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Cloud Computing: A Perspective Study

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Abstract: *Cloud computing can be defined as reliable services that are delivered through data centers which are built on compute and storage technologies. Consumers are able to use applications and data from a cloud anywhere in the world on demand. Services like Google Docs are cloud Computing , where your document exist on the company's servers and you can reach these documents easily and work on them without using your own hard drive.*

A cloud is a type of parallel and distributed system consisting of interconnected and virtualized computers. Cloud computing uses 'Hadoop' software that implements a cloud on a cluster of computers. Google Apps, Google Maps and Gmail are all based on the cloud .Other major web players including Amazon, eBay, yahoo and Facebook are running some sort of an enormous cloud computing. Computing at the scale of the cloud allows the users to access supercomputers-level power and storage. The concept behind cloud computing is to scale your application by deploying it on a large grid of commodity Hardware boxes. Thus, cloud computing and storage compiles physical resources into scalable and shareable resources over the internet.

Keywords: *Cloud Computing, Distributed System, Hadoop, supercomputers, Virtualization.*

I. Introduction

With the increase in development of the processing and storage technologies and the success of the internet, computing resources have become cheaper, more powerful than ever before. This has enabled the realization of a modern computing model called cloud computing. In this model, the category of service provider can be divided into two : the infrastructure provider, who manages the cloud platforms and lease resources as per the usage-based pricing model, and service provider, who rent resources from one or many infrastructure providers to serve the end users. Cloud are clearly next generation data centers with nodes 'virtualized' through hypervisor technologies like Virtual Machines[VMs].These are designed to meet a specific service level-agreement, which is established through a 'negotiation and is accessible as a compos able service. The compute cloud consists of three basic elements:

A. A Web Server/Application Layer
B. A Distributed Layer and
C. A Distributed Queue Layer.

Each one of these layers is a cloud in itself, which means that boxes are all identical and perform the same function.

II. Cloud-Computing Architecture

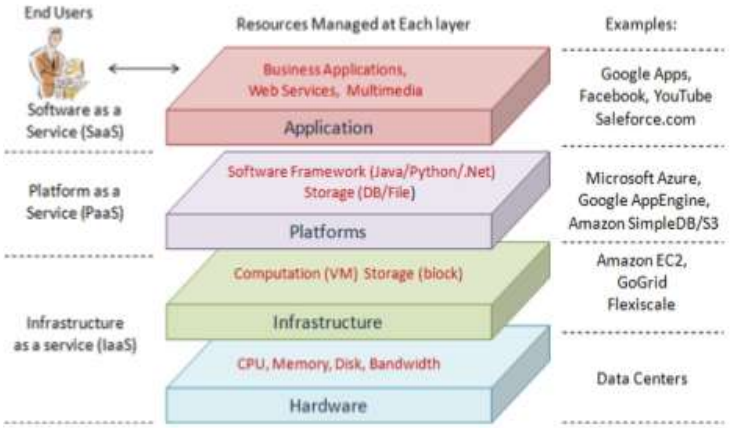

Fig.1

Generally, the architecture of a cloud computing environment can be divided into 4 layers:

A. The Hardware layer

The hardware layer manages the hardware resources of the cloud, which includes physical servers, routers, switches, power and cooling systems. The hardware layer is traditionally implemented in data centers. A data center comprises of thousands of servers that are organized in stacks and interconnected through switches, routers.

B. The Infrastructure Layer

The infrastructure layer provides a group of storage and computing resources by portioning the physical resources using virtualization technologies such as Xen, KVM and VMware. The infrastructure layer is one of the primary component of cloud computing, because many important features, such as dynamic resources assignment, are only made available through virtualization technologies. It is also known as the virtualization layer.

C. The Platform Layer

Present above the infrastructure layer, this layer comprises of operating systems and application frameworks. The work of the platform layer is to reduce the burden of deploying applications directly into VMcontainers, For example GoogleAppEngine operates at the platform layer to provide API support for implementing storage, database and business logic of typical web applications.

D. The Application layer

Application layer is at the top of the hierarchy, It consists of the actual cloud application. Cloud application performs the automatic scaling feature to achieve better performance, availability and lower operating cost.

III. Features Of Cloud Computer

The characteristic features of cloud computing include off-site resources, availability on demand, payment mechanism, and that is web-based.

A. Offsite Resources

The basic principles of cloud computing is that user access IT resources in a data center that is not his own, these IT resources are virtual, implying that they are icon based and can be assembled with drag-and-drop ease. This enables cloud service providers to assemble software stacks of databases, web servers, operating systems, storage and networking, and manage them as virtual servers.

B. Availability On Demand

In a cloud, resources can be either added or removed at any moment of time. This includes all types of resources, such as processors, the amount of memory, network bandwidth, etc.

C. Payment Mechanism

Based on the usage, users can subscribe mostly on monthly deals or per-hour basis. For Example: - Amazon charges in intervals of 10 cents per hour for EC2.

D. Web-Based Nature

Cloud computing involves browser access to hosted data and resources.

IV. Cloud Deployment Models

There are three generally used cloud deployment models are private, public, and hybrid

A. Private cloud

Private cloud is built and managed within a single organization. Organizations use software that enables cloud functionality, such as VMware, vCloud Director, or Open-Stack.

B. Public cloud

Public cloud is a set of computing resources provided by third-party organizations. The most popular examples of public clouds are Amazon Web Services, Google AppEngine, and Microsoft Azure.

C. Hybrid cloud

Hybrid cloud is a mix of computing resources provided by both private and public clouds.

D. Community cloud

Community cloud shares computing resources around several organizations. It can be managed by either organizational IT resources or third-party provide.

V. Cloud Computing Service Models

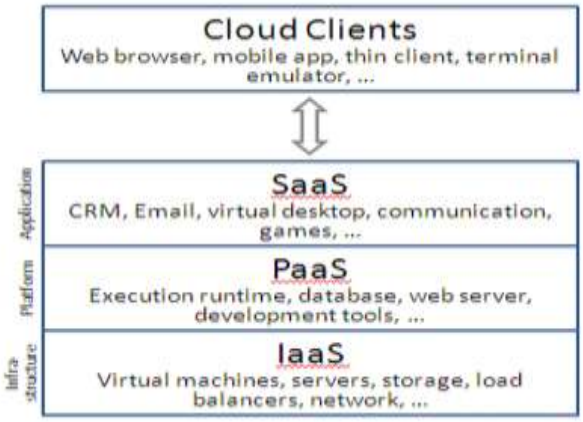

Fig.2

Cloud service models are briefing of how cloud services are delivered to clients. Most fundamental service models include a combination of IaaS (infrastructure as a service), PaaS (platform as a service), and SaaS (software as a service).

A. IaaS (Infrastructure as a Service)

The IaaS (Infrastructure as a Service) model delivers infrastructure components to the respective clients. Components may comprise of virtual machines, storage, networks, firewalls, load balancers. Using IaaS, clients can be able to have direct access to the bottom-level software in the stack which is to the operating system on virtual machines, or to the management dashboard of a firewall or load balancer. Amazon Web Services is one of largest IaaS providers.

B. The PaaS (Platform as a Service)

The PaaS (Platform as a Service) model delivers a pre-built application platform to the client . PaaS automatically scales and provides provision which is used for infrastructure components based on application requirements. Basically, PaaS solution delivers an API that includes a set of functions for programmatic platform management and solution development. Google AppEngine is a popular PaaS provider, and Amazon Web Services also provides some PaaS solutions in addition to IaaS offerings.

C. SaaS (Software as a Service)

SaaS (Software as a Service) delivers ready online software solutions. The SaaS software provider has complete control of application software. SaaS application examples include online mail, project-management systems, CRMs, and social media platforms. The main difference between SaaS and PaaS is that PaaS normally represents a platform for application development, while SaaS provides online applications that are already developed.

VI. Cloud Computing Actors

Cloud Computing Actors, here we introduce 4 major actors of Cloud computing that have a distinct role inside Cloud environment.

A. Cloud User

Cloud user consumes the Cloud computing services that can be a person or an organization.

B. Cloud Provider

Cloud provider is responsible of produce and management of a Cloud environment, serving the requested service by users and delivery of service through access networks to users.

C. Cloud Broker

Cloud Broker acts as an intermediate tool between Cloud users and provider facilitating the procedure in terms of management, performance and delivery of services to users.

D. Cloud Carrier

It is related to carrying Cloud services from Cloud provider towards Cloud users that is carried out by use of telecommunication and access networks like optical and wireless.

VII. Cloud Management Services Provider

Cloud management service providers are the market players that help customers to simplify cloud management. Major cloud providers focuses on the core of their business by delivering scalable and reliable cloud infrastructure to customers, but in some cases providers may lack the resources to develop complementary cloud management services Customers take advantages from the additional capabilities provided by cloud

management services, which may include integration services, security and access control services, high-availability features, and database-replication services. CMS providers work directly with specific cloud providers to integrate provider services with a customer's existing cloud, or to create value added services above the provider's existing infrastructure. CMS can be delivered through three main branches: Cloud Value Added Management Services, Cloud Integration Services, and Cloud Service Brokerages.

A. Cloud Value Added Management Services

Cloud value added management service (CMS) provider optimizes existing cloud provider services by developing additional features above them. CMSs are typically used for public cloud services. CMSs provides value to customers by saving time and resources by automating regular tasks that customers would otherwise have to implement themselves. Cloud value added management service enhances the functionality because they save time and resources for companies.

B. Cloud Integration Services

Cloud Integration Services (CIS) provide integration between private and public clouds. A benefit CIS is that they provide a transparent management abstraction layer which offers exactly the same controls to manage multiple clouds. A CIS can provide automation in routine administrative tasks such as provisioning, scaling, and monitoring and configuration management with easy-to-use centralized administration tools.

C. Cloud Service Brokerages

Cloud service brokerages (CSB) aggregate the services offered by multiple cloud providers and organize these services into a service catalog. This service catalog provides easily-searchable product information for the IaaS, SaaS, and PaaS services available for purchase though the CSB provider distribution network. CSB services can be defined as a cloud services marketplace, where customers can quickly identify and purchase required services.

VIII. Cloud Storage Pricing

Most cloud storage providers determine pricing using the following factors:

A. On-Demand

These types of pricing technique allow customers to pay hourly service fees without long-term commitments. This pay-as-you-go pricing model is most suitable for situations when a company cannot estimate computing resources demand up-front.

B. Prepaid

By using prepaid services, customers pay a fixed amount up-front for a specific commitment period. Generally, you pay fewer prices during longer commitment periods because this helps cloud providers to evaluate their infrastructure expenses.

C. Auctioned

This pricing model enables customers to bid for the computing capacity offered by a cloud provider. If your bid meets or exceeds the current bid price, you can access the resources. If your bid is overridden, you give resources back.

IX. Cloud Adoption And Control Challenges

Cloud transformation is a lengthy process that involves both technical and organizational challenges.

A. Data Security

Data security is by far the most challenging barrier to cloud adoption. Data is the most precious corporate asset, and companies want to know that their data is safe.

B. Cost Uncertainty

There are numerous different cloud offerings available in the market, and their pricing models vary accordingly. This results in the uncertainty, and makes it complex to evaluate the real financial benefits of cloud computing.

C. Loss of Control

This can be categorized into two types: technical loss of control, and organizational loss of control.

D. Software Compatibility

Cloud providers typically support a specific set of software vendors and versions. A public cloud is a shared environment, where software is shared among hundreds or thousands of isolated customer environments.

E. Lock-In Challenges

This can be easier with IaaS-based cloud services, to which companies can install their own software on a provided infrastructure platform, but with PaaS or SaaS cloud platform customers must learn the provider's specific interfaces and APIs in order to interact and manage these platforms.

X. Top Security Risks

The security risks related to cloud computing could be divided in three categories:

A. Policy and Organizational Risk

1) Lock In*:* There is not much portability or interoperability for data and services provided by the current cloud providers, and there is no clear incentive for cloud providers to provide these benefits.
2) Loss of Governance: The loss of governance and control could severely impact the organization's strategy and ability to meet its mission and goals.
3) Cloud Service Termination: Failures in the services delivered by the cloud provider may have a drastic impact on the cloud customer's ability to meet its goal and commitments to its own customers and employees.

B. Technical Risks

1) Management interface compromise: The management interface could suffer from problems such as man-in-the middle, script attacks etc.
2) Denial of Service (Dos): An attacker could launch a denial of service by using the public channel to use a customer's metered resources.
3) Loss of Security Keys: Vulnerabilities like poor management of keys and usage of certain algorithms could lead to the corruption or loss of the keys and potentially result in unauthorized use for authentication and signature purposes.
4) Isolation Failure: This type of risk involves the breakdown of mechanisms separating storage, memory, routing.

C. Legal Risks

1) Subpoena and e-discovery*:* In the event of the confiscation of physical hardware by law enforcement agencies occasioned by a subpoena or civil suits, including the centralization of storage as well as shared tenancy of hardware means many more clients are at risk of the disclosure of their data to unwanted parties.
2) Changes of Jurisdiction*:* Customer data may be held in multiple jurisdictions, some of which may be high risk.
3) Data Protection*:* Failure to comply with data protection laws may lead to administrative, civil and also criminal sanctions, which vary from country to country, for the data controller.

XI. Sla Agreements

An SLA (Service-Level Agreement) agreement is a contract that describes the level of services offered by a cloud provider .An SLA works as both the blueprint and warranty for cloud computing. As far as Cloud services are concern, SLA could be evaluated in terms of mean time between failures, mean time to repair the outage and other operational metrics such as network response time and system performance. The SLA acts as a reference for handling potential problems. SLA can also be stated as a tool for protecting the stability of the service, protecting the resources of the company and minimizing the expenses.

Companies should carefully examine a cloud provider's SLA agreements. Even cloud providers as huge as Amazon provide 99.95% guaranteed annual uptime for of their servers, while some organizations require 99.99% annual uptime. Interdepartmental service between IT and other departments inside a company are typically defined by operational level agreements (OLA).

XII. Advantages Of Cloud Computing

Since the user define the resource requirements and the cloud provider virtually assembles these components within its infrastructure.

A. Elasticity

The ability to scale computing capacity up or down on-demand is very important. Financially, it doesn't make sense to invest up-front knowing that computing infrastructure will remain only partially utilized nine or ten months per year.

B. Pay-As-You-Grow

Public cloud providers like Amazon allow companies to avoid large up-front infrastructure investment and purchase new computing resources dynamically as needed.

C. Economics

Without Cloud computing customer pays for everything including the required service while in case of using Cloud computing payment is done only for what he uses therefore is definitely more financial than the usual way.

D. Flexibility

Businesses are able to determine how much resources they need like storage and processing.

E. Time-to-Market

Introducing and developing new services demanding new infrastructure is more efficient and faster through Cloud Computing compare to traditional computing.

F. Economics

Without Cloud Computing customer pays for everything including the required service while in case of using Cloud computing payment is done only for what he uses therefore is definitely more financial than the usual way.

G. Portability

Cloud computing give the opportunity to businesses employees and users to access the computing resources remotely no matter where they are as soon as they have a web based access to Cloud, geographical restrictions.

H. Scalability

Businesses are able to transition from processing a small quantity of data to large amount of data immediately without requiring extra requirements or buying additional devices.

XIII. The Future Of Emerging Trend

The Emerging computing trend, namely grid computing, SOA and cloud computing, are increasingly being deployed in Enterprises and across the Internet. Commercial deployment is also on the rise. Global compute cloud comprises compute and storage components. The enterprise IT consumer would use a broker service to use the compute cloud. Auctioneers periodically clear bids and tasks received from market participants. Brokers mediate between consumers and providers by buying capacity from the provider at one end and sub-leasing these to the consumers on the other end. Consumers, brokers, and providers are bound to their requirements and related compensations through SLA's. Thus the enterprise IT consumer would get this compute tasks executed through the compute cloud.

XIV. Conclusion

Cloud computing is changing the way IT departments buy IT. Businesses have a range of paths to the cloud, including infrastructure, platforms and applications that are available from cloud providers as online services. In conclusion, cloud computing is recently new technological development that has the potential to have a great impact on the world. It has many benefits that it provides to it users and businesses. For example, some of the benefits that it provides to businesses, is that it reduces operating cost by spending less on maintenance and software upgrades and focus more on the businesses it self. But there are other challenges the cloud computing must overcome. People are very sceptical about whether their data is secure and private. There are no standards or regulations worldwide provided data through cloud computing. Europe has data protection laws but the US, being one of the most technological advance nation, does not have any data protection laws. Users also worry about who can disclose their data and have ownership of their data. But once, there are standards and regulation worldwide, cloud computing will revolutionize the future.

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