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Features and Services that Set Cloud Computing Apart

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Abstract **–** This research shows how cloud computing may benefit businesses and consumers via flexible, adaptable, and affordable service delivery models. In this article, we attempt to delve into the wide-ranging services, applications, and features of cloud computing, providing several instances of cloud services provided by industry leaders like Google, Microsoft, and Amazon. We have also covered the advantages of cloud computing service models.

Keywords **–** Data backup, Virtualization, Cloud Computing, Electronic Government, Service Provider.

I. INTRODUCTION

Computing in the cloud, or "the cloud," refers to the practice of transferring data and applications to and from remote servers rather than a local machine. The "cloud" is really simply shorthand for the World Wide Web. The Internet is frequently shown as a cloud in computer networks..

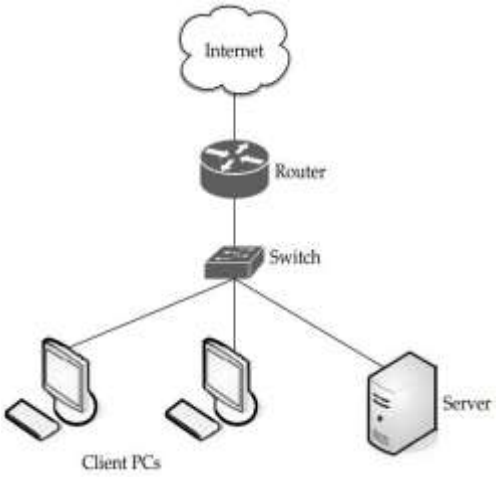

Fig1: Internet is depicted by a cloud in a network

Cloud computing refers to the deployment of an application and associated infrastructure through a network, most often the Internet. Users may access their data and run their programs from any Internet-connected device thanks to cloud computing. Gmail, from Google, is a popular Cloud Computing service.

NIST's Definition of "Cloud Computing" With cloud computing, users can access a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services) over an always-on, always-available network. These resources can be quickly provisioned and released with minimal management effort or service provider interaction. There are 5 core features, 3 service types, and 4 deployment options in this cloud architecture. [1]

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Companies like Google, Microsoft, and Amazon, together known as "Cloud Service Providers" (CSPs), provide their clients access to a shared pool of configurable computing resources and services. Data and software programs are kept on the cloud servers, which are hosted in the data centers, and are accessible through the internet using a web browser to deliver services in many fields, including as business, education, and governance, to consumers [3].

Cloud computing has been a revolutionary step forward for the IT industry. Its introduction has significantly altered the IT industry. It's been crucial in meeting the rising storage and infrastructural needs. Cloud's capacity to make available resources like hardware and software through a network is its most remarkable feature. In cloud computing, you may make use of a variety of resources on a pay-as-you-go basis. The cloud may be roughly classified as [4]:

1. ***Private cloud:*** Clouds of this kind are designed to serve a single company or group.
2. ***Public cloud:*** Google, Amazon, Microsoft, and other large IT companies all provide public cloud services. The advantages of using public cloud support systems for individuals or businesses. Hundreds, if not thousands, of individuals are involved in resource sharing.

Thirdly, the "community cloud" offers its services and infrastructure to businesses that share common goals and values.
Hybrid cloud, the fourth kind of cloud, combines elements of both private and public cloud infrastructures. Even while there is some overlap across the clouds, each one has its own identity, which is helpful for a number of different deployments.

Table 1: Comparison of Cloud Computing Service Models

Model	***Scope***	***Managed by***	***Security Level***
Public Model	General public and industries	Cloud service providers	Low
Private Model	Single organization	Single organization	High
Community Model	Organizations having similar policies and same security concerns	Many organizations or cloud service providers	High
Hybrid Model	Public and organization	Public and organization	Medium

Some common Cloud Service Providers

First, there's Google Docs, Sheets, and Slides, all of which are cloud-based services that rely on Google's online storage. In reality, the vast majority of Google's offerings (including Gmail, Calendar, Maps, Picasa, Analytics, and so on) may be categorized as cloud computing.
Second, Apple iCloud, which is Apple's cloud service, is where you may save your electronic correspondence, calendar, and other files. There has been no loss of data accessibility on any platform.
Amazon Cloud Drive is primarily intended for MP3s purchased from Amazon and pictures; Prime members get access to limitless photo storage. Amazon Prime includes cloud storage as part of all its goods and services, making it ideal for storing any digital content purchased from the company.

II. CLOUD COMPUTING TECHNOLOGY

Unlike a microprocessor or a mobile phone, cloud computing is not a stand-alone device. Instead, it's an organization, centered on resources. The cloud allows businesses to make use of services provided by organizations other than their own. Cloud computing platforms are well-established for commercial and academic use. Cloud computing allows businesses to save costs on the gear and software that are necessary for certain functions to execute smoothly [5].
Using cloud computing, businesses may expand their IT capabilities without spending money on new hardware, software, employees, or training.

III. CLOUD COMPUTING SERVICE MODELS

The following are examples of fundamental cloud computing models:
One option is "IaaS" (Infrastructure as a Service).
(IaaS) is a kind of cloud computing in which the service provider hosts a collection of virtualized hardware and software components. In order to provide consumers with the ability to provide and release resources on demand, IaaS makes use of virtualization technologies [6]. Rackspace Cloud Servers, Google, Amazon Elastic Compute Cloud (EC2), IBM, and Verizon are just a few of the big organizations that provide infrastructure as a service.

Benefits of IaaS Solutions

Capital costs are decreased.

Users are only charged for the content they access.

• Use of first-rate computer facilities and services befitting a major corporation.

• Users may dynamically increase or decrease the allocated resources as needed.

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B) PaaS, or "Platform as a Service"

This is a more sophisticated kind of cloud service. PaaS refers to the provisioning, operation, and maintenance of an operating system and other computer resources by a cloud service provider. The services provided by a PaaS provider include all stages of an app's lifecycle. Collaboration, database integration, security, web service integration, scalability, and so on are all additional services. Users are relieved of the burden of acquiring and maintaining their own gear and software, or of hiring specialists in this area. This setup allows for adaptability in terms of program installation, and it is also scalable. Lack of interoperability and portability across providers is a drawback of the PaaS.

including "platform as a service," "software as a service," and "infrastructure as a service," or IaaS, SaaS, and PaaS, respectively.

Technology organizations often use cloud computing to get access to IT infrastructure including software and hardware.

Customers pay for use of the platforms, which allows them to run their own code on the cloud. Rackspace Cloud Sites, Salesforce.com's Force.com, Google App Engine, and Microsoft Azure are all examples of PaaS platforms.

Benefits of PaaS Solutions

Cloud application development in PaaS settings often involves a large team of workers. This establishes a solid, welcoming community that may serve as a valuable resource for your development staff.

There is no longer any need for businesses to upgrade the software that runs their infrastructure. Instead of users worrying about installing updates or fixes, the PaaS provider handles everything.

The upfront costs of hardware and software are avoided, reducing the financial risk for businesses. The cloud allows the development team to focus only on the program itself, rather than the infrastructure required for testing and deployment.

B) Cloud Computing (SaaS)

In this setup, cloud service providers are in charge of managing infrastructure and tools including operating systems and application software. When it comes to the user experience, the SaaS model looks like any other web-based application interface where services are delivered over the internet and accessible using a web browser. Hosted programs, such as Gmail and Google Docs, may be accessed from a variety of devices. SaaS is preferableto conventional software since the user is relieved of the burden of software ownership and management. In addition to these benefits, it is also multitenant efficient, highly configurable, and scalable [8].

Benefits of SaaS Solutions

Ability to expand quickly

Advantages: • Availability from anywhere with an Internet connection • Freedom from infrastructure worries

Maintenance and support packages tailored to your needs

B) RaaS, or "Recovery as a Service"

Companies may replace their backup, archiving, disaster recovery, and business continuity solutions with a single, unified platform provided by Recovery as a Service (RaaS) providers. Providers of RaaS aid businesses in restoring anything from a full data center to individual servers (together with their operating system, applications, configuration, and data).

RaaS lessens the blow to businesses from interruptions in service caused by natural disasters and other similar events. Companies like WindStream Business, Geminare, etc., provide RaaS, also known as DRaaS (Disaster Recovery as a Service).

Benefits of RaaS Solutions

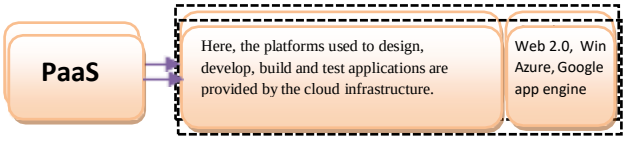
Protect vital business information from being lost, either temporarily or permanently.

• Prevents irreparable damage to the physical and digital infrastructure.

• Low-priced data retrieval option.

Provides more options for the kind of backup needed (primary or secondary) and allows for speedier recovery without sacrificing accuracy.

Cloud services may help businesses save money and increase productivity. Different businesses may embrace different cloud services, business processes, and areas of expertise based on their own unique goals. Any IT project considering migrating to cloud services should first engage in thorough planning and preparation.



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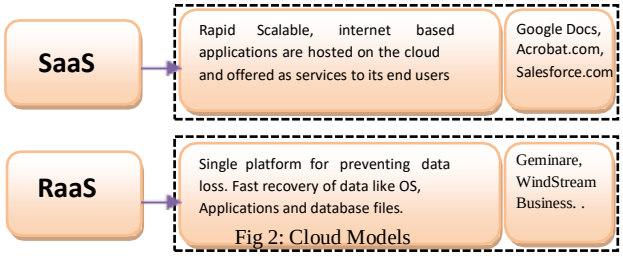

Fig 2: Cloud Models

IV. CHARACTERISTICS OF CLOUD COMPUTING

There are many intriguing features of cloud computing systems that make them a suitable platform for emerging IT services and applications. We outline the five defining features of cloud computing systems as specified by the National Institute of Standards and Technology (NIST) [9]:

• **On-demand self-service:** Automatically and without human intervention, cloud services like CUP time, Storage, network access, server time, web applications, etc. may be distributed to customers according on their needs.

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• **Cost effectiveness:** The cloud's service providers provide low-priced or even free service options. Pay as you go eliminates the need to front cash for expensive infrastructure and frees up operational capital.

• **Broad Network Access (mobility):** Ubiquitous refers to the ease with which users may access cloud services through the Internet using a variety of devices (including mobile phones, computers, and personal digital assistants).

• **Resource Pooling:** The cloud is a shared pool of both actual and virtual servers. The consumer has no say in or access to the specific location of these resources, hence location is irrelevant.

• **Rapid Elasticity:** Provisioning and releasing computer resources quickly and flexibly in response to customer demand is possible. To buyers, it may seem as if there is no limit to how much of these goods may be acquired at any one moment.

• **Measured Services:** CSPs employ a pay-as-you-go approach to monitor, manage, and optimize cloud resources and services. Customers use these services in a manner comparable to their use of traditional utilities like power, water, and gas. Additional features of cloud computing are [15, 16]:

• **Multitenancy:** Multiple customers may take use of a cloud's offerings at the same time. While they are all using the same cloud resources on the network, host, and application levels, each user is completely separate from the others inside his own virtual application instance.

• **Scalability:** Cloud computing makes use of a highly scalable infrastructure. Adding more nodes and servers to the cloud only requires minimal adjustments to the cloud's underlying architecture and software.

• **Reliability:** is achieved in cloud computing by using multiple redundant sites. High reliability makes the cloud a perfect solution for disaster recovery and business critical tasks.

• **Economies of scale:** in order to take advantage of economies of scale, clouds are implemented to be as large as possible. Other considerations are also taken to reduce cost such as locating the cloud close to cheap power stationsand in low cost real estate.

• **Customization:** a cloud is a reconfigurable environment that can be customized and adjusted in terms of infrastructure and applications based on user demand.

• **Efficient resource utilization:** delivering resources only for as long as they are needed allows for efficient utilizationof these resources.

• **Virtualization:** Thanks to cloud computing, users may access their data from any device, at any time. Instead than relying on a physical server, it uses cloud resources. Whether you're on a desktop computer or a mobile phone, you have full access to the web and can do anything. It's simple and secure for users to access and share whenever and wherever they need it. When users collaborate, they can do more than a single machine could.

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V. APPLICATIONS OF CLOUD COMPUTING

Cloud Computing is one of the most dominant field of online computing because resource sharing and its management is easy using cloud. Therefore cloud computing has its importance in the following fields:-

A) E-Learning

As for as Education is concerned this field provides anattractive environment to students, researchers and faculty members. Students, faculty members and researchers can connect to the cloud of their organization and access data and information from there.

B) E-Governance

The government can improve its functioning by introducing cloud computing. This way the services provided by the various government organizations

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can be delivered in an improved and more sophisticated way. Cloud computing will also cut off the burden of managing, installing and upgrading applications.

C) Enterprise resource planning (ERP)
When the business of an organization grows up the use of Cloud in ERP comes into existence. The work of managing applications, human resources, payroll etc becomes expensive and complex. To overcome such problems the service providers can install ERP in the cloud itself.

Table 2: Different applications of cloud computing.

Application	Service Delivered
E-Learning	E-mail, simulation tools, files broadcasting, class recording, virtual classrooms, virtual labs, surveys, education forums etc.
E-governance	Complaint resolution system, employee management system, E-police, E-Tendering, E-court, payment and tax system, agriculture and food, industry and energy etc.
ERP Cloud	Supply chain and vendor, project and HR Management, customer Relationship management, finance and accounting etc.

VI. CLOUD COMPUTING CHALLENGES

Concerns about cloud computing persist despite the technology's increasing use. Common problems include:
1) Privacy & Security
The safety of one's data is an issue that must never be overlooked. Companies are hesitant to purchase vendor guarantees of data security for their operations. The worry

losing data to other companies or having consumers' information stolen. The security issues of any company are compounded by the fact that the real storage location is often not revealed. In the current setup, this kind of sensitive data is guarded by firewalls between various data centers that are controlled by corporations. In the cloud model, businesses must depend heavily on their service providers to ensure the safety of their data.

B) **Availability and Data Recovery**
Service level agreements (SLA) are adhered to religiously across the board in commercial software. Service level agreements and application runtime governance are two areas where operational teams play a crucial role in management. System monitoring (Transactions monitoring, logs monitoring, and others) is another responsibility of operational teams in production situations.
Maintenance (Runtime Governance) Capacity and Performance Management A data catastrophe may occur if a cloud service fails to adequately fulfill any of the aforementioned features and functions. Capabilities in Administration (A)
Despite the proliferation of cloud services, infrastructure and platform management have only just begun to mature. Dynamic scaling and dynamic resource allocation are two examples of features that are essential for many businesses. The current scalability and load balancing options have a lot of room for development.
B) Limitations imposed by rules and regulations
Certain European governments prohibit the storage of private information about its citizens in data centers situated in other nations. Cloud service providers may be required to establish physical facilities inside the nation to house data in order to fulfill such obligations. It is difficult for cloud service providers to constantly have such an infrastructure in place.

With cloud computing, the focus shifts to the interface, or the point of contact between service providers and various communities of service users. Many businesses are only somewhat prepared to deal with the complexities posed by cloud services, such as procurement, risk assessment, and service negotiation.

VII. CONCLUSION AND FUTURE WORK

Cloud computing is a relatively new innovation that will likely have a profound impact on the information technology industry over the next several years. The Cloud's many appealing features, services, and apps make it an ideal platform for delivering a wide range of useful tools and resources. Some of these features, services, and uses were covered in this article, and we anticipate that many more will be covered in future works. Many businesses and people from a wide range of fields are likely to use cloud services and apps; our research provides insight into how these services will affect their operations. The largest barrier to widespread use of cloud computing is security and privacy concerns. The security concerns of cloud computing will be the subject of much research and development in the years to come. With our future research, we want to present a framework and security model to deal with cloud computing's security issues and reduce the dangers that come with using this technology.

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