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A Comparative Study of Various Cloud Computing Applications

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Abstract: ***In this recent scenario various organizations and companies are trying to reduce their cost like IT infrastructure, network and software. In this way, cloud technology is very useful powerful and flexible software environment, which delegates the material's management and in which users pay as they go. The migration of enterprise applications on the Cloud is increasing. Most of these applications are available with a standardized access to the business logic through Internet. The users assume that infinite resources are available and pay only for the resources they consume. Different cloud computing providers have emerged during recent years, providing various services and features to end users. Due to the diversity of the features provided by these providers, it becomes very difficult for an ordinary user to select a platform based on their requirements. This paper provides reflections on different cloud computing providers currently available in market. It analyzes the features provided by existing providers and summarizes the current options available to an ordinary user. Based on comparative study, conclusions have been drawn and research avenues have been highlighted.***
Keywords: Cloud Computing, Cloud Services, Comparative study, On-premises.

I. INTRODUCTION

A. Cloud Computing

Cloud Computing (Shriwas, M. J. et al., 2012) is one of the computing model, not a technology. It is another version of internet technology. In this model "customers" plug into the "cloud" to access IT resources which are priced and provided "on-demand". Essentially, these IT resources are accessible and shared among multiple users. In very easy words we can define cloud computing as it is provider of pooled network resources such as CPU, RAM, Storage, software over the web. These services are easily provides and released on demand. These days hosting companies are provided cloud servers, cloud resources, cloud storage, software hosted on the cloud environment. The business people use cloud in minimum cost they just pay for the storage usage. Cloud Computing combine virtualization (one computer hosting several "virtual" servers), automated provisioning (servers have software installed automatically), and Internet connectivity technologies to provide the service. These are not new technologies but a new name applied to a collection of older technologies that are packaged, sold and delivered in a new way.

B. Types of Cloud Services

There are various services provided by cloud. Most cloud computing services fall into following three broad categories:

1) *Infrastructure-as-a-Service (IaaS):* It is the most basic category of cloud computing services. With IaaS, we rent IT infrastructure servers and virtual machines (VMs), storage, networks, operating systems from a cloud provider on a pay-as-you-go basis. (https://www.computenext.com/blog/when-to-use-saas-paas-and-iaas/) [11] Moving down the stack, we get to the fundamental building blocks for cloud services. IaaS is comprised of highly automated and scalable compute resources, complemented by cloud storage and network capability which can be self-provisioned, metered, and available on-demand.
2) *Platform as a Service (PaaS):* Platform-as-a-service (PaaS) refers to cloud computing services that supply an on-demand environment for developing, testing, delivering and managing software applications. PaaS is designed to make it easier for developers to quickly create web or mobile apps, without worrying about setting up or managing the underlying infrastructure of servers, storage, network and databases needed for development.
3) *Software as a Service (SaaS):* Software-as-a-service (SaaS) is a method for delivering software applications over the Internet, on demand and typically on a subscription basis. With SaaS, cloud providers host and manage the software application and underlying infrastructure and handle any maintenance, like software upgrades and security patching. Users connect to the application over the Internet, usually with a web browser on their phone, tablet or PC.

C. Deployment Model of Cloud

The Deployment models of Cloud [10] are three types are commonly used:-

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1) *Private Cloud:* It is also known as Internal Cloud or on-premises Cloud. It is managed and operated by single organization or a group. It is also known as internal cloud or on-premise cloud, a private cloud provides a limited access to its resources and services to consumers that belong to the same organization that owns the cloud. In the other words, the infrastructure that is managed and operated for one organization only, so that a consistent level of control over security, privacy, and governance can be maintained [10].

2) *Public Cloud:* It is also known as external cloud or multitenant cloud. It is available and open used by general public. It may be owned and managed by government organization or some combination of them. It is referred as external cloud or multi-tenant cloud, this model represents an openly accessible cloud environment in this cloud can be accessed by general public. Customer can access resources and pay for the operating resources. Public Cloud can host individual services as well as collection of services.

3) *Community Cloud:* It refers to an special purpose cloud environment which is shared and managed by number of related organization participating in a common domain or vertical market. This deployment model share resources with many organizations in a community that shares common concerns (like security, governance, compliance etc.). It typically refers to special-purpose cloud computing environments shared and managed by a number of related organizations participating in a common domain or vertical market[10].

4) *Hybrid Cloud:* It is composition of two or more distinct cloud infrastructure (private, community or public) but they are bound together by standardized technologies that enable data and application portability. A hybrid cloud is a combination of public and private cloud. It provides benefits of multiple deployment models. It enables the enterprise to manage steady-state workload in the private cloud [10].

II. DIFFERENT CLOUD COMPUTING SERVICE PROVIDERS

In the arena of cloud computing there are enormous of service providers available, some of them are:

A. *Amazon*

Amazon provides all three types of services as Iaas, Saas and Paas. These services are known as different service name. EC2 (IaaS), Amazon Web Services (PaaS), Amazon Web Services (SaaS), S3 (Simple Storage Services).

1) *EC2 (Elastic Cloud Compute):* Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides secure, resizable compute capacity in the cloud. It is designed to make web-scale cloud computing easier for developers. Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate them from common failure scenarios.
2) *S3 (Simple Storage Service):* Amazon Simple Storage Service (Amazon S3) is object storage with a simple web service interface to store and retrieve any amount of data from anywhere on the web. It is designed to deliver 99.999999999% durability, and scale past trillions of objects worldwide. Customers use S3 as primary storage for cloud-native applications; as a bulk repository, or "data lake," for analytics; as a target for backup & recovery and disaster recovery; and with server less computing. It's simple to move large volumes of data into or out of Amazon S3 with Amazon's cloud data migration options. Once data is stored in S3, it can be automatically tiered into lower cost, longer-term cloud storage classes like S3 Standard - Infrequent Access and Amazon Glacier for archiving.

B. *Google cloud computing platform*

Google Cloud Platform is a cloud computing service byGoogle(https://en.wikipedia.org/wiki/Google_Cloud_Platform) [12] that offers hosting on the same supporting infrastructure that Google uses internally for end-user products like Google Search and YouTube. Cloud Platform provides developer products to build a range of programs from simple websites to complex applications. Google Cloud Platform is a part of a suite of enterprise services from Google Cloud [disambiguation needed] and provides a set of modular cloud-based services with a host of development tools. For example, hosting and computing, cloud storage, data storage, translations APIs and prediction APIs.

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The products of Google cloud computing platform are:

1) Google Compute Engine – IaaS service providing virtual machines.
2) Google App Engine – PaaS service for directly hosting applications.
3) Bigtable – IaaS service providing storage services.
4) BigQuery – IaaS service providing Columnar database.
5) Google Cloud Functions – Currently in beta testing. FaaS allowing functions to be triggered by events without developer resource management.
6) Google Cloud Datastore - DBaaS service providing a document-oriented database.
7) Cloud Pub/Sub - a data streaming and messaging service.

C. HP Cloud

(https://en.wikipedia.org/wiki/HP_Cloud) [13] HP Cloud is a set of cloud computing services available from Hewlett-Packard (HP) that offered public cloud, private cloud, hybrid cloud, managed private cloud, and other cloud services. It was the combination of the previous HP Converged Cloud business unit and HP Cloud Services, which is the OpenStack technology-based public cloud. It is used by enterprise organizations so they can combine public cloud services with their own internal IT resources to create hybrid clouds, or a mix of different cloud computing environments made up of private and public clouds.

Services:

1) *HP Cloud Advisory Services*: Delivers information on the possible uses for cloud services and solutions and identifies opportunities to begin implementing cloud.
2) *HP Cloud Strategy Services*: Develop a business case for moving to cloud, plans how to shift some resources from traditional IT to cloud resources, and designs a multi-year strategy on how to incorporate private, public, and hybrid cloud with traditional IT environments.
3) *HP Applications Transformation to Cloud Services*: Delivers design, development, migration, and testing services to enable new and existing applications and business processes to run in the cloud.
4) *HP Cloud Design Services*: Provides user organizations with recommended practices for using cloud and frameworks for building detailed architectures and designs for cloud solutions.
5) *HP Cloud Implementation Services*: Helps build, integrate, migrate, and deploy cloud solutions based on detailed design and architecture with a transition to operations.
6) *HP Cloud Operation Services*: Provides support services for a company's cloud environment.
7) HP Cloud Education Services: Trains and certifies a company's IT staff and third-party partners to help them architect, integrate, and administer cloud solutions.
8) *HP Helion OpenStack Professional Services*: Consultants help a company plan, implement, and run HP clouds in a hybrid IT environment based on the OpenStack technology.

D. IBM Cloud

(https://www.ibm.com/cloud-computing/services) [14] IBM cloud computing is a set of cloud computing services for business offered by the information technology company IBM. IBM cloud includes infrastructure as a service (IaaS), software as a service (SaaS) and platform as a service (PaaS) offered through public, private and hybrid cloud delivery models, in addition to the components that make up those clouds. IBM offers cloud delivery options including solely private cloud, solely public cloud, and variations in between. Private, public and hybrid clouds are not strictly distinct, as IBM allows the option to build a customized cloud solution out of a combination of public cloud and private cloud elements. Companies that prefer to keep all data and processes behind their own firewall can use private cloud services managed by their own IT staff. A company may also choose pay-as-you-go pricing. Hybrid cloud options allow for some processes to be hosted and managed by IBM, while others are kept on a private cloud or on a VPN or VLAN. IBM also offers planning and consultation throughout the deployment process.

IBM offers five cloud provision models**:**

1) Private cloud, owned and operated by the customer
2) Private cloud, owned by the customer, but operated by IBM (or another provider)
3) Private cloud, owned and operated by IBM (or another provider)

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4) Virtual private cloud services (based on multi-tenanted support for individual enterprises) Public cloud services (based on the provision of functions to individuals).

E. Microsoft Azure

Microsoft Azure is a cloud computing service created by Microsoft for building, deploying, and managing applications and services through a global network of Microsoft-managed data centers. It provides software as a service, platform as a service and infrastructure

as a service and supports many different programming languages, tools and frameworks, including both Microsoft-specific and third- party software and systems. Azure was announced in October 2008 and released on February 1, 2010 as Windows Azure, before being renamed to Microsoft Azure on March 25, 2014

III. COMPARATIVE ANALYSIS

There are various cloud services available to provide the services to the users Microsoft, Amazon, Google App engine etc. Here we have compared only Microsoft and Google cloud services.

A. Microsoft provides cloud services as Microsoft Azure while Google provides the cloud services as google AppEngine.

B. Microsoft provides IaaS, PaaS services while google provides SaaS, PaaS services.

C. Microsoft provides SQL Azure database services while Google provides Data Store database services.while

D. Cost is depends in Microsoft as Pay-as-you-go, then subscription while Charged on pay-per-use basis in case of google.

E. Microsoft provides Operating system Windows 7, Windows Server 2008, Windows Vista as support environment while Google provides Java Runtime Environment, Python Runtime Environment as support environment.

F. Microsoft uses .NET framework as tool while Google uses AppEngine Framework, Java SDK ,go, Python SDK as tool.

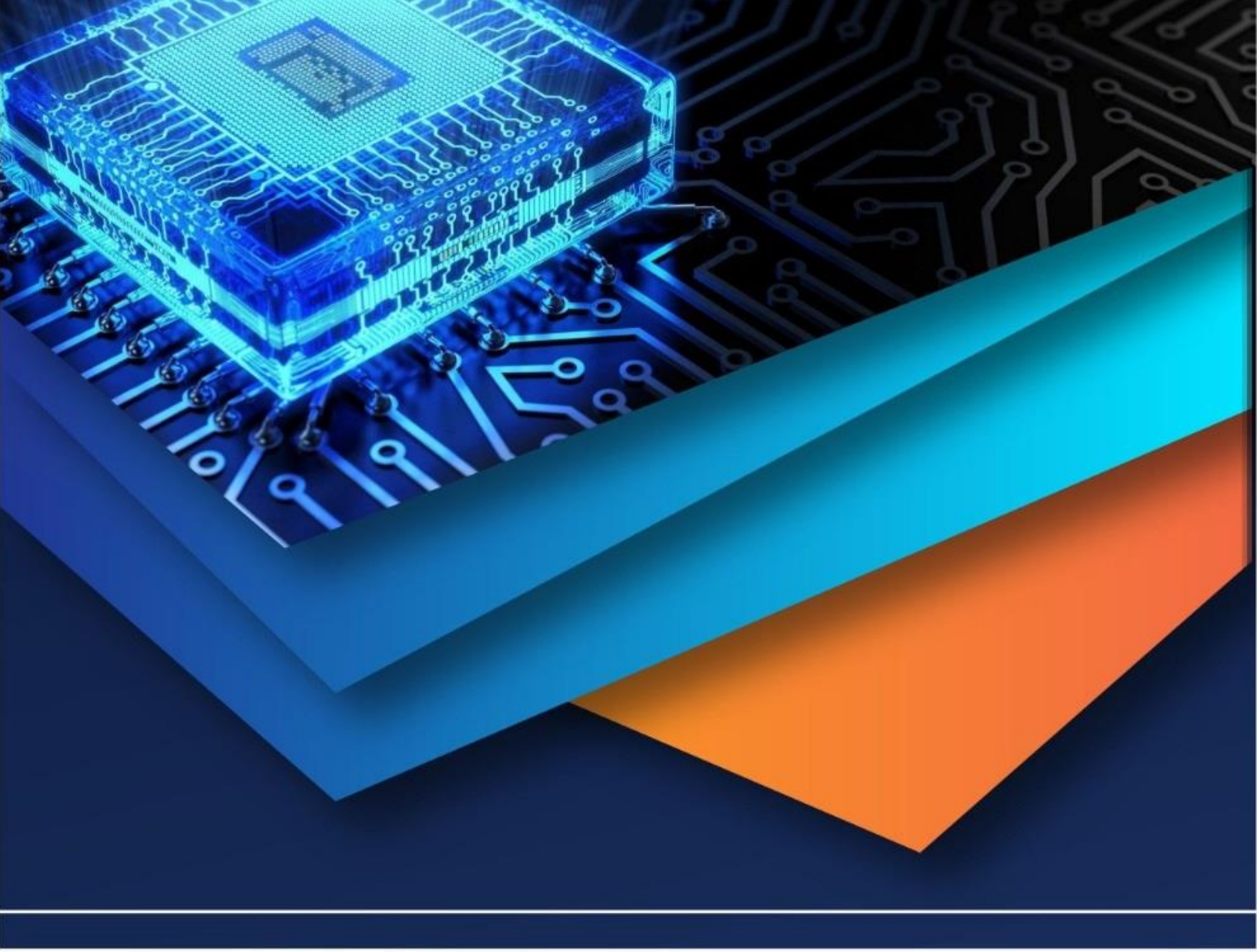
IV. CONCLUSION AND FUTURE WORK

Cloud computing play very important role to provide the services to the use in safe and secure manner. In this paper compared the services of Microsoft and google services. There are many possible implications for further study with regards to this study. Of course there are hundreds and thousands of cloud service providers are available to provides the services. There are several similarities and significant difference between them as regards to the reliability and quality of service provided by them.So, similar other research can be conducted to compare the cloud service vendors in terms of range of service offered by them and the level of reliability of service offered by them. In future we can also use various MCDM techniques to rank the service providers which will be helpful to compare the service providers.

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