ISSN No. 0976-5697

Volume 7, No. 6(Special Issue), November 2016

International Journal of Advanced Research in Computer Science

REVIEW ARTICLE

Available Online at www.ijarcs.info

Pillars of Cloud Computing

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Abstract:- Cloud Computing represents both the application that are being delivered as services over the internet and as well as the Hardware and the System Software's that provide these services. Cloud has totally changed the way IT Hardware and Software is designed as purchased. With cloud the internet has become a place where you not only browse websites and download software but each and every thing you do on your computers and much more is available. It can be looked as everything has been moved to internet one just need only a browser and everything is available space to store data, virtual machines to run every kind of operating systems available, all the software application can be accessed using the web browser. These software applications and data is stored in the servers that are placed in the data centres across the world to provide better service to consumers. So cloud has bring a new era to the computer world where one need not to buy or install the software application or hardware you need to pay only for what you use and this is the principle of the cloud computing. One of the main feature of the cloud computing is the scalability which is the ability to add or remove hardware and software according to the need of the user, this process technically known as scale up, adding more hardware or software and scale down, removing existing hardware or software in cloud Datacenters to meet the changing requirements of the user.

Keywords:- Cloud Computing, SaaS, PaaS, IaaS, Virtualization

1.INTRODUCTION

Cloud Computing: Cloud Computing represents both the application that are being delivered as services over the internet and as well as the Hardware and the System Software's that provide these services. Cloud has totally changed the way IT Hardware and Software is designed as purchased. With cloud the internet has become a place where you not only browse websites and download software but each and every thing you do on your computers and much more is available. It can be looked as everything has been moved to internet one just need only a browser and everything is available space to store data, virtual machines to run every kind of operating systems available, all the software application can be accessed using the web browser. These software applications and data is stored in the servers that are placed in the datacenters across the world to provide better service to consumers. So cloud has bring a new era to the computer world where one need not to buy or install the software application or hardware you need to pay only for what you use and this is the principle of the cloud computing. One of the main feature of the cloud computing is the scalability which is the ability to add or remove hardware and software according to the need of the user, this process technically known as scale up, adding more hardware or software and scale down, removing existing hardware or software in cloud Datacenters to meet the changing requirements of the user. For example you goto a service provide say DropBox and buy 100 GB of space one will pay only for 100 GB of space one can scale up or scale down it if you want to use the 50 GB you will pay for 50 GB. This hard-disk is installed on the servers of the service provider user can upload or download the data from this hard-disk using specialized software application or simply browser to access the cloud service. Cluster are provided for high availability, this is very basic example of cloud computing there are lot many examples that normal users use in their daily life Gmail, Gdrive, DropBox, OneDrive, Spideroak.

2. Main Three Pillars of Cloud

When talking about cloud there are mainly three architectures that makes the foundation of the cloud computing. These are Software as a Service (SaaS) which comes at the top this is for normal users who want to store or access software application then comes the Platform as a Service (PaaS) which is specialized designed for the software developers, and at last core of the cloud Infrastructure as a Service (IaaS) which covers all the hardware devices infrastructure that is necessary to run the cloud the major part of IaaS in cloud is that it is used for running virtual images. All the servers computers that are running in the Datacenters of Cloud provider collectively and Collaboratively

build the Infrastructure as a Service. We call them as Three Pillars of the Cloud Computing.

A. Software as a Service:

At the top most level of the cloud computing there exist a layer of abstraction called Software as a Service. This is basically the establishment of the different kind of software applications, commonly used applications and business logic applications on the servers of cloud provider in such a manner that they can be easily accessed using web browser or other client side tool. Software as a Service also work as an interface layer between the cloud and the user. In a more complex manner Software as a Service is the implementation of a multitenant architecture in which a single software application is being used, accessed by multiple users from different location across the globe. Software as a Service provide software applications on demand, on rent to users who want to access these application for a specific time period and bill is generated according to the hours and minutes they use the application although the access to these application is provided freely to some extent with limited features but users have to buy it if their need increases. For example a user can buy Microsoft Office 365 for one year for 300 rupee. It will provide you Office Online, Email with 50 GB mailbox, 1 TB file storage and sharing and HD video conferencing. Software as a Service provide a Complete Software Solution. These software can include Email management system, Enterprise Resource Planning (ERP) system, documentation management, Customer Relationship Management and other normally used software applications such as online document editing, online photoshop for photo editing, online code editor to run and compile the code etc. Software as a Service sometimes also combined with the Storage as a Service.

B. Storage as a Service:

This is another cloud service model in which storage space is provided to users where they can store whatever they want. It is simply harddrive on remote location where user upload and download files. Charges are paid by user as per the space in GB they use.

Popular and well known live examples of Software as a Service / Storage as a Service

- **Microsoft Live** Microsoft is providing its all services online under URL people.live.com users log in to their Microsoft account and then can access applications Outlook.com, People, Calendar, OneDrive to save documents online, Word Online to edit documents, Excel Online to create and edit spreadsheets, PowerPoint Online to work with presentations, OneNote Online , Office Online and Skype online within the web browser.
- **Google Drive** Google is providing storage service under Google Drive drive.google.com it gives users 15 GB of free storage users can sign up for Google and can upload their documents, pictures and other things. Whatever files we attach to our Gmail also gets stored in Google Drive.
- **DropBox** is providing free space to users. Its basic account starts with 2 GB of free storage but users can earn more 16 GB free space by referencing to their friends. This is not available for Linux users.
- **Spider Oak** is also providing 2 GB of free storage to users. Users can buy more space such as 30 GB for USD 7 a month or USD 79 per year, 1 TB for USD 12 a month or USD 129 per year, 5 TB for USD 25 a month or USD 279 per year. This is also available for Linux systems like Ubuntu.
- There also exist unique techniques called **ODrive** this combine all your space and files saves across different cloud like GDrive, GPhotos, DropBox, and make them available to your personal computer using single ODriver client application. This is secure as it provide AES 256 bit encryption.

C. Platform as a Service

Platform as a Service is the cloud service model that is specially designed for the developer, programmer who develop applications write code and work with different platform such as Java platform .Net platform, PHP and database server to run these application like mysql server. Platform here represents a runtime environment that is required for an application to run. Thus applications are executed on the dedicated servers datacenters and is no more the matter of concern for programmers in exchange for this, developers have to handle some constraints that environment imposes on their application design. A very simple example of Platform as a Service can be taken as if programmer has developed a java web application in JSP then developer has to install Tomcat or JBoss server on the local machine to process JSP pages then a database server to store and retrieve data and the corresponding hardware to store and handle requests coming from the users and after establishing this complete platform only then he can deploy his application, the job does not end here he also has to maintain the availability and uptime of the application. And the risk is if user requests are not coming in large no. then the hardware resources are not fully utilize and this lead to increased cost. But with

Platform as a Service this has been totally removed and now the only job of the developer is to develop the application and deploy it to the cloud. The cloud provider provide the servers where all to platform like Tomcat, JBoss, WAMP, database server are already installed. Developer just has to choose the platform and deploy the application, developer can scale up or scale down the hardware software resources according to users requests and space required. Charges are paid by the developers on the basis of hardware/software resources and space they use. On the servers in datacenters these platforms are shared by multiple applications.

Popular and well known live examples of Platform as a Service

- **OpenShift by RedHat** OpenShift is Red Hat's Platform-as-a-Service (PaaS) that allows developers to quickly develop, host, and scale applications in a cloud environment. You can freely signup for the OpenShift. OpenShift provide a wide range of platforms where you can deploy you application these platforms include Java, JBoss, JBoss AS/ Wildfly, Tomcat, PHP, Zend, Ruby, Node.js, MongoDB, MySQL, PostgreSQL,JBoss Fuse, Vert.x and many more. You can deploy you application freely in small gear it gives you the option to specify public URL to access your application, upload source code and region selection while deploying and creating application. You can upgrade your gear size accordingly.
- **Salesforce.com force.com** Force.com is Salesforce.com's cloud computing platform as a service (PaaS) development framework. It facilitates developers in building multi-tenant applications to be hosted by and presumably integrated to Salesforce.com. The company pushes the tag line "development as a service", however that phrase has not gained acceptance outside its own marketing context. Other vendors and the industry at large continue to describe this type of service within the "platform as a service" cloud category. Force.com development is performed using nonstandard, purpose-built tools and a proprietary development language called Apex. Specialized tools are designed for the presentation layer, application layer and data model. For example, Visualforce uses an XML-like syntax for building user interfaces in HTML, Ajax or Flex. Force.com development is performed using nonstandard, purpose-built tools and a proprietary development language called Apex. Specialized tools are designed for the presentation layer, application layer and data model. For example, Visualforce uses an XML-like syntax for building user interfaces in HTML, Ajax or Flex. The Apex language mimics a C-style syntax and is a pseudo-combination that resembles Java and SQL (structured query language). To maintain integrity, extensibility and continued evolution, custom developed code is positioned in layers of abstraction whereby Force.com's runtime engine can interpret the metadata at the point of execution.
- **Heroku** is another Platform as a Service provider who's parent organization is Salesforce.com. you can build and deploy applications in Node.js, Ruby, Java, Python, PHP, Scala, Clojure, Go which is the programming language of Google. Heroku run applications on Dynos. A dyno is a lightweight Linux container that runs a single user-specified command. A dyno can run any command available in its default environment or in your app's slug that is a compressed and pre-packaged copy of your application and its dependencies. There may be three types of dynos. Web Dynos web dynos are dynos of the "web" process type that is defined in your Procfile(it is a file which declares what commands are run by your dyno on Heroku Platfrom). Only web dynos receive HTTP traffic from Heroku's routers. Worker Dynos worker dynos are typically used for background jobs, queueing systems, and timed jobs. You can have multiple kinds of worker dynos in your application. For example, one for urgent jobs and another for long-running jobs. One-off Dynos they are used for administrative tasks such as database migrations and console sessions.
- **Google App Engine** Google's Platform as a Service. Google App Engine supports Python with webapp2 and jinja2, Java with Maven, PHP with Cloud SQL. Go with html package/template. Go is a new programming language which has been developed by Google itself. From storage perspectives Goolge App Engine provide schemaless NoSQL data stores which provide robust, scalable storage web applications, with no planned downtime, high availability, strong consistency and atomic transactions.
- **Cloud Bees** is a powerful Platform as a Service provider now it also provides continuous delivery solutions powered by Jenkins CI. Jenkins is an open source continuous integration tool written in java CloudBees is built upon the core of Jenkins, Jenkins manages and controls development lifecycle processes of all kinds, including build, document, test, package, stage, deployment, static analysis and many more. To deploy application to CloudBees developer need to

create a account on CloudBees and subscribe to basic Dev@Cloud and Run@Cloud services then developer need to create a new project after this developer need to initialize the application from cloudbees menu you have to specify the name of the application select the cloudbees domain. This will initialize the application to Run@Cloud. Then you need manage the source code which is done with GitHub as intermediate. With SSH url developer can fetch the source code and push it to GitHub. After you have done with GitHub, in the "Post-build Actions" , select Cloudbees Deployment and enter the Application Id that you had chosen when initializing the application. Now its time to launch the build once it is build the application is deployed to the Run@Cloud.

3. INFRASTRUCTURE AS A SERVICE

At the most basic level of cloud there comes the infrastructure actual hardware on which all other cloud services operate because you need a server a computer system on which you can run your application so it is the service of cloud in which running live machine instances are created for the developers. These instances essentially behave like dedicated servers that are controlled by the developers, who therefore have full responsibility for their operation. It experience like having a personal computer on remote location and accessing it remotely. A developer can create a thousand of machines within few seconds. These machine instances on the cloud are fully customizable. When these machines are created developer is asked about how much CPU power is required (how much cores you want your machine to have 2, 4,8, etc). RAM to be assigned to the instance being created depending upon the operating system you are going to install on it. Harddisk space no. of drives developer can upload virtual harddisk to attach to this instance. After this developer has to made a final selection which is to select the operating system this operating system will be installed on the machine and after few minutes this instance will be up and running and can be accessible from any remote location. The major concept used in Infrastructure as a Service is the virtualization all these machine instances are virtual machines. In the cloud datacenters a single server runs thousands of virtual machine. This is running multiple operating system on vmware workstation on single hardware but in the cloud technology is used which allows virtualization on bare metal. Thus virtualization covers a major part of cloud where all the machine instances are running. This service is intended for developers who can write arbitrary software on top of the infrastructure with only small compromises in their development methodology.

Popular and well known live examples of Infrastructure as a Service

- **Amazon Web Services (AWS) Elastic Cloud Computing (EC2)** Amazon EC2 presents a powerful virtual computing environment, allowing you to use web service interfaces to launch instances with a variety of operating systems. You just need to choose the preconfigured Amazon Machine Image, specify the other parameters and type how many no. of instances of this type you want and the instances will be created. Amazon usage Amazon Elastic Blok Storage which provides persistent storage for Amazon EC2 instances. Amazon allow developers to deploy applications to multiple regions according to the users who will access the instance. To create a virtual instance on Amazon you need to create account on Amazon and also have to provide the credit card detail, however there exit Amazon Free Tier which lets you access Amazon resources free to some extent. With Amazon Free Tier you can use the resources free for 12 month/one year. You can use Amazon EC2 for 750 hours per month of Linux, RHEL instance usage, Amazon DynamoDB with 25 GB of Storage and 25 units of read and write operations. You can use free software like CentOS, LAMP Stack, Git, Wordpress, Magento and others.
- **Openstack:** OpenStack is an open source cloud operating system that is a global collaboration of developers and cloud computing technologists producing the ubiquitous open source cloud computing platform for public and private clouds. OpenStack provides a series of services that openstack is built on to deliver all the different services that are required to run a public or a private cloud. OpenStack is the best open source option available if an organization wants to build its own private cloud. If you don't want to use public cloud platform provided by Amazon, Microsoft or any other company and want to build your own private cloud you can go with Openstack. All you need is the hardware infrastructure on top of which you want to build you cloud, configure the different Openstack services according to you needs. There are three core Openstack services that needs to be configured properly if an organization want to use Opentsack and these services are:

  Horizon (Dashboard): Openstack Horizon service provide a web based dashboard which is used to access

monitor and control all the other different services running on the Openstack. It provides a rich GUI to Launch new virtual machines, control and connect existing virtual machines, assigning IPs and configuring access control.

Nova (compute): Openstack compute service manages the different running instances, and here an instance refer to a virtual machine. The Openstack Nova service is responsible for launching , spawning, scheduling and decommissioning of the virtual machines on demand.

Neutron (Networking): Openstack Neutron enables Network-Connectivity-as-a-Service for other different Openstack services. This basically provides the network connectivity between different virtual machines running inside Openstack and connectivity of those VMs to the outer world internet. Apart from these three core Openstack services there are other service that include but not limited to : Swift (object storage), Cinder (block storage), Glance (image service), Keystone (identity), Ceilometers (billing and metering), Ironic (bare metal provisioning), Designate (DNS service), Trove (Database), Barbican (key management), Zaqar (messaging service).

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