International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 09 Issue: 12 | Dec 2022 www.irjet.net p-ISSN: 2395-0072

Comprehensive Study on Deployment Models and Service Models in Cloud Computing.

Dhanashri Ravi Patil[1], Prof. Chetan S. Arage[2], Pratik S. Gaikwad[3]

[1, 3] *Research Student, Department of Computer Science and Engineering,*
[2] *Professor Department of Computer Science and Engineering,*
[1, 2, 3] *Sanjay Ghodawat University*

Abstract - *Since its inception Cloud Computing is making a paradigm shift in the world of computing technology. Based on pay-peruse principle it provides a variety of services to both individual and industry. The services it provides include Platform-asa-Service (PaaS), Software-as-a-Service (SaaS) and Infrastructure-as-a-Service (IaaS) and it is still making its way to other similar services. These services models have certain requirements to be met and other security and design issues. This paper aims at discussing these three services models, important factors for these models and challenges currently faced by these services models.*

Key Words: Cloud Computing, Service Models in Cloud, Deployments in Cloud Computing.

1. INTRODUCTION

Cloud computing is a type of internet-based computing that allows computers and other devices to share different processing resources and data. Cloud computing is a thriving technology that offers a variety of services such as computers, databases, storage, virtual machines, servers, analytics, machine intelligence, and many more. Cloud computing delivers these services over the internet, making it scalable and allowing businesses to save capital expenditures on hardware purchases. The National Institute of Standards and Technology defines cloud computing as "a model for enabling ubiquitous, convenient, or demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and related with minimal management effort or service provider interaction."[1]

Cloud models are classified into two types: service models and deployment models. Service models are categorised based on the sorts of cloud services supplied, whereas deployment models are classed based on how and by whom the cloud services are used. There are three types of service models: IaaS (Infrastructure as a Service), PaaS (Platform as a Service), and SaaS (Software as a Service) (Software as a Service). NIST officially recognises these three models. There are several additional well-known cloud services, such as MBaaS (Mobile Backend as a Service), DaaS (Data as a Service), MaaS (Monitoring as a Service), and so on. Public cloud, private cloud, community cloud, and hybrid cloud are all deployment methods. There are various cloud deployment models, such as Inter cloud, Distributed cloud etc.

2. CHARACTERISTICS OF CLOUD COMPUTING

There has been substantial debate in industry and academics over what exactly cloud computing entails. [2][3][4].The National Institute of Standards and Technology (NIST) in the United States has created a working definition that encompasses the most widely accepted characteristics of cloud computing. Cloud computing is defined as "a model for providing convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." Cloud computing has the following five fundamental qualities, according to this definition:

1) On-demand self-service.
2) Broad network access.
3) Resource pooling.
4) Rapid elasticity.
5) Measured Service.

Cloud computing is a new distributed computing paradigm that promises to provide consumers with cost-effective, scalable on-demand services without requiring massive upfront infrastructure investments [5]. One of the primary reasons for cloud computing's success is the role it has played in removing the scale of a business as a significant component in its economic success. An outstanding illustration of this shift is the concept of data centres, which eliminates the need for small businesses to invest heavily in infrastructure in order to gain a worldwide client base [6].

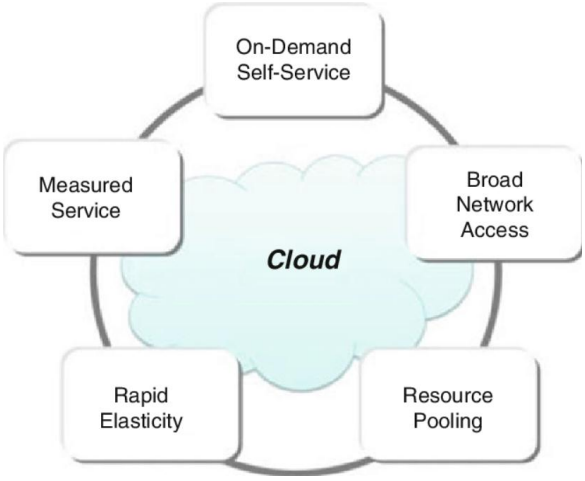


Fig 1 Source: internet

3. CLOUD COMPUTING DEPLOYMENT MODEL

It is necessary to discuss the fundamental cloud service deployment capabilities of each architecture right away. Four fundamental types of cloud computing are defined by NIST [National Institute of Standards and Technology]:

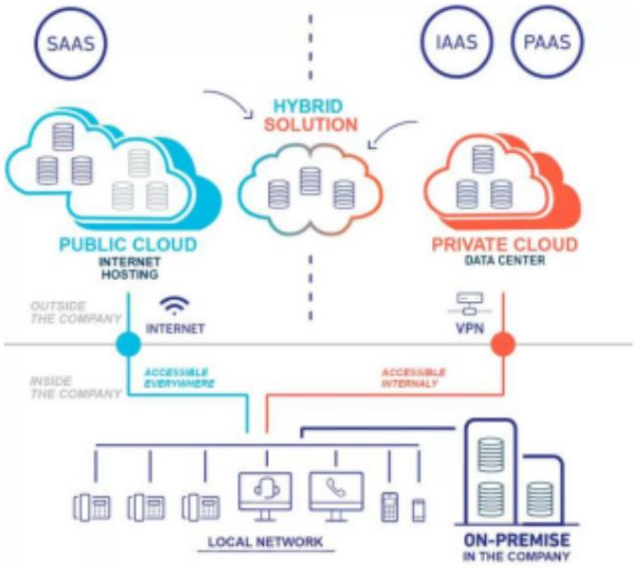


Fig 2 Source: https://www.padok.fr/

3.1 Public Cloud –

The name is self-explanatory. It is open to the public. Public cloud deployment strategies are ideal for enterprises with changeable and rising demands. It is also an excellent alternative for businesses with fewer security concerns. As a result, you pay a cloud service provider for networking, computing virtualization, and storage on the public internet. It is also an excellent delivery mechanism for development and testing teams. Its rapid and simple configuration and deployment make it an excellent choice for test environments.

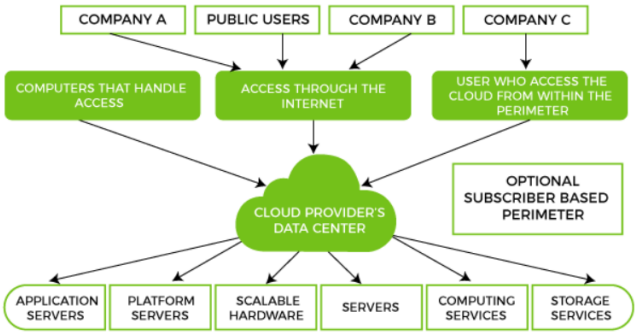


Fig 3 : Source: Internet

Benefits of Public Cloud

- Minimal Investment - As a pay-per-use service, there is no large upfront cost and is ideal for businesses who need quick access to resources
- No Hardware Setup - The cloud service providers fully fund the entire Infrastructure
- No Infrastructure Management - This does not require an in-house team to utilize the public cloud.

Limitations of Public Cloud

- Data Security and Privacy Concerns - Since it is accessible to all, it does not fully protect against cyber-attacks and could lead to vulnerabilities.
- Reliability Issues - Since the same server network is open to a wide range of users, it can lead to malfunction and outages
- Service/License Limitation - While there are many resources you can exchange with tenants, there is a usage cap.

3.2 Private Cloud –

The public cloud deployment paradigm is diametrically opposed to the private cloud deployment model. It is a one-on-one setting for a single user (customer). It is not necessary to share your hardware with anyone. The contrast between private and public cloud is in how all of the hardware is handled. The capacity to access systems and services within a certain border or organization is referred to as the "internal cloud." The cloud platform is deployed in a secure cloud environment secured by robust firewalls and overseen by an organization's IT staff.

The private cloud allows for better control over cloud resources.

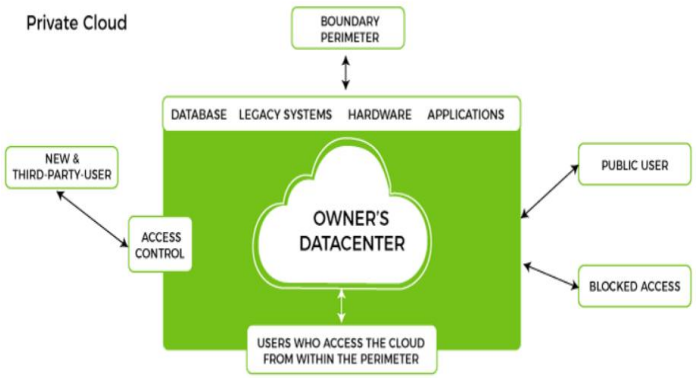


Fig 4 Source: Internet

Benefits of Private Cloud

- Data Privacy - It is ideal for storing corporate data where only authorized personnel gets access
- Security - Segmentation of resources within the same Infrastructure can help with better access and higher levels of security.
- Supports Legacy Systems - This model supports legacy systems that cannot access the public cloud.

Limitations of Private Cloud

- Higher Cost - With the benefits you get, the investment will also be larger than the public cloud. Here, you will pay for software, hardware, and resources for staff and training.
- Fixed Scalability - The hardware you choose will accordingly help you scale in a certain direction
- High Maintenance - Since it is managed in-house, the maintenance costs also increase.

3.3 Community Cloud

It enables a number of businesses to access systems and services. It is a distributed system made by combining the functions of many clouds to meet the unique requirements of a neighbourhood, sector, or company. The community's infrastructure might be shared by organisations with similar interests or duties. It is often handled by a third party or a collaboration of one or more community organisations.

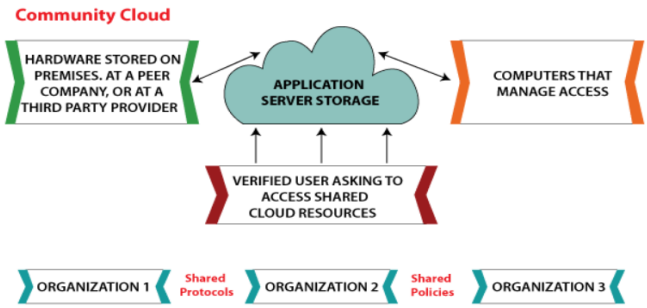


Fig 5 Source : Internet

3.4 Hybrid Cloud

Hybrid cloud is a solution that combines a private cloud with one or more public cloud services, with proprietary software enabling communication between each distinct service. A hybrid cloud strategy provides businesses with greater flexibility by moving workloads between cloud solutions as needs and costs fluctuate. Hybrid cloud services are powerful because they give businesses greater control over their private data. An organization can store sensitive data on a private cloud or local datacenter while simultaneously leveraging the robust computational resources of a managed public cloud—and manage it all in a single plane of glass.

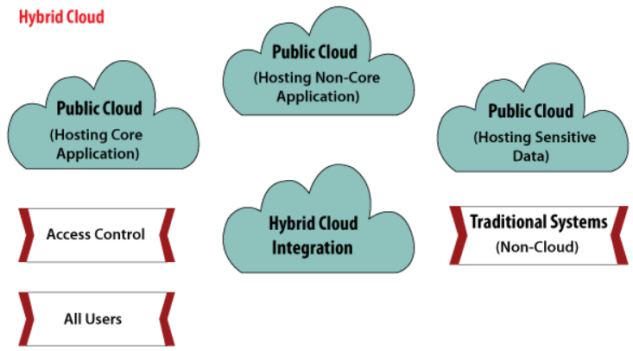


Fig 6 Source: Internet

Benefits of Hybrid Cloud

- Cost-Effectiveness - The overall cost of a hybrid solution decreases since it majorly uses the public cloud to store data.
- Security - Since data is properly segmented, the chances of data theft from attackers are significantly reduced.
- Flexibility - With higher levels of flexibility, businesses can create custom solutions that fit their exact requirements

Limitations of Hybrid Cloud

- Complexity - It is complex setting up a hybrid cloud since it needs to integrate two or more cloud architectures
- Specific Use Case - This model makes more sense for organizations that have multiple use cases or need to separate critical and sensitive data

Important Factors to Consider	Public	Private	Community	Hybrid
Setup and ease of use	Easy	Requires professional IT Team	Requires professional IT Team	Requires professional IT Team
Data Security and Privacy	Low	High	Very High	High
Scalability and flexibility	High	High	Fixed requirements	High
Cost-Effectiveness	Most affordable	Most expensive	Cost is distributed among members	Cheaper than private but more expensive than public
Reliability	Low	High	Higher	High

Chart -1: A Comparative Analysis of Cloud Deployment Models

4. CLOUD COMPUTING SERVICE MODELS

This technology paradigm has gone through several stages throughout the years. Grid, utility, and on-demand computing were older kinds of computing that before current cloud computing. The early types of contemporary cloud computing, such as Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), originated as a technological byproduct of falling computer and server hardware prices. Individual servers might be purchased by users to meet their computing needs.

The cloud paradigm originated when software and hardware providers collaborated to integrate many servers in an effort to harness the massive computational capacity created by a grid (or network) of linked servers. Concurrently, the recent advancement of digital networking technologies that underpin the World Wide Web formalised the present idea of "cloud computing." In recent years, technology vendors have parlayed cloud computing systems into numerous tiers of service, including SaaS, PaaS, and IaaS.

Cloud computing is able to provide a variety of services at the moment but main three services are Infrastructures-A-Service, Platform-As-A-Service and Software-As-AService also called as service model of Cloud computing

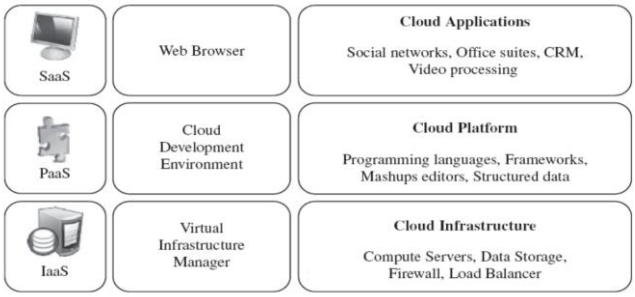


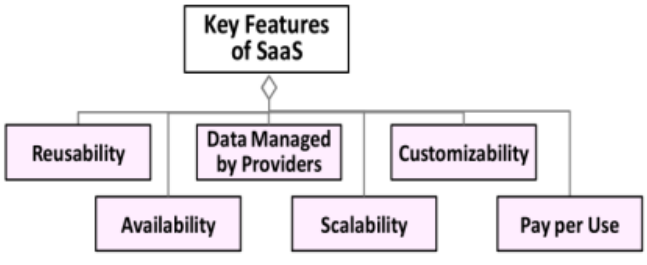
Fig 7 Source: Medium.com

4.1 Infrastructure-As-A-Service [IaaS]

The core computing resources are hardware and software components. They lay the foundations of every computing infrastructure. Infrastructure-as-a-Structure service of cloud computing provides these services to cloud end users. In other words IaaS is making user free of these services. End users can hire any of these services at the level they desire. User has to pay only for the usage of his resources. IaaS is to provide computing infrastructure and operating middleware. Grid/Cluster architectures provide high performance infrastructures to the organizations on rent bases and make them free from their own resources. So organizations can put their attention on manufacturing and quality concerns. The main concept behind IaaS is the resource virtualization. It allows the user to have his own guest operating system on top of infrastructure provided by the cloud provider. This concept leads to automatic deployment of infrastructure which is both distributed and scalable. The administration, deployment, and maintenance is the responsibility of the service provider.

4.2 Software-As-A-Service (SaaS)

SaaS is the top layer of cloud computing services. It is different than traditional software services, where traditional software need own hardware and software components, Where SaaS makes users, independent of their own resources. Users use the integrated services provided by cloud operator. One of the best examples of SaaS is Google Docs.



Quality Model of SaaS

Fig 8 Source: Internet

4.3 Platform-As-A-Service (PaaS)

Platform as a service provides a development platform to its users so that they can develop and maintain their applications and cloud specific utilities. It is different from SaaS because SaaS is a developed and deployed application and PaaS provides a platform or ground to develop those applications. PaaS provides development environment and platform, so all supporting material i.e. programming environment, development tools and infrastructure etc. must be provided by cloud provider

Attribute System	Features	Challenges
Infrastructure-as-a-Service	1. Elasticity 2. Transferring the risks 3. Reduced operational costs 4. Availability of latest infrastructure 5. Inter-operatability 6. Disaster recovery	1. Temperature of cloud places need to be maintained 2. System should be power failure tolerant 3. Selection of infrastructure hardware is very important 4. Connection between cloud and hardware should be a high bandwidth channel 5. Storage of cloud should be able to fulfill the changing demands of large data size 6. Loss of control
Software-as-a-Service	1. Cost minimization 2. High throughput 3. Time saving 4. Availability of high tech services 5. High availability 6. Reduced administration cost	1. Data security is highly preferred feature 2. High availability requirement 3. Authentication and authorization 4. Data integrity 5. Data privacy 6. Network security 7. Cloud standardization 8. Deployment of cloud resources in different countries results in conflict of rules 9. Data backup 10. Web application security 11. Data confidentiality 12. Virtualization
Platform-as-a-Structure	1. Access of high level infrastructure 2. Flexibility 3. Ready to use services 4. Scalability 5. Less administration cost	1. Limited APIs 2. Data Lock-in 3. Auditability 4. Performance is unpredictable 5. Lack of control over low level security 6. Data inaccessibility between applications 7. Vulnerabilities of web applications and SOA

Chart -2: Features and challenges of cloud computing services models

3. CONCLUSIONS

Cloud computing is an emerging technology which introduced itself as a service oriented technology. It is working on the principle of on demand service and scalability. It is providing services in many ways including software, platform and infrastructure and making the users free of installing and administering these services. In spite the fact that cloud computing provide high performance, high available, fault tolerant services; the issues it comes with are also very serious in nature. Of the worth mentioning are data and network security, data authenticity and audit ability, lack of user control over data and security polices and virtualization problem. In order to attract the organizations and build the confidence of customer, these issues need to be well researched and resolved

REFERENCES

[1] L. Gonzalez, L. Merino, J. Caceres, and M. Lindner, "A Break in the Clouds: Towards a Cloud Definition", Computer Communication Review, 39(1), 2009.

[2] D. Plummer, T. Bittman, T. Austin, D. Cearley, and D. Smith, "Cloud computing: Defining and describing an emerging phenomenon", Technical report, Gartner, 2008.

[3] J. Staten, S. Yates, F. Gillett, W. Saleh, and R. Dines, "Is cloud computing ready for the enterprise?", Technical report, Forrester Research, March 2008

[4] M. Armbrust, A. Fox, R. Griffith, A. D. Joseph, R. Katz, A. Konwinski, G. Lee, D. Patterson, A. Rabkin, I. Stoica, and M. Zaharia, "A view of cloud computing," Commun. ACM, 53:50–58, April 2010.

[5] D. Agrawal, A. El Abbadi, F. Emekci, and A. Metwally, "Database Management as a Service: Challenges and Opportunities," In ICDE, 1709–1716, 2009.

[6] Aniruddha S. Rumale, D.N.Chaudhari, " Cloud Computing: Infrastructure as a Service," International Journal of Inventive Engineering and Sciences (IJIES) ISSN: 2319–9598, Volume-1, Issue-3, February 2013.