October 2014, having over 7 million of its users passwords stolen by hackers in an effort to get monetary value from it by Bitcoins (BTC). By having these passwords, they are able to read private data as well as have this data be indexed by search engines.

There is the problem of legal ownership of the data .Many Terms of Service agreements are silent on the question of ownership. Physical control of the computer equipment (private cloud) is more secure than having the equipment off site and under someone else's control (public cloud). This delivers great incentive to public cloud computing service providers to prioritize building and maintaining strong management of secure services. Some small businesses that don't have expertise in IT security could find that it's more secure for them to use a

public cloud. There is the risk that end users do not understand the issues involved when signing on to a cloud service. This is important now that cloud computing is becoming popular and required for some services to work, for example for an intelligent personal assistant . Fundamentally, private cloud is seen as more secure with higher levels of control for the owner, however public cloud is seen to be more flexible and requires less time and money investment from the user.

C. Limitations and disadvantages:

According to Bruce Schneier, "The downside is that you will have limited customization options. Cloud computing is cheaper because of economics of scale, and — like any outsourced task — you tend to get what you get. A restaurant with a limited menu is cheaper than a personal chef who can cook anything you want. Fewer options at a much cheaper price: it's a feature, not a bug." He also suggests that "the cloud provider might not meet your legal needs" and that businesses need to weigh the benefits of cloud computing against the risks. In cloud computing, the control of the back end infrastructure is limited to the cloud vendor only. Cloud providers often decide on the management policies, which moderates what the cloud users are able to do with their deployment. Cloud users are also limited to the control and management of their applications, data and services. This includes data caps, which are placed on cloud users by the cloud vendor allocating certain amount of bandwidth for each customer and are often shared among other cloud users. Cloud computing is beneficial to many enterprises; it lowers costs and allows them to focus on competence instead of on matters of IT and infrastructure. Nevertheless, cloud computing has proven to have some limitations and disadvantages, especially for smaller business operations, particularly regarding security and downtime. Technical outages are inevitable and occur sometimes when cloud service providers become overwhelmed in the process of serving their clients. This may result to temporary business suspension. Since this technology's systems rely on the internet, an individual cannot be able to access their applications, server or data from the cloud during an outage.

Conclusion:

Cloud computing is changing the way IT departments but IT. Business have a range of paths to the cloud, including infrastructure, platforms and applications that are available from cloud providers as online services. Many people may be confused by the range of offerings and the terminology used to describe them and will be unsure of the risk and benefits. Cloud computing is a really cheap way for companies to have all the resources they need in once place. It's a much better way to spread your resources, and it becomes easier to access things from longer distances.

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