Volume 2 No. 2, February 2012 ISSN 2223-4985

International Journal of Information and Communication Technology Research

http://www.esjournals.org

A Brief Survey on Architecture, Challenges & Security Benefit in Cloud Computing

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ABSTRACT

Cloud computing is the emerging technology which emphasizes commercial computing. Cloud is a platform providing dynamic resource pools, virtualization & high availability. It's the concept implemented to overcome our regular computing problem like hardware software resource availability and related aspects. Cloud computing makes it easy to have high performance computing. Cloud computing is a service which is easily available on market when you want it you can start the service and when you don't want you stop the service and you pay it for what you use, you need is a thin client or a laptop to access the internet. It's like prepaid taxi. Cloud computing is wild wild west, it's use world wide web to connect with cloud computing, user work with web based application it's acts like desktop program only. Users don't need to be IT programmer, a normal person will be able to use it and it's like setting our mobile profile. User has to do the same thing in cloud computing. The best example of cloud computing will be Google apps. With the new technology lots of security concern has came up. In this brief survey on architecture, challenges & security benefit in Cloud Computing we are going to discuss more on its security of cloud computing.

Keywords: *Cloud Computing, IAAS, PAAS, SAAS, Google Apps, Security*

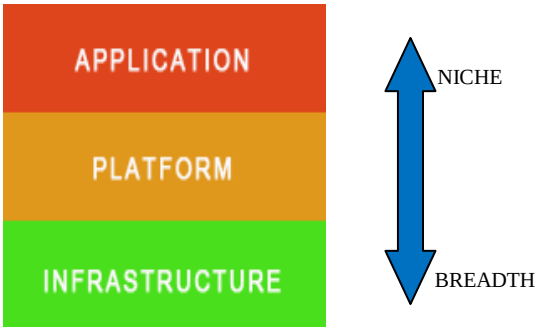

Fig. 1 Cloud Layer

I. INTRODUCTION

It's a 5th generation computing having the facility to access online shared resources and many infrastructure. All the services are on demand over the network which has the capability to meet the industries needs. End user is not aware of the location of physical resources and device. The cloud model represents nothing less than a fundamental change to the economics of computing and the location of computing resources [3].

Some examples:

- Amazon's Elastic Computing Cloud (EC2) offering computational services that enable people to use CPU cycles without buying more computers
- Storage services such as those provided by Amazon's Simple Storage Service (S3)
- SaaS companies like Salesforce.com delivering CRM services, so clients can manage customer information without installing specialized software

II. CLOUD DEPLOYMENT MODELS

A. Public Cloud

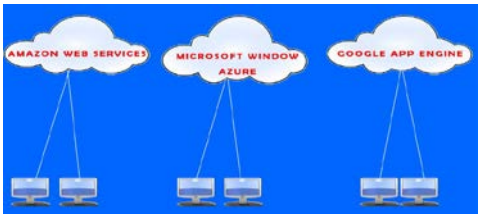

Fig. 2 Public Cloud

Public cloud as name implies its public area anyone can buy a service from any service provider. The vendor will be taking care of all security concern, backup maintenance. Public clouds are mainly use by small and medium sized company. Here you have to pay what you have used [4].

Example of cloud vendors are Salesforce.com, Amazon EC2 and Flexi scale.

B. Private Cloud

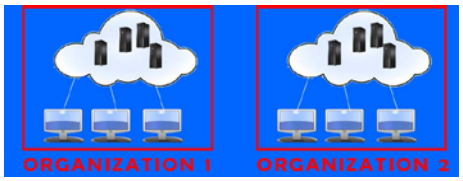

Fig. 3 Private Cloud

Private cloud as name implies it's for private use. It's mainly own by big or large company to protect their data with firewall. They will locate their datacenter in their area with greater control and privacy. With private cloud we get the same benefit of public cloud such as self-service, scalability and elasticity and with the additional control and customization available from dedicated resources. [5]

C. Hybrid Cloud

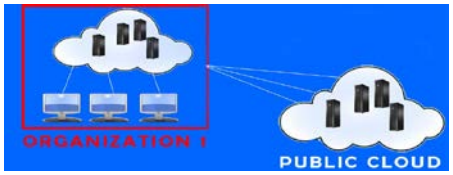

Fig.4 Hybrid Cloud

It uses both resource from both private and public. For example, xyz companies want to host their website in a public cloud but prefer to keep the customer data within its own data center [6]. In future people will prefer more in hybrid then in public or private.

D. Community Cloud

A group of several organizations where they have the similar requirements and share the same infrastructure can be benefitted from cloud computing. This cloud is more expensive comparing to others but offer high level of privacy, security or policy compliance. Community Cloud Computing makes use of the principles of Digital Ecosystems to provide a paradigm for Clouds in the community, offering an alternative architecture for the use cases of Cloud Computing. [7]

III. CLOUD SERVICES MODELS

Once a cloud is established, how its cloud computing services are deployed in terms of business models can differ depending on requirements. Cloud service delivery is divided among three archetypal models and various derivative combinations [20]. The three fundamental classifications are often referred to as the "SPI Model," where 'SPI' refers to Software, Platform or Infrastructure (as a Service), respectively.

A. Infrastructure as a Service

Fig. 5 Infrastructure as a Service

IaaS can be referring as service like IT infrastructure, hardware facilities. Company has to invest lots of money in maintenance and IT department salary. Instead of keeping IT Department Company outsource IT department to vendor which we call IaaS (Infrastructure as a Service). On behalf of organization they will do all the maintenance, upgrading. The client typically pays on a per-use basis [8]. Amazon EC2 is an example of commercial IaaS offering.

B. Platform as a Service

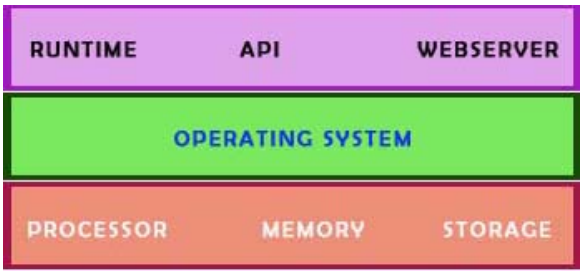

Fig. 6 Platform as a Service

Platform as a Service or PaaS has changed the world of computing. PaaS offers a platform of buying and managing the hardware and software and provision hosting capabilities which required for software development life cycle. The designer or programmers don't have to worry about installation of complex programming models like J2EE or .net. All developer can work in web based and use any kind of software to develop their application. And more benefit is also cutting down the software price and updating of software will be take care by PaaS vendor. "Cloud computing" has dramatically changed how business applications are built and run [9].

C. Software as a Service

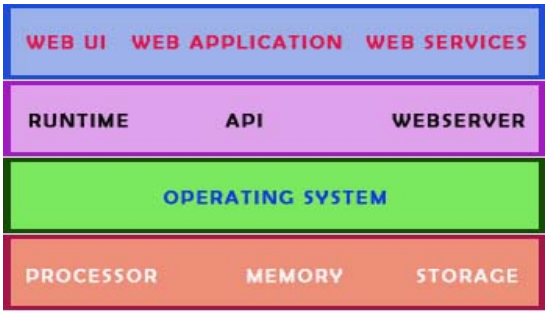

Fig. 7 Software as a Service

Software as a service (or SaaS) is the changes of computing. All application is available in Internet as a service. We don't need to install and maintain the software, just by using SaaS we can use any complex software in internet by using and Intel Atom based Notebooks and abundant bandwidth. This reduces the expenditure of hardware plus software. Software application is delivered as a service [10]. We can go with Pay-as-you- go model. Google Apps, Salesforce.com and Microsoft Online Services are examples of SaaS.

IV.CAPABILITIES THAT THE CLOUD COMPUTING OFFERS

A. Elasticity

It would be easier in this world to know the demand of us without saying a single word. May be our every wish will not come true but in cloud computing it already have where it's term as Elasticity. Let say a website www.websitename.com which is launch on April 2010 where the traffic is very poor but suddenly by June it's popular and traffic is huge without elasticity your server will be down but thanks to elasticity it's understand the DNA of traffic and increase the server and all this happen almost instantly and the best thing is our application and the customers don't even realize that. If we do in traditional we have to request to vendor to upgrade it manually which might take time and we may lose many customer [11].

B. Pay-By-Use

As with elasticity which is giving a best service we have not concern about the budget also. Upgrading a new server might cost us high so cloud has the feature of it also as told you we get what we want in cloud computing. Cloud got pay-by-use. You must have seen hoarding pre paid taxi in airport or railway station or pre paid sim card or DTH. World cup is coming so we subscribe to sports pack and when world cup is over we unsubscribe we pay only what we have used. Same thing we can do in cloud computing pay-by-use policy. We only pay for the IT infrastructure based on our needs. We subscribe for the services and unsubscribe when we don't want it. Cloud computing has made our work more easy in this IT field. Vendors offer pay-per-usage or pay-as-you-go access to computers [12].

C. Self Service

When we have the service like elasticity and pay-by-use why do we need to depend on someone to wait for our work to be done in the datacenter to add an additional server to our application? Cloud has the provision to do with our own. As previously mention of subscribe and unsubscribe. Here is method of up gradation or degradation. We can add a additional CPU or storage or memory whenever we required with just with a few step and for doing this we don't need to be a computer geek. By this it will reduce IT support and maintenance. For example to setup Google apps we just have to click next and follow the instruction to map up with your personal hosting server. By using self service we can cut the IT cost more than before [13].

D. Programmability

The greatest user of computer is that developer who designs the website or software. They

need powerful system and update software. By using the cloud computing they don't need to worry about all this. Thus cloud computing offers scripting interface or API to programmatically manage the service offering [14].

E. Entrepreneur

Cloud computing is more helpful to those entrepreneur who have small or medium sized company especially in India. Where IT budget is the concern. By using cloud computing entrepreneur can reduce the human resources and IT infrastructure.

V. BENEFITS OF CLOUD COMPUTING

As cloud computing [1][2] are booming in market, several major benefits have become evident. The following are some of the benefits for those who offer cloud computing-based services and applications [27].

A. Cost Savings

The cloud promises to cut the cost of acquiring, delivering, and maintain computing power, a benefit of particular importance in times of economic uncertainty. By enabling SME to purchase only the computing services needed, instead of investing in complex and expensive IT infrastructures, SME can cut down the costs of developing, testing, and maintaining new and existing systems [21].

B. Mobile Access

The cloud computing enables to access high-powered computing and storage resources for anyone with a network access device. Capabilities of cloud computing helps to facilitate Tele-network initiatives, as well as bolster an agency's continuity of operations (COOP) demands.

C. Scalability and Capacity

Cloud Computing main benefit is scalability and capacity. By using of public cloud we can scale up and won as per our requirement and the capacity also. But in private it's not possible. Traditional computing also doesn't support scalability [27].

D. Resource Maximization

Cloud computing has reduce burden of IT resources to many companies and agencies by maximizing the resources from cloud computing pool [27].

E. Collaboration

Collaboration is a term where a group of people can work together through online. By using cloud computing environment online, collaboration is easier than before a good example is Google docs.

F. Customization

Cloud computing is a platform where we can modify to our needs with being redevelopment. It offers a platform for creating and amending applications to address a diversity of tasks and challenges [27].

VI. CLOUD COMPUTING CHALLENGES

A. Security and Privacy

The most challenging issue in cloud computing is security and privacy. Storing of data in cloud seems to less secure than any other else. High risk is seen where any third party might get access to data in cloud environment. Even our all data are stored in our own allocated space but as it shared publicly any intruder may try to access it for the safety private cloud is available [15].

B. Lack of Standards

Lots of standards development work is going on. Open grid forum, open cloud consortium is looking on this issue and working on cloud computing standards and practices [20].

C. Continuously Evolving

User requirements are continuously evolving, as are the requirements for interfaces, networking, and storage. This means that a "cloud," especially a public one, does not remain static and is also continuously evolving [20].

D. Compliance Concerns

Question were ask by many user who want to adopt cloud computing is. What information is stored on a system? Where is the information stored? Who can access the system? What they can access? Is the access appropriate? CSP are having difficulty in answering question, a user from china will not like there data to be stored at India.

VII. MAJOR IT PLAYERS FOCUSING ON CLOUD

As for previous technological developments, all the key players are focused on trying to best each other in the game of IT one-upmanship. Players include, but are not limited to the following well-known organizations: Amazon, Google, Citrix, Microsoft and VMware.

There is a good business reason for these companies to be 'pursuing the cloud.' Industry research firm IDC is forecasting that spending worldwide on cloud technology will reach almost $60 billion (US) by next year. Surveys of chief information officers (CIOs), indicate that most of them intend to consider cloud services for any new technical rollout, despite the fact that it may ultimately become an unworkable technology.

Does Cloud Computing Come Risk Free?

Unfortunately not! If cloud computing was risk free, then it would have been the first perfect thing in the world. Cloud computing does have its risks, but if you know what to watch for and pick genuine professionals, then you will hardly have horror stories to tell. Data security is the biggest risk with SaaS, followed closely by service availability. But if you sign with a reliable company, then the risks are decreased.

VIII. SEVEN TECHNICAL SECURITY BENEFITS OF THE CLOUD CENTRALIZED DATA, INCIDENT RESPONSE / FORENSICS, PASSWORD ASSURANCE TESTING, LOGGING, IMPROVE THE STATE OF SECURITY SOFTWARE (PERFORMANCE), SECURE BUILDS, SECURITY TESTING

By using of cloud computing it reduced Data Leakage, crisis of laptop and system is common where we accidentally loss our data. Centralize data is used to store the data by doing this monitoring of data is easy to control. One good benefit is Incident response is where if any of the server breaks down then we can upload another server which have to back up of the server for doing this it don't need to any call anyone by using web interface it can online anytime. And what we are paying for is only for data. Cloud computing helps us to reduce testing time of SaaS application.

IX. APPLICATION

A **cloud application** leverages cloud computing in software architecture [19], often eliminating the need to install and run the application on the customer's own computer, thus alleviating the burden of software maintenance, ongoing operation, and support.

For example:

- Peer-to-peer / volunteer computing (BOINC, Skype)
- Web applications (Webmail, Facebook, Twitter, YouTube, Yammer)
- Security as a service (MessageLabs, Purewire, ScanSafe, Zscaler)
- Software as a service (Google Apps, Salesforce,Nivio,Learn.com, Zoho, BigGyan.com)
- Software plus services (Microsoft Online Services)
- Storage [Distributed]
- Content distribution (BitTorrent, Amazon CloudFront)
- Synchronisation (Dropbox, Live Mesh, SpiderOak, ZumoDrive

X. HOW CLOUD COMPUTING WORKS?

If you need a program, it is now usual to simply download it off from the Internet. You never have to deal with a physical disk to install, use and get rid of a program. We now even send data the other way; storing things on the Internet, using services such as Webmail and online applications such as Google Docs and Scribd. However, you may have heard the phrase 'cloud computing' attached to all this. Cloud computing is, in essence, the next step up from the current scenario. In the ideal of cloud

computing, all your data is stored on the Internet. Your computer would only contain perhaps a small Solid State Drive, like a pendrive, to hold an operating system that would be based around a giant Web Browser, allowing you to do practically anything on the Internet [23].

XI. WHO ARE ALL IN CLOUD COMPUTING?

Some of the companies researching cloud computing are big names in the computer industry.

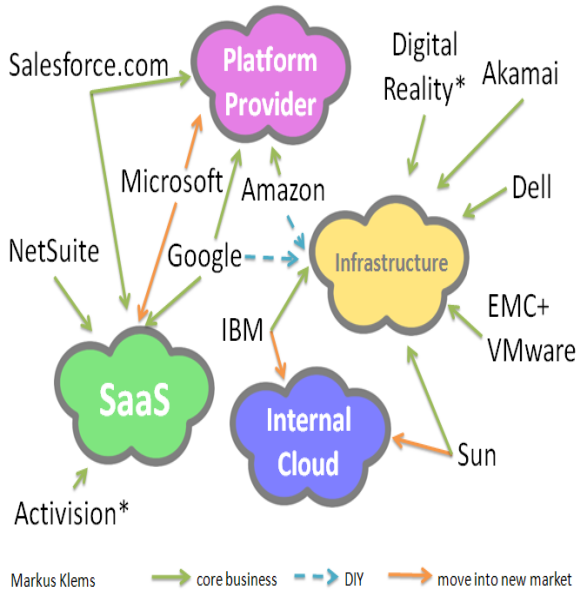

Fig. 8 Companies in the Cloud Computing

Image source: http://markusklems.wordpress.com/2008/07/05/merill-in-the-cloud/

As you seen in Fig. 4, Google is the leader of the web-based applications, so it's not surprising that the company also offers cloud development services. Microsoft, IBM and Google are investing millions of dollars into research. The applications of cloud computing are practically limitless.

With the right middleware, a cloud computing system could execute all the programs that a normal computer could run. Potentially everything from generic word processing to customized computer programs designed for a specific company could work on a cloud computing system [23].

A. Google

Google offers Google App engine, which enables developers to build their own web applications utilizing the same infrastructure that powers Google's powerful applications. The Google App Engine provides a fully integrated application environment.

Using Google's development tools and computing cloud, App Engine applications are easy to build, easy to maintain, and easy to scale. Unlike most other cloud hosting solutions, Google App Engine is completely free to use—at a basic level, anyway. A free App Engine account gets up to 500MB of storage and enough CPU strength and bandwidth for about 5 million page views a month.

B. Amazon

Amazon, one of the largest retailers on the Internet, is also one of the primary providers of cloud development services.

Amazon has spent a lot of time and money setting up a multitude of servers to service its popular website, and is making those vast hardware resources available for all developers to use. The service in question is called the Elastic Compute Cloud, also known as EC2.

This is a commercial web service that allows developers and companies to rent capacity on Amazon's proprietary cloud of servers-which happens to be one of the biggest server farms in the world.

EC2 enables scalable deployment of applications by letting customers request a set number of virtual machines, onto which they can load any application of their choice.

Thus, customers can create, launch, and terminate server instances on demand, creating a truly "elastic" operation. EC2 is just part of Amazon's Web Services (AWS) set of offerings, which provides developers with direct access to Amazon's software and machines.

C. IBM

IBM is offering a cloud computing solution. Blue Cloud is a series of cloud computing offerings that enables enterprises to distribute their computing needs across a globally accessible resource grid.

To manage its cloud hardware, IBM provides open source workload-scheduling software

called Hadoop, which is based on the Map Reduce software used by Google in its offerings.

D. Salesforce.com

Salesforce.com is probably best known for its sales management SaaS, but it's also a leader in cloud computing development.

The company's cloud computing architecture is dubbed Force.com. The platform as a service is entirely on-demand, running across the Internet. Sales force provides its own Force.com.

API and developer's toolkit Pricing is on a per log-in basis.

Developers can use AppExchange applications uploaded by others, share their own applications in the directory, or publish private applications accessible only by authorized companies or clients. Many applications in the AppExchange library are free, and others can be purchased or licensed from the original developers.

XII. MANAGING SCHEDULES USING CLOUD COMPUTING

Scheduling is very important in our life so as to complete the work in time. A web-based scheduling, which runs on cloud computing is easy to schedule and changes anywhere even we can post our schedule on personal website to see by other of our schedule.

Web-based scheduling programs let you schedule both in-person meetings and teleconferences with attendees from multiple locations 24][25].

Web-based calendar programs, such as Google Calendar (calendar.google.com) and Yahoo! Calendar (calendar.yahoo.com).

More industrial strength scheduling application, such as Appointment Quest (www.appointmentquest.com), hit Appoint (www.hitappoint.com), and Schedule book (www.schedulebook.com).

Enterprise-level apps cost more to use than the free web-based calendars; expect to pay anywhere from $20 to $200 subscription fees per month [24][25].

XIII. MANAGING PROJECTS USING CLOUD COMPUTING

Project are concern if want to adopt cloud computing so here is PaaS a service for the developer. If a company is doing project then with cloud computing it's not compulsory that a developer has to be same place. Developer can work from any place in any time where he can do all coding online in PaaS environment as ass soon as it completes its ready to be online. Jclouds for java environment, window azure and many other are there for project development. The most popular of these apps include AceProject (www.aceproject.com), Basecamp (www.basecamphq.com), onProject (www.onproject.com), and Project Insight (www.projectinsight.com).

XIV. PROS AND CONS OF CLOUD COMPUTING

As you see in fig. below, the greater advantage of cloud computing is "elasticity". The ability to add capacity or applications in cloud computing is a moment notice. Companies buy exactly the amount of storage computing power, security and other IT functions that they need from specialists in data centre computing. They get sophisticated data centre services on demand, in only the amount they need and can pay for in the service level set with the vendor, with capabilities that can be added or subtracted at will [26].

Fig 9 Pros and Cons

Image source: blogs.-zdnet.-com/-hinchcliffe

A. Pros

- **Fewer Maintenance Issues**

Maintenance is free from every point once your computer resources are on cloud maintenance is worry free from both hardware and software. Maintenance is immediately lowered. Software maintenance, all cloud apps are based elsewhere, so there's no software on the organization's computers for the IT staff to maintain. It's that simple [26].

- **Lower Software Costs**

Instead of purchasing separate software packages for each computer in the organization, only those employees actually using an application need access to that application in the cloud [26]. By doing this installation charges for the software is also reduce. Piracy of software is zero by using cloud computing.

- **Instant Software Updates**

All the software is updates automatically from software provider to cloud server.

- **Increased Data Safety**

Data are all stored in cloud unlike desktop if the desktop is crash and no backup then all data is lost but in cloud environment all data is save. Dropbox is good example for cloud computing online backup. Date in the cloud is automatically duplicated, so nothing is ever lost [26].

- **Easier Group Collaboration**

Sharing documents are lots easier in cloud computing. Collaboration with office staff and update is faster which leads to success of business.

B. Cons

- **Requires a Constant Internet Connection**

Cloud computing need constant internet connection cloud computing is depend on Internet to connect to both the applications and documents, if you don't have an Internet connection, you can't access anything, even own documents [26].

- **Doesn't Work Well with Low-Speed Connections**

A low-speed Internet connection, such as that found with dial-up services is not suitable for cloud computing environment. Web based apps often require a lot of bandwidth to download, as do large documents [26].

XV. CONCLUSION

Cloud computing infrastructures are the current and next generation platforms that can provide tremendous value to companies of any size. Cloud Computing can help companies to achieve more efficient use of their IT hardware and software investments and provide a means to accelerate the adoption of innovation Cloud computing increases profitability by improving resource utilization. Costs are driven down by delivering appropriate resources only for the time those resources needed. In addition to all the advantages of cloud computing, one should also understand the basic disadvantage of cloud computing- maintaining secrecy of personal data. Bigger companies still lack the conviction that their bulk data will be maintained with the utmost privacy over the internet. This concern can only be resolved by drafting strict rules for maintaining data privacy over cloud computing and strict adherence to these rules. In this paper we discuss cloud computing architecture, its challenges and security benefit of cloud computing.

Invent of Internet changes the way we use of computer. From mail to shopping we all depend on this huge group of network computer. Cloud computing has entirely changes what the internet means. Powerful of desktop application is available on net and storage is available online wherever we go from any device. E-Learning and web 2.0 learning totally changes of education system. Teacher and student work together in online project not in school or colleges but from home also. Teaching has never been easy without cloud computing. Implement of cloud computing in education era we can benefit a lot.

ACKNOWLEDGEMENT

We thank Karpagam University for motivating and encouraging doing our Research work in a Successful.

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