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Exploring Cloud Computing for Naive

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Abstract— Cloud computing is a convergence of technologies and trends that are making IT infrastructures and applications more dynamic, more modular, and more consumable. It lets organizations ramp up new services and reallocate computing resources rapidly, based on business needs. It gives users self-service access to computing resources, while maintaining appropriate levels of control. And, done right, it provide the means to manage across hybrid computing environments, both on- and off-premise, based on cost, capacity requirements, and other factors. This paper aims to provide a means of understanding cloud services, solutions, benefits and challenges of cloud computing.

Keywords— Cloud Computing, SaaS, PaaS, IaaS. Virtualization, Multitenancy

I. INTRODUCTION

Cloud computing is the delivery of computing services over the Internet. Cloud services allow individuals and businesses to use software and hardware that are managed by third parties at remote locations. Cloud services include online file storage, social networking sites, webmail, and online business applications. The cloud computing model allows user to access information and computer resources remotely with an available network connection i.e. internet. Cloud computing provides a shared pool of resources, including data storage space, networks, computer processing power, and specialized corporate and user applications.

The following definition of cloud computing has been developed by the U.S. National Institute of Standards and Technology (NIST)[5]:

Cloud computing is a model for enabling 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.

Forrester defines cloud computing as:

A pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end-customer applications and billed by consumption.

II. BACKGROUND

Major Cloud computing is a computing style in which scalable and flexible IT functionalities are delivered as a service to external customers using Internet technologies. Cloud computing is not a revolutionary idea; Instead, it is an evolutionary concept that integrates various existing technologies to offer a useful new IT provisioning tool.

The 1950s

The below concept of cloud computing dates back to the era of 1950s, when large-scale mainframe computers were available in academia and corporations, accessible via thin/thick clients/terminal computers, often referred as "static terminals", because they were used to communicate but had no internal processing/pooling capacities. To make more efficient use of those costly mainframes, a practice/process evolved that allowed multiple users to share both the physical access to the computer from multiple terminals as well as to share the CPU time. This eliminated periods of inactivity on the mainframe and allowed for a greater return on the investment and work. The practice of sharing CPU time on a mainframe became known in the industry as time-sharing. During mid 70s it was popularly known as RJE Remote Job Entry process mostly associated with IBM and DEC[7,8,9,10]

The 1960s–1990s

Evangualist John McCarthy opined at 1960s that "computation may someday be organized as a public utility." Almost all of the modern-day characteristics of cloud computing (elastic provision, provided as a utility, online, storage, illusion of infinite supply, virtual computing), the comparison to the electricity industry and the use of public, private, government, and community forms, were thoroughly explored in Douglas Parkhill's 1966 book, “The Challenge of the Computer Utility”. Other scholars/researchers have shown that cloud computing's roots go all the way back to the 1950s when scientist Herb Grosch (the author of Grosch's law) postulated that the entire world would operate on dumb terminals powered by about 15 large data centers. Due to the expense of these powerful computers, many corporations and other entities could avail themselves of computing capability through time sharing and several organizations, such as GE's GEISCO, IBM subsidiary The Service Bureau Corporation (SBC, founded in 1957), Tymshare (founded in 1966),

National CSS (founded in 1967 and bought by Dun & Bradstreet in 1979), Dial Data (bought by Tymshare in 1968), and Bolt, Beranek and Newman (BBN) marketed time sharing as a commercial venture. [7,8,9,10]

The 1990s

In the era of 1990s, telecom companies, who previously offered primarily dedicated point-to-point data circuits, began offering virtual private network (VPN) services with comparable quality of service, but at a lower cost. By switching traffic as they saw fit to balance server use, they could use overall network bandwidth more effectively and effectivly. They began to use the cloud symbol to denote the demarcation point between what the provider was responsible for and what users were responsible for. Cloud computing extends this boundary to cover servers as well as the network infrastructure. [7,8,9,10]

Since 2000

After the dot-com bubbleemerged in world, Amazon played a key role in all the development and research of cloud computing by modernizing/organising their data centers, which, like most computer networks, were using as little as 10% of their capacity at any point of time, just to leave room for occasional spikes. Amazon initiated a new product development effort to provide cloud computing to external customers, and launched Amazon Web Services (AWS) on a utility computing basis in 2006. In early 2008, Eucalyptus became the first open-source, AWS API-compatible platform for deploying private clouds. In early 2008, OpenNebula, enhanced in the RESERVOIR European Commission-funded project, became the first open-source software for deploying private and hybrid clouds, and for the federation of clouds. In the same year, efforts were focused on providing quality of service guarantees (as required by real-time interactive applications) to cloud-based infrastructures, in the framework of the IRMOS European Commission-funded project, resulting to a real-time cloud environment. By mid-2008, Gartner saw an opportunity for cloud computing "to shape the relationship among consumers of IT services. [7,8,9,10]

Origin of the term 'Cloud Computing'

The origin of the term cloud computing is unclear. The expression cloud is commonly used in science to describe a large agglomeration of objects that visually appear from a distance as a cloud and describes any set of things whose details are not inspected further in a given context.

Meteorology: a weather cloud is an agglomeration.

Mathematics: a large number of points in a coordinate system in mathematics is seen as a point cloud;

Astronomy: a cloud of gas and particulate matter in space is known as a nebula (Latin for mist or cloud),

Physics: The indeterminate position of electrons around an atomic kernel appears like a cloud to a distant observer

Cloud: In analogy to above usage the word cloud was used as a metaphor for the Internet and a standardized cloud-like shape was used to denote a network on telephony schematics and later to depict the Internet in computer network diagrams and resources(hardware). The cloud symbol was used to represent the Internet as early as 1994, in which servers were then shown connected to, but external to, the cloud. References to cloud computing in its modern sense can be found as early as 1996, with the earliest known mention to be found in a Compaq internal document. The term became popular after Amazon.com introduced the Elastic Compute Cloud in the year 2006. [7, 8,9,10]

Cloud computing shares characteristics with:

Client–Server Model — Client–server computing refers broadly to any distributed application that distinguishes between service providers (servers) and service requestors (clients).

Grid Computing — "A form of distributed and parallel computing, whereby a 'super and virtual computer' is composed of a cluster of networked, loosely coupled computers acting in concert to perform very large tasks."

Mainframe Computer — Powerful computers used mainly by large organizations for critical applications, typically bulk data processing such as: census; industry and consumer statistics; police and secret intelligence services; enterprise resource planning; and financial transaction processing.

Utility Computing — The "packaging of computing resources, such as computation and storage, as a metered service similar to a traditional public utility, such as electricity."

Peer-to-Peer — A distributed architecture without the need for central coordination. Participants are both suppliers and consumers of resources (in contrast to the traditional client–server model).

Cloud Gaming — Also known as on-demand gaming, is a way of delivering games to computers. Gaming data is stored in the provider's server, so that gaming is independent of client computers used to play the game. One such current example, would be a service by OnLive which allows users a certain space to save game data, and load games within the OnLive server.[7,8,9,10]

III. LIVE CHANNEL

Many companies are delivering services from the cloud. Some notable examples as of 2004-05 include the following:

• Google

Has a private cloud that it uses for delivering many different services to its users, including email access, document applications, text translations, maps, web analytics, and much more.

•Microsoft

Has Microsoft® Sharepoint® online service that allows for content and business intelligence tools to be moved into the cloud, and Microsoft currently makes its office applications available in a cloud.

•Salesforce.com

Runs its application set for its customers in a cloud, and its Force.com and Vmforce.com products provide developers with platforms to build customized cloud services.

IV. CHARACTERISTICS

Cloud computing has a variety of characteristics, with the main ones being:

Resource abstraction and pooling

Pooled computing resources serve multiple consumers using a multi-tenant model (whether different internal groups within one company or different organizations within a shared, public resource) with physical and virtual resources dynamically assigned and reassigned depending on demand. On-demand self service means that customers (usually organizations) can request and manage their own computing resources[4]. Pooled resources means that customers draw from a pool of computing resources, usually in remote data centres.

Network-centric/ Network Access

Whether implemented within a single organization or at a public cloud provider, cloud computing is network-centric. Services are made available over the network and accessed through standard mechanisms, typically lightweight web protocols. Needs to be accessed across the internet from a broad range of devices such as PCs, laptops, and mobile devices, using standards-based APIs (for example, ones based on HTTP)[4]. Deployments of services in the cloud include everything from using business applications to the latest application on the newest smartphones.

Simple, fast provisioning of resources/ Dynamic Provisioning

Allows for the provision of services based on current demand requirements. This is done automatically using software automation, enabling the expansion and contraction of service capability, as needed. This dynamic scaling needs to be done while maintaining high levels of reliability and security

Rapid and elastic scaling

Uses metering for managing and optimizing the service and to provide reporting and billing information. In this way, consumers are billed for services according to how much they have actually used during the billing period.

Managed Metering/ Utility pricing

Utility pricing (also called pay-per-use) , which is at the primary billing approach used by public cloud providers. Metering at a level of abstraction appropriate to the type of service (e.g., storage, CPU usage, bandwidth, or active user accounts) may become more widespread over time as organizations learn the types of data that are most useful—whether or not the information is used for billing or just for informational purposes (often referred to as "showback")

It uses a virtualized software model, enabling the sharing of physical services, storage, and networking capabilities. The cloud infrastructure, regardless of deployment model, seeks to make the most of the available infrastructure across a number of users. Services can be scaled larger or smaller; and use of a service is measured and customers are billed accordingly.

Agility: improves with users' ability to re-provision technological infrastructure resources.

Application programming interface (API): accessibility to software that enables machines to interact with cloud software in the same way that a traditional user interface (e.g., a computer desktop) facilitates interaction between humans and computers. Cloud computing systems typically use Representational State Transfer (REST)-based APIs.

Cost: cloud providers claim that computing costs reduce. A public-cloud delivery model converts capital expenditure to operational expenditure. This purportedly lowers barriers to entry, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained, with usage-based options and fewer IT skills are required for implementation (in-house).

Device and location independence: enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.

Virtualization: technology allows sharing of servers and storage devices and increased utilization. Applications can be easily migrated from one physical server to another.

Multitenancy : enables sharing of resources and costs across a large pool of users thus allowing for: centralization of infrastructure in locations with lower costs (such as real estate, electricity, etc.)peak-load capacity increases (users need not engineer for highest possible load-levels) utilisation and efficiency improvements for systems that are often only 10–20% utilised.

Reliability: improves with the use of multiple redundant sites, which makes well-designed cloud computing suitable for business continuity and disaster recovery.

Scalability: and elasticity via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time(Note, the VM startup time varies by VM type, location, os and cloud providers), without users having to engineer for peak loads.

Performance: is monitored, and consistent and loosely coupled architectures are constructed using web services as the system interface.

Security: can improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford to tackle. However, the complexity of security is greatly increased when data is distributed over a wider area or over a greater number of devices, as well as in multi-tenant systems shared by unrelated users.

Maintenance of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places. [7,8,9,10]

The National Institute of Standards and Technology's definition of cloud computing identifies "five essential characteristics":

On-demand self-service, A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

Broad network access, Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

Resource pooling, The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand.

Rapid elasticity, Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear unlimited and can be appropriated in any quantity at any time.

Measured service, Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts). Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service. [7,8,9,10]

V. SERVICE MODELS

Cloud computing, the concept of being able to use reusable and fine grained component across a vender's network. This is widely known as "as a service". Once a cloud is established, how its cloud computing services are deployed in terms of business models can differ depending on requirements. Figure 1.1. shows primary service models. IAAS gives hardware with network, hence PaaS providers put their cloud on top of it. And same is done by SaaS as well. In the same way PaaS and SaaS users are directly or indirectly using IaaS model. The IaaS, PaaS and SaaS are inter-related, and hence sometimes they work in coordinated fashion. Big giants like Amazon, Salceforce are using all three in combination. Many new bees are also adopting this and proving their presence. The primary service models being deployed are commonly known as:

Software as a Service (SaaS)

Software's that is provided on demand for use is SaaS. Consumers purchase the ability to access and use an application or service that is hosted in the cloud. A complete application is offered to the customer, as a service on demand. A single instance of the service runs on the cloud & multiple end users are serviced. On the customers" side, there is no need for upfront investment in servers or software licenses, while for the provider, the costs are lowered, since only a single application needs to be hosted & maintained. Microsoft is expanding its involvement in this area, and as part of the cloud computing option for Microsoft Office 2010, its Office Web Apps are available to Office volume licensing customers and Office Web App subscriptions through its cloud-based Online Services[2]. Today SaaS is offered by companies such as Google, Salesforce, Microsoft, Zoho etc.

Platform as a Service (PaaS)

PaaS providers offer a platform for others to use. What is being provided is part operating system and part middleware. A proper PaaS provider takes care of everything needed to run some specific language or technology stack[6].

Consumers purchase access to the platforms, enabling them to deploy their own software and applications in the cloud. The operating systems and network access are not managed by the consumer, and there might be constraints as to which applications can be deployed. A layer of software or development environment is encapsulated & offered as a service, upon which other higher levels of service can be built.

The customer has the freedom to build his own applications, which run on the provider's infrastructure. To meet manageability and scalability requirements of the applications, PaaS providers offer a predefined combination of OS and application servers, such as LAMP platform (Linux, Apache, MySql and PHP), restricted J2EE, Ruby etc. Google's App Engine, Force.com, etc are some of the popular PaaS examples.

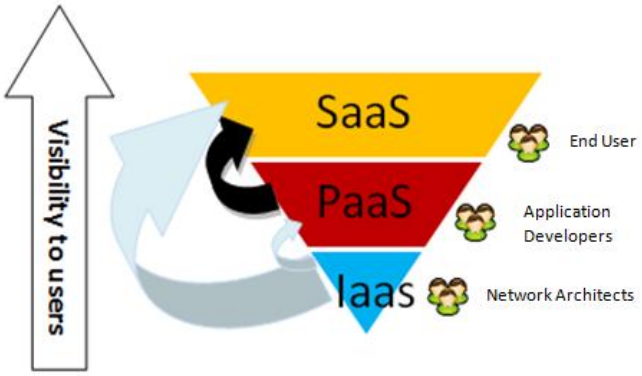

Fig.1-1 Cloud Computing Service Models

Infrastructure as a Service (IaaS)

Consumers control and manage the systems in terms of the operating systems, applications, storage, and network connectivity, but do not themselves control the cloud infrastructure. It also known as HaaS, Hardware as a Service.

IaaS provides basic storage and computing capabilities as standardized services over the network. Servers, storage systems, networking equipment, data centre space etc. are pooled and made available to handle workloads [2]. The customer would typically deploy his own software on the infrastructure. Some common examples are Amazon, GoGrid, 3 Tera, etc.

VI. DEPLOYMENT OF CLOUD

Deploying cloud computing can differ depending on requirements, and the following four deployment models have been identified, each with specific characteristics that support the needs of the services and users of the clouds in particular ways.

Private Cloud

The cloud infrastructure has been deployed, and is maintained and operated for a specific organization[1]. The operation may be in-house or with a third party on the premises.

Community Cloud

The cloud infrastructure is shared among a number of organizations with similar interests and requirements. This may help limit the capital expenditure costs for its establishment as the costs are shared among the organizations[1]. The operation may be in-house or with a third party on the premises.

Public Cloud

The cloud infrastructure is available to the public on a commercial basis by a cloud service provider. This enables a consumer to develop and deploy a service in the cloud with very little financial outlay compared to the capital expenditure requirements normally associated with other deployment options.

Hybrid Cloud

The cloud infrastructure consists of a number of clouds of any type, but the clouds have the ability through their interfaces to allow data and/or applications to be moved from one cloud to another. This can be a combination of private and public clouds that support the requirement to retain some data in an organization, and also the need to offer services in the cloud.

VII. SOLUTION

A cloud computing solution is made up of several elements:

clients, the datacenter, and distributed servers. As shown in Figure 1-2, these components make up the three parts of a cloud computing solution.

Each element has a purpose and plays a specific role in delivering a functional cloud based application, Clients are, in a cloud computing architecture, the exact same things that they are in a plain, old, everyday local area network LAN).

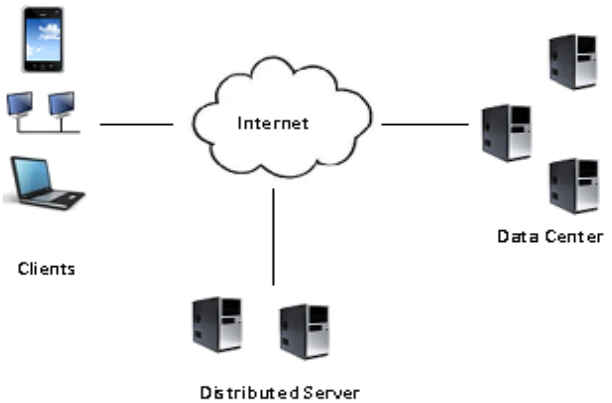

Fig. 1-2 Cloud Computing Solution

A. Clients

They are, typically, the computers that just sit on your desk. But they might also be laptops, tablet computers, mobile phones, or PDAs—all big drivers for cloud computing because of their mobility.

Anyway, clients are the devices that the end users interact with to manage their information on the cloud. Clients generally fall into three categories:

Mobile

Mobile devices include PDAs or smartphones, like a Blackberry, Windows Mobile Smartphone, or an iPhone.

Thin Clients

Thin Clients are computers that do not have internal hard drives, but rather let the server do all the work, but then display the information.

Thick

This type of client is a regular computer, using a web browser like Firefox or Internet Explorer to connect to the cloud.

B. Datacenter

The datacenter is the collection of servers where the application to which you subscribe is housed. It could be a large room in the basement of your building or a room full of servers on the other side of the world that you access via the Internet.

A growing trend in the IT world is virtualizing servers. That is, software can be installed allowing multiple instances of virtual servers to be used. In this way, you can have half a dozen virtual servers running on one physical server.

C. Distributed Servers

But the servers don't all have to be housed in the same location. Often, servers are in geographically disparate locations. But to you, the cloud subscriber, these servers act as if they're humming away right next to each other.

VIII. BENEFITS

The following are some of the possible benefits for those who offer cloud computing-based services and applications:

Cost Savings - Companies can reduce their capital expenditures and use operational expenditures for increasing their computing capabilities. This is a lower barrier to entry and also requires fewer in-house IT resources to provide system support. This technology reduces the cost of computation, application hosting, content storage and delivery significantly due to billing model which is pay as per usage.

Scalability/Flexibility - Companies can start with a small deployment and grow to a large deployment fairly rapidly, and then scale back if necessary. Also, the flexibility of cloud computing allows companies to use extra resources at peak times, enabling them to satisfy consumer demands.

Reliability - Services using multiple redundant sites can support business continuity and disaster recovery.

Maintenance - Cloud service providers do the system maintenance, and access is through APIs that do not require application installations onto PCs, thus further reducing maintenance requirements The billing model is pay as per usage and infrastructure is not purchased thus lowering maintenance.

Mobile Accessible - Mobile workers have increased productivity due to systems accessible in an infrastructure available from anywhere. It is also a convenient for telecommuters and traveling remote workers, who can simply log in and use these applications wherever they are.

IX. CHALLENGES

The following are some of the notable challenges associated with cloud computing, and although some of these may cause a slowdown when delivering more services in the cloud, most also can provide opportunities, if resolved with due care and attention in the planning stages.

Security and Privacy - Two major issues surrounding cloud computing relate to storing and securing data, and monitoring the use of the cloud by the service providers [3]. These issues are generally attributed to slowing the deployment of cloud services. The security mechanisms between organization and the cloud need to be robust and a Hybrid cloud could support such a deployment.

Lack of Standards - Clouds have documented interfaces; however, no standards are associated with these, and thus it is unlikely that most clouds will be interoperable [3]. The Open Grid Forum is developing an Open Cloud Computing Interface to resolve this issue and the Open Cloud Consortium is working on cloud computing standards and practices. The findings of these groups will need to mature, but it is not known whether they will address the needs of the people deploying the services and the specific interfaces these services need. However, keeping up to date on the l atest standards as they evolve will allow them to be leveraged, if applicable.

Continuously Evolving - User requirements are continuously evolving, as are the requirements for interfaces, networking, and storage[3]. This means that a "cloud," especially a public one, does not remain static and is also continuously evolving.

Compliance Concerns - The Sarbanes-Oxley Act (SOX) in the US and Data Protection directives in the EU are just two among many compliance issues affecting cloud computing, based on the type of data and application for which the

cloud is being used[3]. The EU has a legislative backing for data protection across all member states, but in the US data protection is different and can vary from state to state. As with security and privacy mentioned previously, these typically result in Hybrid cloud deployment with one cloud storing the data internal to the organization.

X. CONCLUSIONS

The key advantages for using the clouds are that our needs might be so massive that the number of servers require far exceeds our desire or budget to run those in-house and on the other hand we may only need a sip of processing power so we don't want to buy and run a dedicated server for the job. The cloud fits for both. An internet outage would affect our cloud application. In July 2008, Amazon's S3cloud storage device went down for second time that year. A lots of applications were hosted by the company and all those service could not be accessed until techs could fix the problem. Some applications were get down for eight hours. This is the major weak link for cloud.

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