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# Cloud Computing

CIS 5100: IS/IT Architecture Term Project

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## Abstract:

This project reports covers the cloud computing concepts with comparisons of SaaS vs PaaS vs IaaS. It also includes case studies where the application of cloud computing can be observed and how it has been proven beneficial to the company's growth and development. Also currently, it is being used by big tech companies where the employees or clients have access to the applications or projects on cloud.

Keywords: Cloud, Cloud computing, SaaS, IaaS, PaaS

## 1. Introduction

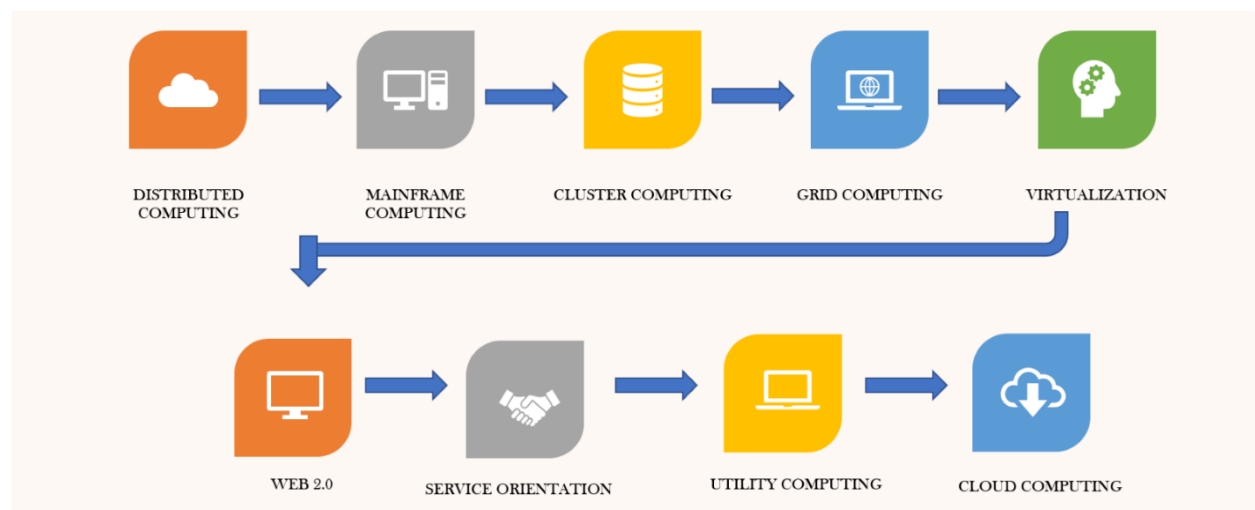
Cloud Computing is one of the most potent technologies used in the 21st century. This innovation has undoubtedly risen for a decade because of a surge in smartphones and mobile devices that allow internet access. Today, cloud computing is not just used by companies and organizations for their business; but even an average user or customer makes the ultimate use of the cloud in their day-to-day activities. It helps to use the software programs without installing them in the local system, thus making it memory efficient. And one can use it to store photos and videos and access the content over the internet from any device the user has control. It also leads to a dramatic decrease in labor and maintenance costs. As a result, with the hardware owned by the vendors and stored in off-site locations, there is less demand for in-house IT staff. This benefits the business from the purchase cost, off-site hardware cuts internal power costs and saves space. Cloud solutions are obtainable in a pay-as-you-go pricing model. This format provides savings and flexibility where the company does not have to pay for the software that is not utilized.

This project report will include the history, importance, and implementation of cloud computing, both in technical and social perspectives, and a comparative analysis of various cloud computing services.

## 2. Evolution of Cloud Computing

One of the enormous innovations was taken in the 1990s when distributed Computing was first punched to allow users to obtain computing power. Later in 1999, Salesforce became the first company to offer their applications over the internet, thus introducing software as a Service (SaaS) to the world. Further, in 2008, Microsoft launched “Azure” as its cloud application platform. The cloud application allowed people to share files, links, music, and videos over the internet. Many industries today are utilizing cloud computing platforms for their continuous growth and development.

The below architecture will display the technologies built from the point of view in cloud and how the birth of cloud computing took its root in the modern world.



- **Distributed Computing** is the collection of independent computer systems connected to a network and communicate with one another utilizing messages. The major advantages of distributed computing are dependability, concurrency, continuous availability, differentially and independent of failures. At the same time, the

disadvantage was with the network location, as all the systems were required to be closer to each other to function.

- **Mainframe computing** was exceptionally reliable machines. These computing systems have no stoppage with high error tolerance which increases the processing abilities of the system. However, the mainframe systems were overly expensive, and thus to reduce the cost, cluster computing got innovated.
- **Cluster computing systems** were cheaper than the mainframe systems and equally responsible for high processing power. Additionally, new nodes were quickly added to the cluster if needed. However, the problem related to the network location was still ongoing and hence to resolve the issue, grid computing was introduced.
- **Grid computing** consisted of disparate nodes thus leading to efficient functioning when placed at a different geographical location and all the systems were connected using the internet. The major issue with these systems was the low availability of high bandwidth and other network problems.
- **Virtualization** is the procedure to develop a virtual layer over the hardware that would allow the users to run various programs together on a hardware. It is the foundation for various major computing services such as Amazon EC2 and VMware Cloud.
- **Web 2.0** is the technology behind interactive and flexibility among web pages. Social Media, Google Maps, Orkut, Facebook, and Twitter are some of the examples of web 2.0.

- **Service Orientation** solves the problem of costing, flexibility and new features.

Major concepts introduced in this model are the Quality of Service (QoS) and Software as a Service (SaaS).

- **Utility Computing** gave more advancement in areas of storage, infrastructure and providing customers with customized plans on a pay-per-use basis.

- **Cloud Computing** is the evolution of all the above technologies, and it is also referred to as internet-based computing, which gives access to data and programs on remote servers instead of working on computer hardware or local server system.

### 3. Comparison Analysis on Cloud Service Models

Features	SaaS	PaaS	IaaS
<b>Abbreviation</b>	Software as a Service	Platform as a Service	Infrastructure as a Service
<b>Uses</b>	It is accessible through a third party over the Internet	It uses virtualization to offer application development platforms to developers or organizations	It provides cloud-based services
<b>Used by</b>	End users	Developers	Network Architects
<b>Access</b>	It provides access to end-users.	Access to run time environment to deployment and application hosting and development tools	IaaS provides access to virtual machines and virtual storage.
<b>Model</b>	The Cloud provider hosts the applications and makes them available to end-users over the Internet	Deliver the tools required for application development	IaaS provides visualized computing resources over the internet

<b>Technical understanding</b>	No knowledge is required about technical things	Having some knowledge to understand the basic setup	Technical knowledge required
<b>Cloud services</b>	Facebook, Google apps, and Microsoft office	Facebook and Google search engine	Amazon web services, Azure
<b>Popularity</b>	It is mostly between consumer and company	Among the developers who focus on the development apps and scripts	Popular between developers and researchers
<b>Cost</b>	It is cost-efficient, easier, and faster for organizations to utilize as they do not have to purchase, manage, and support the underlying infrastructure	This does not require any setup or maintenance cost of the underlying infrastructure.	Requires no upfront cost as compared to on-premises server installation. This usually is deployed in a pay-as-you-go model where you simply pay for what you use.
<b>Scalability</b>	Used for common business applications and offers greater	It helps to create unique business applications and is	It offers higher on-demand scalability which can be



	scalability and  enables multi-user  access	less scalable than  SaaS. It offers single-  user access	configured as  needed.
<b>Examples</b>	Google Workspace,  Salesforce, Dropbox,  DocuSign, and Slack	Google App engine,  Windows Azure,  OpenShift,  Force.com	AWS (Amazon Web Services) EC2,  Microsoft Azure and  Digital Ocean.

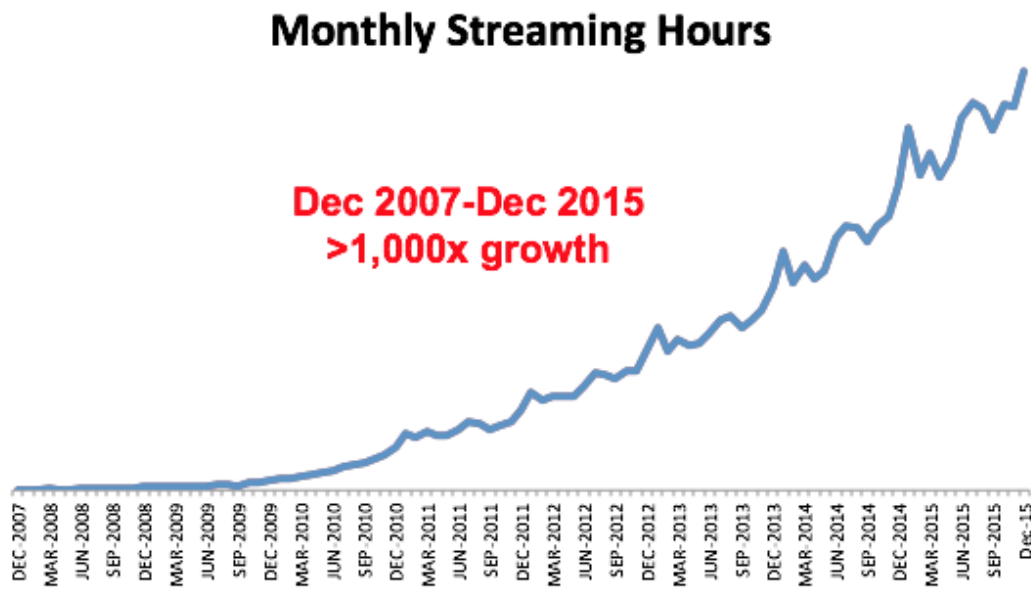
## 4. Case study on popular cloud applications

### Amazon Web Services

**Case Study:** Netflix and Amazon Web Services.

**Problem:** In today's world, Netflix has become one of the most important streaming devices in every apartment. Netflix initially had a business model of selling DVDs of the customer's choice. But in 2008, they experienced a major database loss which impacted the shipping of DVDs for 3-4 days to the customers. This case study demonstrates the solution taken and how Netflix overcame the problem and evolved into one of the most popular apps today.

**Solution:** To overcome the above problem, one of the senior management executives taught about shifting the business model to a scalable horizontal system. Even having Amazon Prime as their competitors, they chose Amazon Web Services as it provided them with more scaling capabilities and a lot of new features. It eventually took Netflix 7 years to completely transition their data and services to the cloud. Since then, Netflix had an increase in their monthly streaming hours and the graph was rapidly upwards as shown below.



Counting today, Netflix is streaming into 130 countries and uses multiple AWS cloud channels throughout the world to create a better customer experience. The company depends on the cloud infrastructure for all its usability, computing, storage requirements to big data processing, and tons of other functions.

Hence, we can infer that taking the cloud-native approach helped Netflix to fundamentally change the dynamics of the company.

### Microsoft Azure

**Case study:** Disaster recovery solution by Saviant consulting.

#### Introduction:

The client is a 50-year-old company that has evolved into a bona fide “brand performance agency”, that offers services designed to maximize a brand potential in the marketplace. The client adds expertise and value at every possible stage of a brand performance process, from research and aiming to product development, and from sourcing and fulfillment to global distribution.

**Problem/Goal:**

Small and medium businesses understand the importance of disaster recovery sites to ensure business continuity. However, traditional disaster recovery sites involve the creation of secondary data centers at an additional cost that SMEs cannot afford. It also imposes an additional cost burden on the company as the secondary data center runs in parallel to the primary data center thus enterprise needs to manage two data centers at a time.

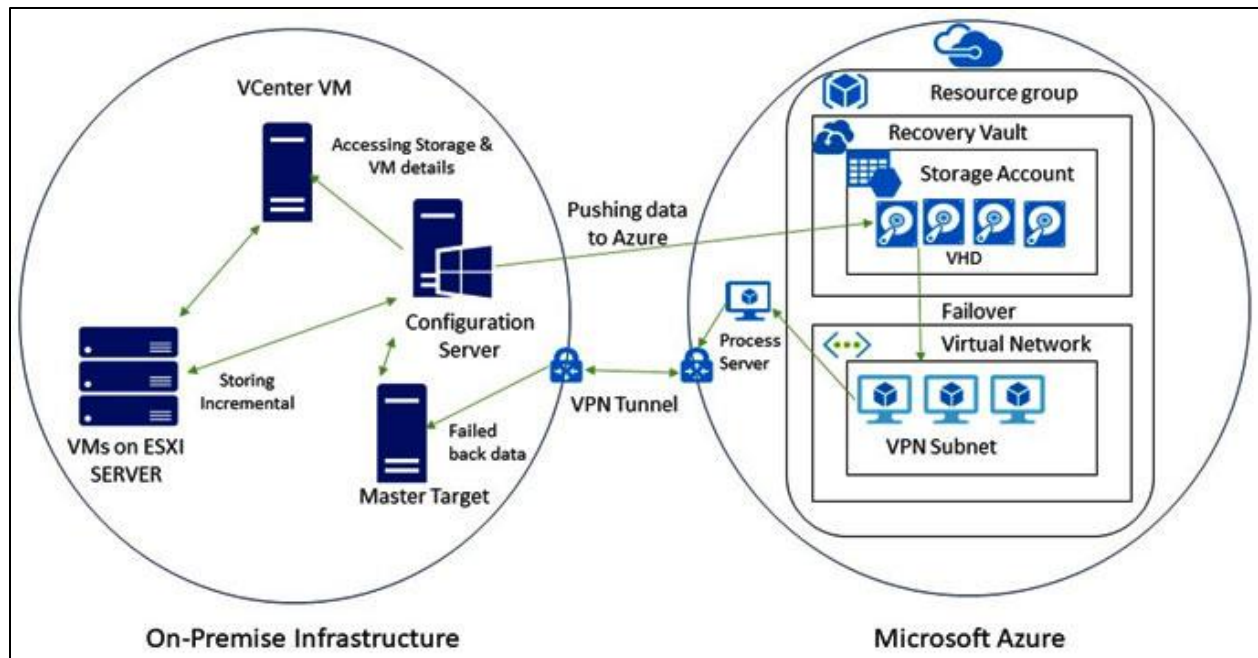
Clients want a reliable and cost-effective solution for creating a Disaster recovery site. The data would be kept safe, and apps/workloads run when planned & unplanned outages occur.

**Technology Solution:**

Saviant 's Azure IaaS consultants analyzed the on-premises IT infrastructure of the client and configured the DR site in Azure Cloud using the Azure Site Recovery Service.

Their solution replicates the client's on-premises infrastructure in the Azure network. Whenever there would be a disaster situation their applications would easily failover to the Azure environment with minimum downtime.

Azure site recovery offers seamless fallback to the on-premises network once the situation is back to normal. This solution to replicate into the azure environment costs much less compared to setting up an entire DR network on-premises. The Azure cost is incurred only for replication and storage.



*Disaster recovery solution by Saviant consulting*

## 5. Future outcomes of cloud computing

As cloud computing is becoming an asset for any organization, more companies prefer the storage of massive amounts of data in the cloud. And one of the major future aspects of cloud computing will be the efficiency increase of storage capacities and the development of the security standards. Moreover, it has minimized nonessential IT expenditures which have helped businesses with cost reduction opportunities. Cloud computing is tremendously admired for its mobility, reduced risk, and availability. It is envisioned that in the near future it will make a major jump in every industry.

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