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# Privacy and Security in Cloud Computing Architecture

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## ABSTRACT

Cloud Computing is the most advanced technical platform for next generation. Cloud Computing provide us a large range of data storage space in web source. Cloud Computing work automatically as per the need of user we don't need to do extra work on it. High level applications and game is run by Cloud Computing. It simply states that cloud computing means storing and accessing the data and programs over the internet rather than the computer's hard disk. Cloud Computing cover the wide range of areas. It provides its service through online net connection. The data can be anything such as music, files, images, documents, and more. The user can access the data from anywhere just with the help of an internet connection. To use cloud computing, the user should register and provide with ID and password for security reasons. The speed of transfer depends on various factors such as the capacity of the server, internet speed, and many more. In this paper, we explore the understanding the determinates of security and privacy in cloud computing, Cloud Computing architecture and we also address the characteristics and applications of several popular cloud computing platforms. We identified several challenges from the cloud computing adoption perspective and we also highlighted the cloud interoperability issue that deserves substantial further research and development. However, security and privacy issues present a strong barrier for users to adapt into cloud computing systems.

**Keywords :** Cloud Computing, Architecture, Challenges, Cloud Platforms.

## I. INTRODUCTION

Cloud computing is first and foremost a concept of distributed resource management and utilization. Cloud computing is a model for enabling convenient, on demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction [4]. Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the data centers that provide those services. Cloud computing has emerged as a popular solution to provide cheap and easy access to externalized IT (Information Technology) resources. An increasing number of organizations (e.g., research centers, enterprises) benefit from Cloud computing to host their applications. Through virtualization, Cloud computing is able to address with the same physical infrastructure a large client base with different computational needs [5], [6]. In contrast to previous paradigms (Clusters and Grid computing), Cloud computing is not application-oriented but service-oriented; it offers on demand virtualized resources as measurable and billable utilities [7], [8]. Cloud computing is becoming an increasingly popular enterprise model in which computing resources are made available on-demand to the user as needed. The unique value proposition of cloud computing creates

new opportunities to align IT and business Cloud Computing is a versatile technology that can support a broad-spectrum of applications. The low cost of cloud computing and its dynamic scaling renders it an innovation driver for small companies, particularly in the developing world. Cloud deployed enterprise resource planning (ERP), supply chain management applications (SCM), customer relationship management (CRM) applications, medical applications and mobile applications have potential to reach millions of users. In this paper, we explore the different concepts involved in cloud computing. Leveraging our experiences on various clouds, we examine clouds from technical, and service aspects. We highlight some of the opportunities in cloud computing, underlining the importance of clouds and showing why that technology must succeed. Finally, we discuss some of the issues that this area should deal with.

## II. CLOUD COMPUTING ARCHITECTURAL

Cloud Computing architecture basically comprises of the two parts. They are the front-end and the back-end. The front end is the end which uses by the user and the back-end manages by the host. Both the end connects to each other with the means of internet.

a). Front End

The front end is the client part of Cloud Computing which uses as per the requirement of the user. Front-end comprises of the applications and the interfaces which help to access the cloud computing. Example- Browser or an app created by the company itself.

b). Back End

The back end is a part which manages by the allotted authorities of the company and their back end has large data storage facilities, Virtual machines, security system, and servers. They are also engaged in traffic management along with security management.

## III. COMPONENTS ON CLOUD COMPUTING ARCHITECTURE

Components of Cloud Computing Architecture - One of the advantages of cloud computing is the automation of the various management tasks, and there is human intervention in it. Peoples are in charge of Developer users while enjoying and using cloud computing system. To be a successful cloud computing implementation, required some components. Without these elements, cloud computing will be involved. These components are implemented by many people with few skills, experience, and their backgrounds are different. In cloud computing, hardware must not be physically adjacent to the developer's Office or the data center. In fact, the infrastructure for cloud computing it can be placed anywhere, even to a foreign country, though. Thus be allocated into the cost of electricity and the price of the land was cheap.

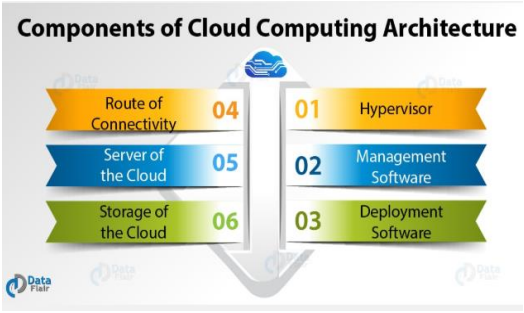


**Fig (1)** Components of Cloud Computing Architecture

**a) Hypervisor**

The hypervisor is also known as Virtual Machine Monitor. This consists of the software, hardware, and firmware which makes and runs the virtual machines. The Hypervisor provides a user with a platform which is known as Virtual Operating Platform. This allows us to manage the guest's operating system to use the cloud. This can be also known as the traditional term of the kernel in an operating system.

### b) Management Software

Management software consists of various plans and the strategies which help to increase the performance of the cloud. This management software provides many features such as on-time delivery of storage, proper security, all-time access, and many other facilities. This is one of the important parts of Cloud Computing architecture. One of the important features of this is the compliance auditing, management of overseeing disaster, and contingency plans.

### c) Deployment Software

Cloud deployment simply means to initiate the working of the SaaS, PaaS, and IaaS. This initiates the solutions that can access by the users or the customers. This deployment consists of all the mandatory installations and configurations of the cloud. This emerges from the back end and implements before the provisioning occur.

### d) Route of Connectivity

It is an important part of the Cloud Computing architecture, through which the whole cloud gets connected. The speed of transfer depends on the network which is the internet connection. There are many cloud servers present which connects with the help of this virtual route. This also provides a facility to the user by allowing them to customize the route and protocol.

### e) A server of the Cloud

A cloud server is a virtual server running in cloud computing premises. It's engineered, hosted and delivered via a cloud computing platform via the web. It can be accessed from anywhere. Cloud servers are stable, quick and secured. They avoid the hardware problems seen with physical servers, and that they are seemingly to be the foremost stable choice for businesses. Also, call as virtual servers. Cloud servers have all the software they need to run and can operate as non-dependent units. It also has the profit because it is incredibly simple and fast to upgrade by adding memory and disk space, further as being more cost-effective.

### f) Storage of the Cloud

Cloud storage service, construct to produce applications, services and organizations with access to offsite storage capability that may provision instantly are versatile in scaling automatically at runtime and is globally accessible. An Infrastructure as a Service (IaaS) service model delivers scalable, flexible and redundant storage capability through net services API, online interfaces and thin client applications. Cloud Storage also benefits the user by providing remote access with the help of internet. The storage services are very quick to access. Cloud information is often held on, altered and retrieved from a remote cloud storage server over the web below a utility computing model.[8]

## IV. CLOUD DELIVERY MODELS

This section of the paper describes the various cloud delivery models. Cloud can be delivered in 3 models namely SaaS, PaaS, and IaaS. On the basis of the services cloud offers, we can count on the following cloud delivery models:

### 1). Software as a Service (SaaS)

Software as a Service (SaaS): In this model, a complete application is offered to the customer, as a service on demand. A single instance of the service runs on the cloud & multiple end users are serviced. On the customers‟ side, there is no need for upfront investment in servers or software licenses, while for the provider, the costs are lowered, since only a single application needs to be hosted & maintained. Today SaaS is offered by companies such as Google, Salesforce, Microsoft, Zoho, etc It is the topmost layer

of the cloud. The end users experience the applications on demand over the internet. The cloud gives access to many applications for development, deployment, and performing other useful tasks like working on excel, word online, Email, ERP tools, etc. In a cloud-computing environment. SaaS is software that is owned, delivered and managed remotely by one or more providers and that is offered in a pay-per-use manner [9]. SaaS in simple terms can be defined as "Software deployed as a hosted service and accessed over the Internet." [10]. SaaS clouds provide scalability and also shifts significant burdens from subscribers to providers, resulting in a number of opportunities for greater efficiency and, in some cases, performance. The typical user of a SaaS offering usually has neither knowledge nor control about the underlying infrastructure [11].

**2). Network as a Service (NaaS)**

Cloud offers you to configure, manage and develop networking environment for your application. Here, you can deploy your application in the Virtual private or public cloud. You can set your subnet groups, perform masking, generate static IP, manage domain name system, and add to or remove security groups for all networking layers you need like HTTP, HTTPs, FTP, sFTP, etc.

**3). Platform as a Service (PaaS)**

Cloud provides a platform for writing, configuring, and deploying your code directly. You don't have to worry about the machine. Cloud will automatically manage your device, no matter which language, for example, node.js, PHP or Python your code is written. You have to select the right one, for example, AWS provides light sail service that you can deploy to host your website in any language. This kind of cloud computing provides development environment as a service. The consumer can use the middleman's equipment to develop his own program and deliver it to the users through Internet and servers. The consumer controls the applications that run in the environment, but does not control the operating system, hardware or network infrastructure on which they are running. Platform as a Service (Paas): Here, a layer of software, or development environment is encapsulated & offered as a service, upon which other higher levels of service can be built. The customer has the freedom to build his own applications, which run on the provider‟s infrastructure. To meet manageability and scalability requirements of the applications, PaaS providers offer a predefined combination of OS and application servers, such as LAMP platform (Linux, Apache, MySql and PHP), restricted J2EE, Ruby etc. Google‟s App Engine, Force.com, etc are some of the popular PaaS examples

**4). Infrastructure as a Service (IaaS)**

The most advanced feature cloud offers IaaS which facilitates to use machine resources in the cloud. You can configure your machine according to your need from the vast marketplace. You can select machine image type from Ubuntu, Amazon, Microsoft etc., and can add CPU in batch or parallel for fulfilling your utilization, choose solid state device memory(SSD) or HDD based on your data input-output speed and so on. So always go for the right one because this architecture would be the efficiency pillar of your organization. Infrastructure as a Service (Iaas): IaaS provides basic storage and computing capabilities as standardized services over the network. Servers, storage systems, networking equipment, data centre space etc. are pooled and made available to handle workloads. The customer would typically deploy his own software on the infrastructure. Some common examples are Amazon, GoGrid, 3 Tera, etc.

**5). Storage as a Service**

Cloud offers storage service to your application. Anyone can buy from a small figure of 5GB to terabytes of storage on the cloud from service providers. It will also provide the type of storage you want to buy like a disk, SSD, IOPS SSD, and HDD.

### 6). Testing as a Service

A lot of software, infrastructure, and other testing tools are now available in the cloud to use like Blazemeter, LoadStorm, Jenkins Dev, etc.

## V. PRIVACY AND SECURITY IN CLOUD COMPUTING

Recent advances have given rise to the popularity and success of cloud computing. However, when outsourcing the data and business application to a third party causes the security and privacy issues to become a critical concern in Security and Privacy in Cloud Computing. Cloud computing becomes a successful and popular business model due to its charming features. In addition to the benefits at hand, the former features also result in serious cloud-specific security issues. The people whose concern is the cloud security continue to hesitate to transfer their business to cloud. Security issues have been the dominate barrier of the development and widespread use of cloud computing. There are three main challenges for building a secure and trustworthy cloud system:

- Outsourcing – Outsourcing brings down both capital expenditure (CapEx) and operational expenditure for cloud customers. However, outsourcing also means that customers physically lose control on their data and tasks. The loss of control problem has become one of the root causes of cloud insecurity. To address outsourcing security issues, first, the cloud provider shall be trustworthy by providing trust and secure computing and data storage; second, outsourced data and computation shall be verifiable to customers in terms of confidentiality, integrity, and other security services. In addition, outsourcing will potentially incur privacy violations, due to the fact that sensitive/classified data is out of the owners' control.
- Multi-tenancy – Multi-tenancy means that the cloud platform is shared and utilized by multiple customers. Moreover, in a virtualized environment, data belonging to different customers may be placed on the same physical machine by certain resource allocation policy. Adversaries who may also be legitimate cloud customers may exploit the co-residence issue. A series of security issues such as data breach [10], computation breach, flooding attack, etc., are incurred. Although Multi-tenancy is a definite choice of cloud venders due to its economic efficiency, it provides new vulnerabilities to the cloud platform. Without changing the multi-tenancy paradigm, it is imperative to design new security mechanisms to deal with the potential risks.
- Massive data and intense computation – cloud computing is capable of handling mass data storage and intense computing tasks. Therefore, traditional security mechanisms may not suffice due to unbearable computation or communication overhead. For example, to verify the integrity of data that is remotely stored, it is impractical to hash the entire data set. To this end, new strategies and protocols are expected.

## VI. CONCLUSION

Cloud Computing is an emerging technology which is skyrocketing nowadays. This technology is often used by big companies as well as the startups as it is flexible for both. Every company is in need to store the data so they require cloud to store their information. The data is secured and can access anytime and from anywhere. Cloud computing is a computing paradigm, where a large pool of systems is connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage. With the advent of this technology, the cost of computation, application hosting, content storage and delivery is reduced significantly. Cloud computing is a practical approach to experience direct cost benefits and it has the

potential to transform a data center from a capital-intensive set up to a variable priced environment. The idea of cloud computing is based on a very fundamental principal of „reusability of IT capabilities'. The difference that cloud computing brings compared to traditional concepts of "grid computing", "distributed computing", "utility computing", or "autonomic computing" is to broaden horizons across organizational boundaries.

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