IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Cloud Computing: Review and Trends

Prof. Minakshi V. Pachpatil, Prof. Vaishali U. Gaikwad

Assistant Professor, Assistant Professor
Computer Science and Engineering
CSMSS Chh. Shahu College of Engineering, Aurangabad, India

Abstract: Cloud Computing is a technology which is a network of remote servers hosted on the internet used for storing and retrieving data. It provides on demand services which can be resources or application. With cloud computing you can pay only for resources that you use. Application can scale up as demand goes increase as well as scale down when number of requests goes down. Cloud computing provides different services like Cloud AI, cloud database, security in the cloud, networking, computing etc.Here in this paper we are discussing some latest trends in cloud computing like computing, storage, security.

***Index Terms*- Cloud, public cloud, private cloud, hybrid cloud, community cloud, IaaS, PaaS, SaaS**

I. INTRODUCTION

Cloud Computing is a technology which is a network of remote servers hosted on the internet used for storing and retrieving data. Different services provided by cloud includes IT services such as servers, databases, software, virtual storage, and networking etc. Companies which offers these services are called as cloud service providers. These cloud service provider gives you ability to store and get data and execute applications, manage them through configuration portals. Two of the best cloud providers today are Amazon Web Services and Microsoft Azure.

II. CLOUD CATEGORIES

Based on Deployment Models.

1. **Public Cloud**: In a public cloud anyone can access the resources through the internet. In allows user with appropriate permissions to access all the resources and applications which is available publicly. The Interesting part about the public cloud is that no need to purchase component likehardware, software, or application. All the components in the cloud are managed by the service provider. Amazon Web Services and Microsoft Azure are the examples of the public cloud.
2. **Private Cloud:** A private cloud owns by a single organization. It provides the computing services to selected users or internal network. Only the people in private network can access private cloud. Private cloud is managed by the organization or third party. VMware cloud is an example of a private cloud. Advantages of Private cloud includes higher security, more control over resources.
3. **Hybrid cloud**: It is the combination of Public cloud and private cloud. Organizations that uses hybrid cloud performs critical activities using private cloud and non-critical activities using public cloud. Best example of hybrid cloud is NASA.A private cloud is used to store sensitive data and public cloud to save and share data that can be viewed by the public worldwide.

Based on Service model

1. **IaaS (Infrastructure as a Service):** In IaaS different cloud service provider such as amazon provides IT infrastructure to your organization either on rent or lease basis. Cloud service provider is responsible for managing hardware like servers, storage as well as software and setting up cloud data center and provide security. Companies like Microsoft Azure, Amazon, Google cloud provides Iaas service.
2. **PaaS (Platform as a Service):** In PaaS runtime environment is provided by cloud service provider to different user applications. Programmer can easily create, test and manage web applications. Cloud service provider is responsible for managing infrastructure which includes server, network and databases as well as platform which includes middleware, development tools, and database management system. Example of PaaS is AWS Elastic Beanstalk, Azure.
3. **SaaS (Software as a Service):** In software as a service different services are hosted by service provider and client can access those services without installing any software using internet. Different services provided by SaaS provider includes:

Enterprise Resource Planning, Customer Relationship Management, billing and sales, mail services. Cloud service providers include: Microsoft Azure, Amazon Web Services (AWS), Google Cloud, Alibaba Cloud, IBM Cloud, Oracle, Salesforce, SAP, Rackspace Cloud, VMWare.

III. CLOUD COMPUTING ACHITECTURE:

.

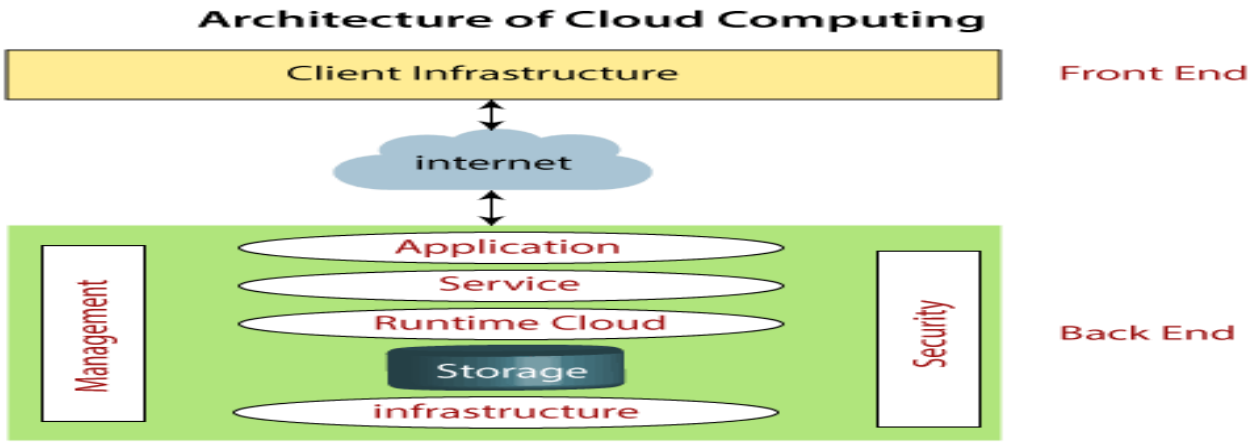

Fig.1 Architecture of Cloud Computing

A Cloud computing architecture is divided into two parts:

Front End: Front end consist of interfaces and applications which is use to access cloud services. E.g. web browser (including Chrome, Firefox, internet explorer, etc.)

Backend: Backend used by cloud service providers which contains different resources like servers, data storage security mechanism, traffic control, virtual machine.

Components of Cloud computing architecture:

1. Client Infrastructure: It is GUI using which client can interact with cloud.
2. Application: Application can be service (platform, software) that client want to access.
3. Service: Services includes Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS).
4. Runtime Cloud: It provides execution environment to different cloud applications.
5. Storage: It provides storage for storing large amount of data in the cloud.
6. Infrastructure: Cloud infrastructure use by cloud service providers which include components like storage, network devices, Virtualization software, servers.
7. Management: It manages the different components like services, runtime cloud, storage, application.
8. Security: Different security mechanisms implemented for securing cloud system, resources,files and infrastructure to user.
9. Internet: End user can access all the services provides by cloud using internet connection.

IV. VIRTUALIZATION:

Virtualization is use to create virtual thing like server, storage device, operating system etc. Creating virtual machine over existing hardware and operating system is called as Hardware virtualization. The machine on which virtual machine is created called as Host machine and virtual machine is called as guest machine. The software which manage virtual machine is called as Hypervisor. VMware and Microsoft provide virtualization services. Instead of using your PC for storage and computation, you can use their virtual servers. They are fast, cost-effective, and less time-consuming.

Different types of Virtualization:

1**. Storage Virtualization**: Pool up the storage devices from multiple networks so it appear like a single storage device.Storage Virtualization provides the facility of secure backup, recovery task, archiving by consuming less time.

2. Server Virtualization: It is the process of dividing physical server into multiple virtual servers. Server virtualization makes possible to run multiple virtual server on same system.so it minimize the cost of hosting a web service on a separate machine for each web server.

3. Operating System Virtualization: It allow to run multiple instances of different operating system. In this kernel allows more than one isolated user space instances.Such instance is known as container/virtualization engine.

V. APPLICATIONS OF CLOUD COMPUTING

Cloud service providers provide various applications in the field of art, business, data storage and backup services, education, entertainment, management, social networking, etc.

Fig. 2 Applications of Cloud Computing.

VI. CLOUD COMPUTING TRENDS

1. Cloud AI:

Artificial Intelligence is the simulation of intelligence in machine.AI driven machine can automate repetitive task and perform data analysis without human intervention. Using AI it is possible to identify patterns and trends in large datasets.AI tools performs data analysis fast so enterprises can address customer issues rapidly.

A significant amount of processing power is required to run AI algorithms, making it unaffordable for many enterprises, but this deterrent is being eliminated by the recent availability of AI software-as-a-service, on the lines of software-as-a-service or infrastructure-as-a-service.

Fig.3 AI in Cloud

Cloud computing and its technologies improved AI using following cloud delivery models:

i. **IaaS (Infrastructure as a Service)** helped AI practitioners to have an infrastructure environment — CPU, memory, disk, Network, O/S easily so that a practitioner doesn't lose time without waiting for an infrastructure team to prepare it.

ii**. PaaS (Platform as a Service)** helped AI practitioners to use AI and data science services including jupyter notebooks, data catalog services to develop new generation applications easily.

iii**. SaaS (Software as a Service)** helped users to consume AI services within an application i.e. CRM, payment applications to create efficient results.

Cloud technologies:

i.Containers: Packaging your applications code and dependencies into single object.Containers can also be used for processes and workflows where essential requirements for security, scalability and reliability.Amazon ECS(Amazon Elastic Container Service) is container management service which enables to run and scale containerized applications on AWS.As containers started to isolate applications from computing environments, containers provided the same interface and environment to all data scientists. Moreover, data scientist teams may run their containers on different cloud providers even with GPU capabilities that they preferred.

ii. **Kubernetes**: Kubernetesis a open source software where you can deploy and managed your containerized application. Amazon Elastic Kubernetes Service (Amazon EKS) is a fully managed service which you can use to run Kubernetes on AWS platform. Data scientists wants containerized data science platforms which can be scale where Kubernetes helped them. Kubernetes also provides data science applications, platforms running on containers to run on different cloud providers without worrying about compute environment.

iii. **Data Sets consumption:** Most important part of AI applications is Data.you can store data either in public cloud or private cloud for work.

iv. **Talent/Skills availability**: Platforms like Kaggle can run on cloud and data experts collaborate to build and optimize AI, ML, NLP algorithms. Datasets are available and platforms like kaggle are open to everyone so it raised new talents.

v. DevOps: It combines two words software development (Dev) and IT operations (Ops). It collaborate between Developer and operator. DevOps promotes collaboration between Development and Operations team to deploy code to production faster in an automated & repeatable way.

2. Serverless Computing

In Serverless Computing all the resources are provided by the cloud service provider and software developers no longer to manage network servers. In Serverless Computing cloud application developer may not need to expert in AWS cloud or Google Platform as a result developer can more productive and focusing on development. Benefits of serverless computing is automatically scale serverless applications. It modifies units of consumptions such as memory, throughput. An AWS Lambda is the example of serverless computing.

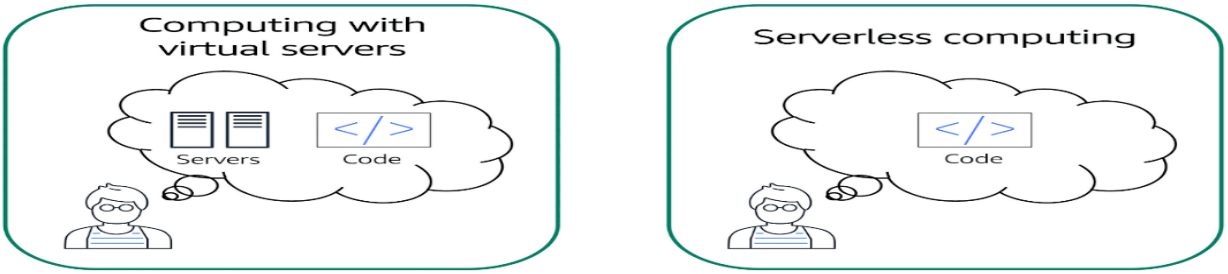

Fig.5 Serverless Computing

i.AWS Lambda: AWS Lambda is a serverless service which runs your code without managing servers. Here you can pay only for time that you consume and charges applicable when code is running. You can also run code for virtually any type of application or backend service. For example, a simple Lambda function might involve automatically resizing uploaded images to the AWS Cloud. In this case, the function triggers when uploading a new image.

3. Enhanced Security

Data Security in cloud is the important issue and organizations do not want to rely on third party security solution. Firms that don't have resources to implement in-house security must rely on third parties. Cloud security having set of control based safeguards designed to protect resources stored online.

Cloud security is a responsibility that is shared between the cloud provider and the customer which is referred as shared responsibility model. The shared responsibility model divides into customer responsibilities (commonly referred to as "security in the cloud") and AWS responsibilities (commonly referred to as "security of the cloud").

Customers: Security in the cloud: Responsibilities of the customer includes specify which content stored in the cloud, who has access to that content, which services you use. Steps include selecting, configuring, and patching the operating systems that will run on Amazon EC2 instances, configuring security groups, and managing user accounts.

AWS: Security of the cloud: AWS manage, controls host operating system, the virtualization layer, and physical security of data centers. Although you cannot visit AWS data centers to see this protection firsthand, AWS provides several reports from third-party auditors. These auditors have verified its compliance with a variety of computer security standards and regulations.

User permissions and access

AWS Identity and Access Management (IAM): AWS IAM provides access to AWS services and resources based on company's specific operational and security needs. IAM features include:

IAM users, groups, and roles

IAM policies

Multi-factor authentication

IAM users:

When you create first AWS account that user is known as root user. It has complete access to all the AWS services and resources in the account. IAM user is an application or user that interact with AWS services and resources.Bydefault it has no permission, in order to perform specific action such as launching Amazon EC2 instance or creating Amazon S3 bucket you(root user) must give necessary permissions to IAM user.

IAM policies

It is a document which allows or denies permissions to AWS services and resources.It enable you to customize users' levels of access to resources. For example, you can allow users to access all of the Amazon S3 buckets within your AWS account, or only a specific bucket.

IAM groups

An IAM group is a collection of IAM users.When IMA policy is assigned to specific group then all the user in the group are granted permissions specified the policy.

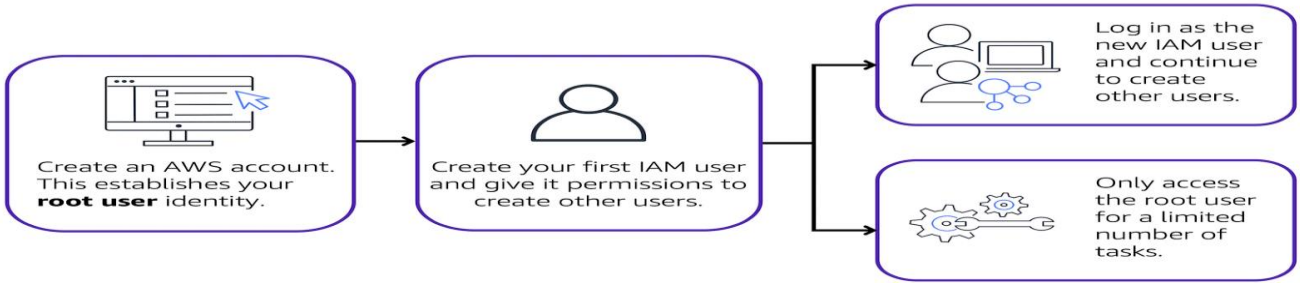

Fig.6 IAM User in Cloud

IAM roles:

It is an identity that you can gain temporary access to permissions. IAM roles are ideal for situations in which access to services or resources needs to be granted temporarily, instead of long-term.

Distributed denial-of-service attacks

In a distributed denial-of-service (DDoS) attack, multiple sources starts an attack that make a website or application unavailable. It can come from a group of attackers, or even a single attacker.

AWS Shield is a service that protects applications against DDoS attacks.

AWS Key Management Service (AWS KMS) enables you to perform encryption operations through the use of cryptographic keys. For example, you can specify which IAM users and roles are able to manage keys. Alternatively, you can temporarily disable keys so that they are no longer in use by anyone. Your keys never leave AWS KMS, and you are always in control of them.

AWS WAF is a web application firewall that lets you monitor network requests that come into your web applications.

Amazon GuardDuty is a service that provides intelligent threat detection for your AWS infrastructure and resources. It identifies threats by continuously monitoring the network activity and account behavior within your AWS environment.

VII. REFERENCES

[1] Murphy, Michael A.; Abraham, Linton; Fenn, Michael; Goasguen, Sebastien: Autonomic Clouds on the Grid, In Journal of Grid Computing, v 8, n 1, p 1-18, February 2010.

[2] Nicholas. Carr, fresh Yan Yu, "IT is no longer important: the Internet great change of the high ground - cloud computing," The Big Switch:Rewining the World,from Edison to Google, CITIC Publishing House, October 2008.

[3] Xin Tan, Yongbeom Kim, "Cloud Computing for Education: A Case of Using Google Docs in MBA Group Projects", Information Systems and Decision Sciences Department, Fairleigh Dickinson University.

[4] Prabir Bhattacharya, Minzhe Guo, Lixin Tao, Bin Wu, Kai Qian, E. Kent Palmer, "A Cloud-based Cyberlearning Environment for Introductory Computing Programming Education", University of Cincinnati, Cincinnati, Ohio, 11th IEEE International Conference on Advanced Learning Technologies, 2011.

[5] Amazon Elastic Compute Cloud (EC2): http://www.amazon.com/gp/browse.html? node= 201590011. 2008.

[6]The four benefits of cloud computing, Sina science and technology, http://www.cloudcomputing-china.cn/Article/jh/200811/218.html, November 13, 2008.