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A New Era of Research & Development: Cloud Computing

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Abstract: Cloud computing is a technology that broadly shares the computer resources instead of being sharing a product. It is advancement over the distributed computing where we pay as per usage basis. Instead of installing a suite of software on each pc we would only have to load only one application which allows the cloud users to log in to the web server to access the resources. Cloud computing is based on several other computing technologies such as HPC, Virtualization. It has its own technical, conceptual & economical aspects. It has various areas of research into different aspects such as platform, architecture, scheduling, security, virtualization etc. All these different areas have good future scope. This paper outlines about all the areas of cloud computing mentioned above.

Keywords: Cloud computing, Virtualization, Scheduling, HaaS, PaaS, IaaS, Platform.

I. INTRODUCTION

Cloud computing is not a total new concept; it is originated from the earlier large-scale distributed computing technology. However, it will be a subversion technology and cloud computing will be the third revolution in the IT industry, which represent the development trend of the IT industry from hardware to software, software to services, distributed service to centralized service. Cloud Computing refers to both the applications delivered as services over the Internet and the hardware and systems software in the datacenters that provide those services. The services themselves have long been referred to as Software as a Service (SaaS). The datacenter hardware and software is what we will call a Cloud. When a Cloud is made available in a pay as- you-go manner to the general public, which called a Public Cloud; the service being sold is Utility Computing. The term Private Cloud is used to refer to internal data centers of a business or other organization not made available to the general public. The main advantage of Cloud computing is the flexibility which makes it distinguishable from grid or utility computing and SAAS (Software as a Service) [1].The cloud computing has amazed the vendors with the idea of pay-as-you-go payment of cloud architecture and grouping of allocation of resources only on demand. Companies subscribe to cloud providers and use their services with payment as per use. It is cost effective for them to just pay and use service rather than maintain their own servers. Cloud providers have come across for ways to distribute differentiated cloud computing services to their clients very speedily & efficiently. Grid computing seems to be a famous trend for few basic reasons that first it's allow to use computer recourse more cost effectively, secondly the computing power of grid. Many problems that are not solved with traditional architecture of computer grouping, grid provides solution to those issues. Third its suggests that the many computer recourse can be agreeably and perchance synergistically connect and deal with as a cooperation toward a ordinary goal. Grid and cloud some time get mixed with each other, grid computing allows a numbers of computers to work jointly like a system whether cloud is a single computer that doing use computing and other task as cloud computing architecture. Classification focus on the architecture, virtualization management, services by cloud, fault tolerance, security and few other issues like load balancing, interoperability, and scalable data storage. As for support of virtualization, SaaS solution has recommended. It allows for the software as a service architecture for cloud computing. Cloud computing is a newly developed computing model, which could use resources over Internet to finish the task by enterprise and personal [10]. As per literature Computing is a virtual pool of computing resources. It provides computing resources in the pool for users through internet. Integrated cloud computing is a hole dynamic computing system. Major advantages of the Cloud computing are , style as SAAS (Software as a service), Utility Computing, Network service, PAAS (Platform as a service), MSP (management service provider), Commercial service platform, integrating internet [7].NLP-model on the intrusion detection application to reduce repetitive implementation expenses by using profitable compute & storage resources [13]. The cloud computing brief introduction has been shown in Fig 1.

This study goal is focusing to find out the potential and prospective of cloud computing architecture. Cloud computing is defined as a model that enable convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [14]. This definition includes cloud architectures, security, and deployment strategies. In particular, five essential elements of cloud computing are clearly articulated [15]:

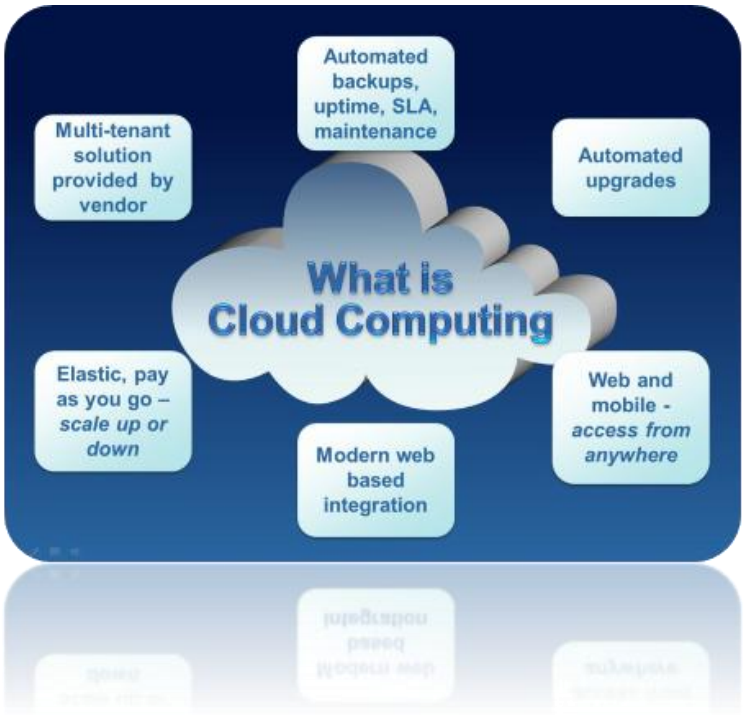

Fig 1: Cloud Computing Basic

***On-demand self-service*:** A consumer with an instantaneous need at a particular timeslot can avail computing resources (such as CPU time, network storage, software use, and so forth) in an automatic (i.e. convenient, self-serve) fashion without resorting to human interactions with providers of these resources.

***Wide network access*:** These computing resources are delivered over the network (e.g. Internet) and used by various client applications with heterogeneous platforms such as mobile phones, laptops, and PDAs) situated at a consumer's site. The network accesses to the users are very wide.

***Resource pooling*:** A cloud service provider's computing resources are 'pooled' together with the motive to serve multiple consumers using the *virtualization* model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand" [1]. The cloud computing is designed to be used by everyone and it also provides various services to the end user. The Fig 2 shows cloud for everyone technology.

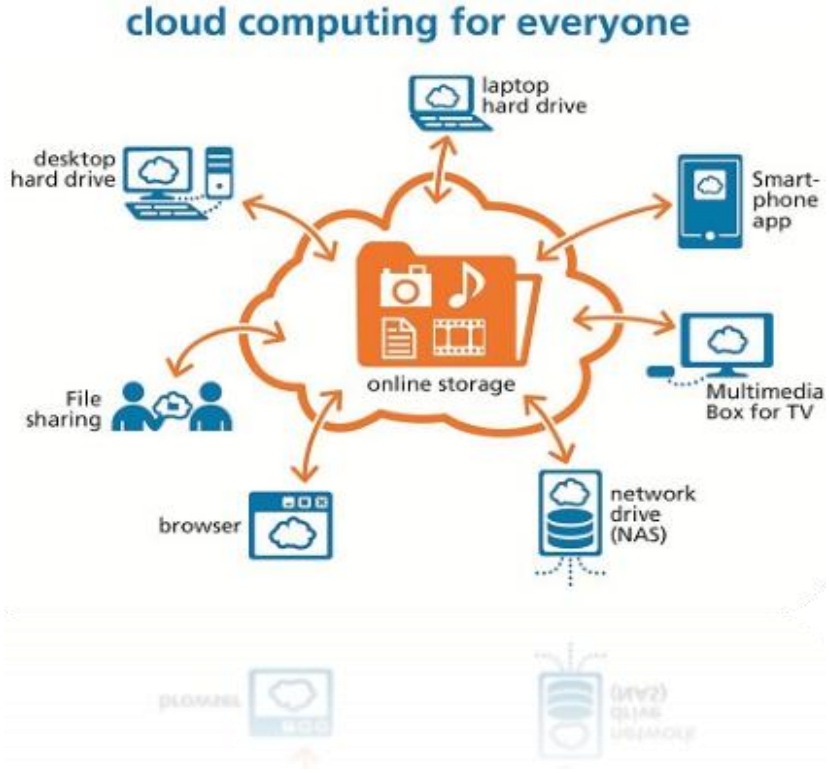

Fig 2: Cloud for everyone

The motivation for setting up such a pool-based computing paradigm lies in two important factors: economies of scale and specialization.

***Rapid elasticity*.** For consumers, computing resources become immediate rather than persistent: there are no up-front commitment and contract as they can use them to scale up whenever they want, and release them once they finish scaling down. Moreover, resources provisioning appears to be infinite to them, the consumption can rapidly rise in order to meet peak requirement at any time. The end users are unaware of the servers and they just pin p the applications they want to use and thereby start the work. The main advantage of Cloud computing is the flexibility which makes it distinguishable from grid or utility computing and SAAS (Software As a Service). This ability to launch new instance of application with minimum lab our & expense allows application providers to:

- Scale up & down rapidly.
- Recover from a failure
- Bring up development or test instance
- Efficiently load test an application

Cloud computing unlike traditional computing provides the computing facility the client by means of various services that are handled by different cloud vendors or cloud providers. One cloud provider may have multiple clients as well. Various services provided by cloud computing are shown in Fig 3.

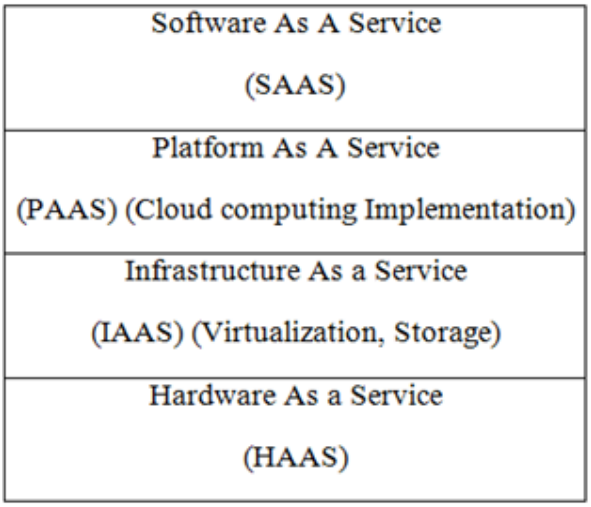

Fig 3: Cloud Computing Services

Software as a Service (SaaS)
Software is presented to the end user as a service on demand usually in a browser. It saves the users from the troubles of software deployment & maintenance. The software is often shared by multiple tenants, automatically updated from the clouds, and no additional license needs to be purchased. [3] It is a model of software deployment wherein a provider delivers its service to the user on demand basis. Example: - Google Apps.

Platform as a Service (PaaS)
It delivers a computing platform & solution stack as a service. It hides all the complexity of managing the underlying hardware, provides all the facilities required to support the complete lifecycle of building & deploying the web application and services entirely from the internet.[4] Platform as a Service (PaaS) is a way to rent hardware, operating systems, storage and network capacity over the Internet. The service delivery model allows the customer to rent virtualized servers and associated services for running existing applications or developing and testing new ones.

Infrastructure as a Service (IAAS)
It is also referred to as the resource cloud. Consumers control and manage the system in terms of the operating systems, applications storage and network connectivity but don't themselves control the cloud infrastructure. IaaS delivers a platform virtualization or network equipment; clients instead buy those resources as a fully outsourced service. Amazon S3, SQL Azure are the examples of IaaS.

Hardware as a Service
Hardware as a Service, also known as (HaaS), provides your business with the ability to provide a complete end-to-end managed service solution, which can include anything necessary to bring a client's network into today's technology. This can include servers, desktops, notebooks, infrastructure components, licensing, and much more, all in a monthly, recurring revenue based solution, with no up-front costs. Hardware as a Service (HaaS), in a managed services context, is a procurement process similar to licensing. Generally speaking, a managed service provider (MSP) remotely monitors and administers hardware on a client's site on a subscription basis.

Measured Service. Although computing resources are pooled and shared by multiple consumers (i.e. multi-tenancy), the cloud infrastructure is able to use appropriate mechanisms. The rest of this paper is organized as. Section II virtualization Section III scheduling Section IV platform and Section V conclude this paper.

II. VIRTUALIZATION

It is a technology that combines or divides computing resources to present one or more number of functional environments. This is achieved through techniques such as hardware or software partitioning or assemblage, time sharing & other methods. It also enables the options to run multiple virtual computers on a single physical system. For each & every organization efficient use of computer resources would be the highest priority. These resources can include hardware & software. With the virtualization technology both hardware and software can be repurposed so that the end user would be able to utilize all the resources efficiently.

IBM was the first to introduce the virtual machine concept in the 1960s. Each virtual machine was the representation of a physical machine; making the users believe that they were accessing the physical system directly. It enabled time-sharing and resource sharing on very expensive hardware. To the end- user this was completely transparent. During the 1970s and 1980s the costs of computer hardware dropped significantly; as a result, virtualization became almost extinct. Throughout the 1990s, with the emergence of Personal Computers, the need to run different applications that were targeted for a specific hardware or operating system on a single machine was the initiative for virtualization to return to the market [2].

Virtualization is a growing technology in the modern era with very high demand & its market is increasing or developing at a very vast rate. Virtualization is taking over datacenters slowly moving into the desktop market there are issues that need to be addressed. There are various major issues associated with virtualization and are discussed below:

Security: There are various security issues in the virtualization during accessing the multiple computers through this technology. Security isolation is the basic requirement to implement the virtualization. VMs have the rapid adoption in the situations where separation from a host program or the main program is very critical. Another security related issue called as “hyper jacking” where an attacker crafts & then runs an ultra-thin hypervisor that takes complete control of the underlying operating system.

Network Complexity*:* Despite of having the cost benefits & the resource utilization benefits it also comprises of network complexity drawback in a manner. While moving from multiple physical servers to virtual machines so the running on a smaller number of physical machines do not negate network requirements. If the network of host computer fails so in that case all other computer may lead to failure.

Power consumption: Its main benefit is that it leads to minimization of power consumption. Reduction in the power consumption has an advantage that it reduces utility bills. The fig 4 shows the virtualization technique. VMM separates software from the underlying hardware by creating a form of deception for the software running in the virtual machine and the hardware. Thus, VMM provides a consistent aspect of underlying hardware, enabling different physical machines from various vendors with diverse storage subsystems to look similar, as a result of which an opportunity is provided for the virtual machine to run on any of these hardware. This way the administrators will be able to view the hardware as a resource pool, and allocate those resources on demand.

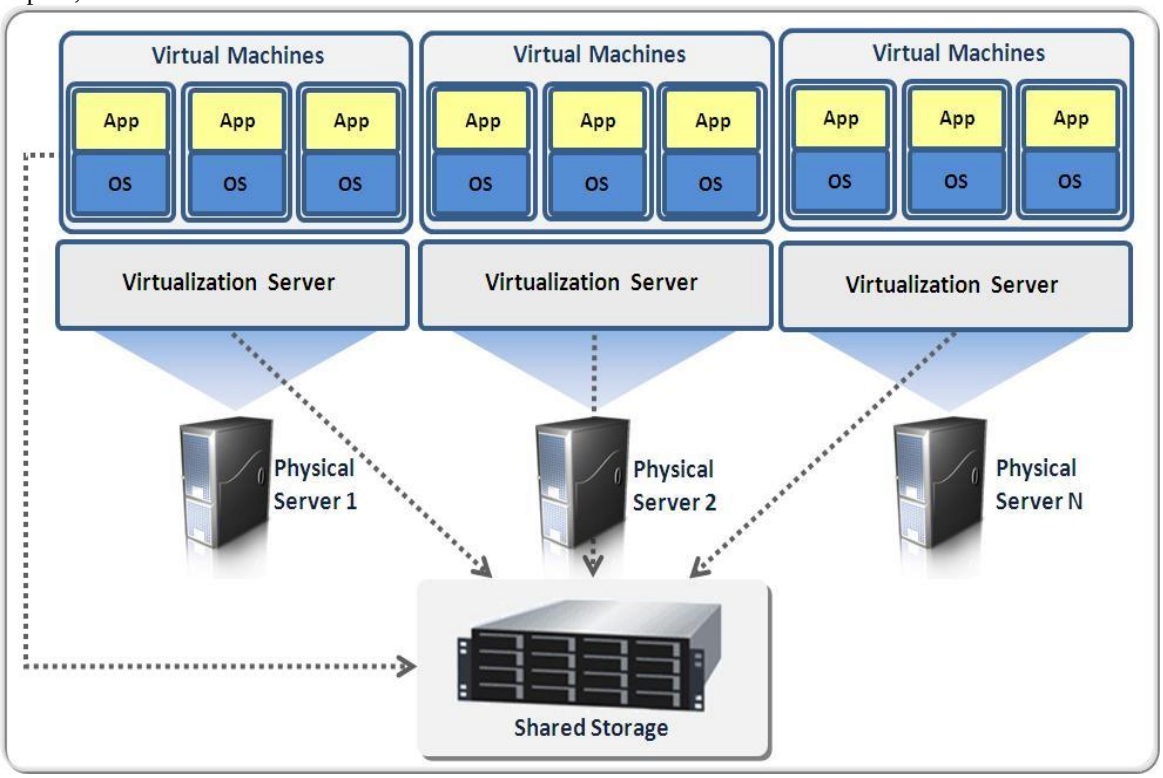

Fig 4: Virtualization

III. SCHEDULING

The job scheduling is a core & challenging task in the field of cloud computing as each job needs to be executing the jobs in order to complete the particular task and thereby provide the Qos in the cloud computing. Qos is a main objective in the cloud in order to execute the tasks on time & thereby having efficient utilization of resources. In order to achieve the efficient utilization of resources we need to execute the jobs continuously in the manner so that CPU may not sit idle and this can be achieved using the metascheduler which can executes multiple jobs at a time thereby increasing the throughput & reducing the waiting time. CloudSim [4] allows modeling and simulations of entities in parallel and distributed computing systems. Aneka [5] form enterprise grid and cloud platform provide following services as task scheduler service for the task programming model, thread scheduler services, for the thread programming model, storage service for file store for applications. Hadoop a popular open-source implementation of the Google's Map Reduce model is primarily developed by Yahoo. The work done by [6], [7] considers Hadoop scheduler can cause severe performance degradation in heterogeneous environments and provide a new scheduling algorithm, Longest Approximate Time to End (LATE) for concurrent jobs in heterogeneous environments. But LATE doesn't always improve the performance. The scheduling mechanism is shown in Fig 5.

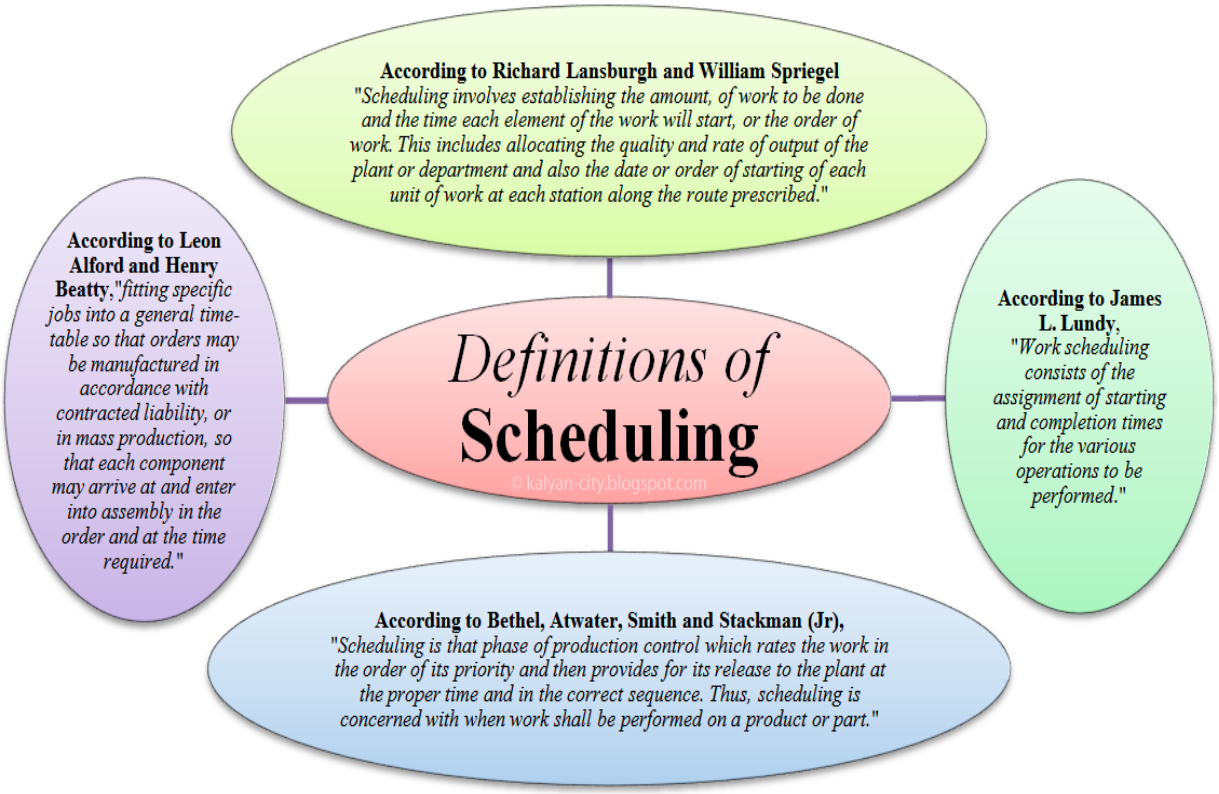

Fig 5: Scheduling

In 2011 the author proposed an improved scheduling algorithm for the cloud metascheduler using the balanced spiral method. This algorithm was the improvement of backfill algorithm [8]. The backfill algorithm works on the principal that bring the smaller jobs first until they don't cause the longer jobs some problem. This algorithm executes multiple jobs at a time through pipelining technology. The main drawback of this algorithm is that jobs are scheduled according to their sequence of arrival no matter which job is in queue. This may also lead to the starvation problem that is not accepted. Hence an improved algorithm was proposed using the Balanced Spiral method.

Further in the year 2011, 2012 the improvements have been made by the authors in the algorithms and the correspondingly SJF-BF & Priority Based backfilling algorithm was proposed that can lead to optimization of resources and fulfilling the gaps of the Backfilling algorithm. There is further scope of modification or the development of the scheduling algorithms because the existing algorithms don't fulfill the Qos requirement fully which is a cumbersome & important task.

IV. PLATFORM

Over the last half-century rapid advances of hardware technology such as computers, memory, storage, communication networks, mobile devices and embedded systems is pushing the need for larger and more complex software. Software development not only involves many different hardware technologies, it also involves many different parties like customers, end users and software developers. That's why SW development is an inherently complex procedure. Since 1968 software developers had to adopt the engineering disciplines i.e. systematic, disciplined and quantifiable approach to make software development more manageable to produce quality software products. The success or quality of a SW project is measured by whether it is developed within time and budget and by its efficiency, usability, dependability and maintainability [12], [13].

The role of software engineer in the development of each kind of software is very vital & without the engineers software can't be made. The software is developed by following the SDLC. In case of normal computation the software can be made by the engineer & there is no need for other persons in the development. But in case of cloud computing the software engineer needs to be interact with the cloud provider in order to develop the software for the cloud computing platform in order to operate the software virtually on the cloud network anywhere. The platform of this technology includes various services such as SaaS, PaaS, IaaS and is shown in Fig 6 below.

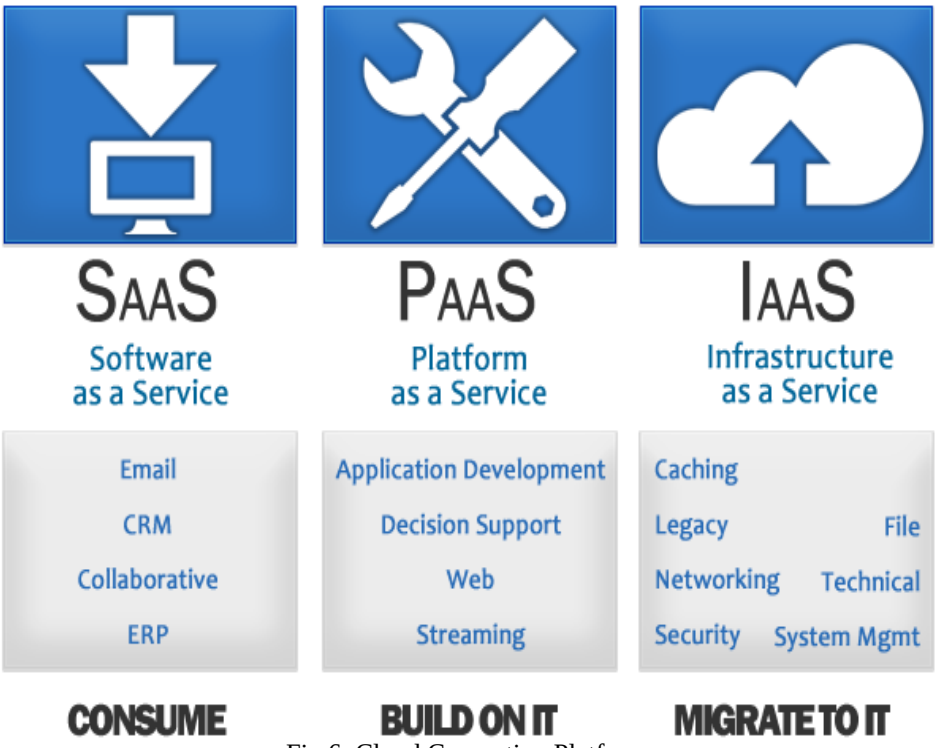

Fig 6: Cloud Computing Platform

Cloud computing is a paradigm shift over traditional way of developing and deploying of software. This will make software engineering more difficult as they have to interact with a third party called the "cloud provider". The amount of work required for developing software will reduce but there will be added communication and coordination requirement with the cloud provider which makes software development project more complex. Originally there is no such thing available so that cloud provider may interact with the software engineer in order to develop the software for the cloud platform. The prevalent SW process models should involve the cloud provider in every steps of decision making in software development life cycle to make the software project a success. So in 2010 the author proposed a software process model [14].

V. CONCLUSION

After the complete description of cloud computing we can imagine that the cloud computing is a new technology and is evolving in the market at a very fast rate and it has a very wide scope in the area of platform, scheduling, virtualization. Distributed computing is based on the multi-processing of jobs and is not focused on the virtualization concept but the cloud computing focusses on virtually allocating the memory to the processes as and when the memory is required. Also these jobs needs to be executed timely and the waiting and turnaround time like factors are very crucial hence the scheduling also needs to be taken in practice and efficient algorithms need to be develop so that the waiting time get decreases every time. These things are important also for the various platform activities including the HaaS, IaaS, PaaS as these are handle by the different cloud provider against the SLA with their client. Finally this can be concluded that this technology is at early stage and will replace the earlier technology hence all the areas need to be researched for any changes.

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