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Cloud Computing-An Overview & its Impact on Economy

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ABSTRACT

Cloud computing is clearly one of today's most enticing technology areas. The coming shift to cloud computing is a major change in our industry. Cloud computing is a construct that allows you to access applications that actually reside at a location other than your computer or the other internet connected devices. This paper provides an overview to cloud computing. It discusses architecture, infrastructure models of cloud computing. It has provided various reasons for acceptance or avoidance of cloud computing.

Keywords: Cloud Computing, SaaS, PaaS, IaaS, CloudArchitecture.

II. INTRODUCTION

The flexible and extensive nature of software architectures and benefits of distributed computing have created a concept known as cloud computing. The cloud shifts the centralized, owned-and-operated computing infrastructure model to a fully distributed decentralized paradigm. To enable the cloud, data centers leverage commodity hardware, virtualization techniques, open frameworks, and ubiquitous network access. Grid computing was generally used to run a few processor-intensive tasks that would normally be run on a high-performance machine. Cloud computing extends this concept to perform multiple tasks for numerous users in a distributed fashion. The network (intranet or Internet) is employed to interconnect commodity machinery and to deliver services to disparate users.[1] Cloud Computing is simply IT services sold and delivered over the Internet. In this model "customers" plug into the "cloud" to access IT resources which are priced and provided "on-demand"[2].According to Gartner cloud computing is defined as: "a style of computing where massively scalable IT-enabled capabilities are delivered 'as a service' to external customers using Internet technologies." Cloud computing is about how an application is deployed and delivered over the Internet and which is scalable on demand [3].

III. CLOUDARCHITECTURE

The architecture of cloud computing can be described using a layered model. At the top of the cloud model is the client layer, which interfaces directly with cloud environment end users. Below the client layer is the cloud applications layer. Applications that run on the cloud reside here and are generally accessed by application developers. Next is the software infrastructure layer, where basic infrastructure services, including storage, computing, and communications, are performed. Below these three layers are the actual cloud environment

software and hardware layers. At the software layer resides the kernel that translates and executes the cloud applications' instructions on the cloud hardware. In many architectures, this cloud software kernel can include a hypervisor for executing virtualizedapplications Finally, underpinning all of the cloud layers is the hardware layer, which includes processor, memory, storage, and communications hardware. Figure 1depicts the relevant layers[5].

Several fundamental components make up the cloud architecture:

- Computing resources are located off site in a data center that is not owned or managed by the enterprise using the cloud services.
- Resources often leverage virtualization for ease of management and interoperability.
- Resources are available on demand.
- Infrastructure is often shared.
- Virtualization can enable multiple customers and applications to share the same physical machines.
- Services are generally provisioned on demand and scaled up or down as required.
- Services are usually subscription-based, with a variety of tiered service offerings as well as flat-rate and per-use pricing models.

These components, fundamentally tied together into architecture, produce a cloud services offering.[4]

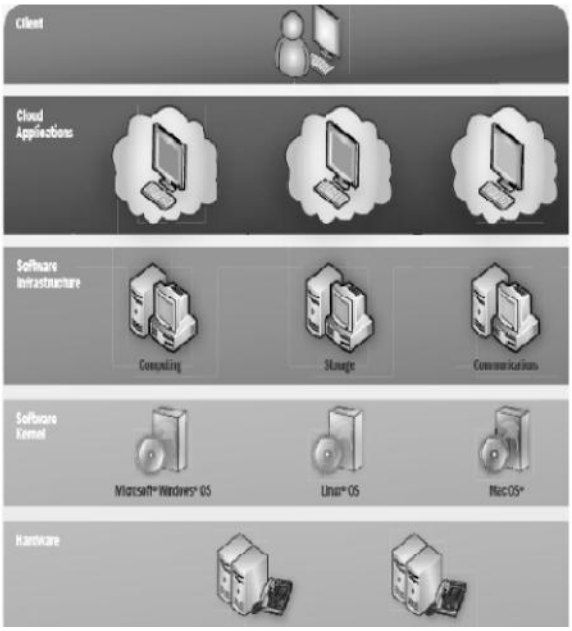

Figure1: Cloud Layer Model[5]

IV. CLOUD COMPUTING INFRASTRUCTURE MODELS

There are three basic service models to be considered in cloud computing. They are public, private and hybrid clouds. IT organizations can choose to deploy applications on public, private, or hybrid clouds, each of which has its trade-offs. The terms public, private, and hybrid do not dictate location. Companies may make a number

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of considerations with regard to which cloud computing model they choose to employ, and they might use more than one model to solve different problems.

3.1. Public clouds

Public clouds are run by third parties, and applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks (Figure2).Public clouds are most often hosted away from customer premises, and they provide a way to reduce customer risk and cost by providing a flexible, even temporary extension to enterprise infrastructure. If a public cloud is implemented with performance, security, and data locality in mind, the existence of other applications running in the cloud should be transparent to both cloud architects and end users. Indeed, one of the benefits of public clouds is that they are offering the ability to scale up and down on demand, and shifting infrastructure risks from the enterprise to the cloud provider is just temporarily[6].

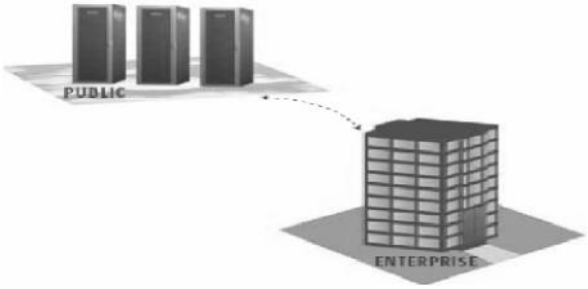

Figure2: A public cloud[6]

3.2.Private clouds

Private clouds are built for the exclusive use of one client, providing the utmost control over data, security, and quality of service (Figure3). The company owns the infrastructure and has control over how applications are deployed on it. Private clouds maybe deployed in an enterprise data center, and they also may be deployed at a collocation facility. Private clouds can be built and managed by a company's own IT organization or by a cloud provider. This model gives companies a high level of control over the use of cloud resources while bringing in the expertise needed to establish and operate the environment [6].

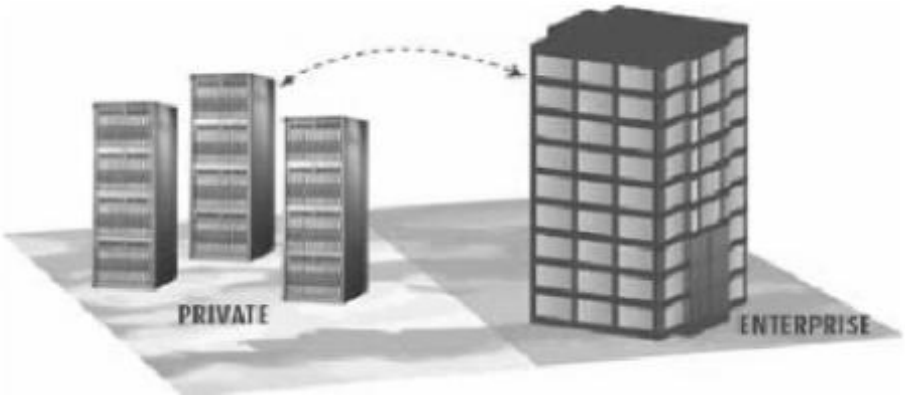

Figure3: Private clouds[6]

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3.3.Hybrid clouds

Hybrid clouds combine both public and private cloud models (Figure 4).They can help to provide on-demand, externally provisioned scale. Hybrid cloud can be used to maintain service levels in the face of rapid workload fluctuation, also to handle planned workload spikes.

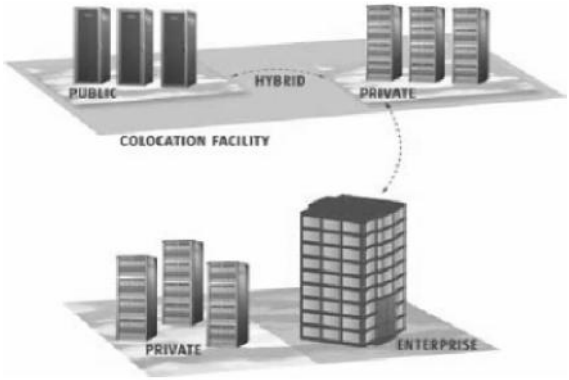

Figure4: Hybrid clouds[6]

IV. TYPES OF CLOUD COMPUTING

Various types of cloud computing areas follows:

> **Software as a service (SaaS):** Software as a service features a complete application offered as a service on demand. A single instance of the software runs on the cloud and services multiple end users or client organizations [6].Highest-profile examples are Salesforce.com, Google's Gmail and Apps, instant messaging from AOL, Yahoo and Google, and VoIP from Vonage and Skype.[2]

> **Platform as a service (PaaS):**

Platform as a service encapsulates a layer of software and provides it as a service that can be used to build higher-level services. There are at least two perspectives on PaaS depending on the perspective of the producer or consumer of the services:

- Someone producing PaaS might produce a platform by integrating an OS, middleware, application software, and evena development environment that is then provided to a customer as a service. For example, someone developing a PaaS offering might base it on a set of Sun x VM hypervisor virtual machines that include a NetBeans integrated development environment, aSun GlassFish Web stack and support for additional programming languages such as PerlorRuby.

- Someone using PaaS would see an encapsulated service that is presented to them through an API. The customer interacts with the platform through the API, and the platform does what is necessary to manage and scale itself to provide a given level of service. Commercial examples of PaaS include the Google Apps Engine, which serves applications on Google's infrastructure[2].

> **Infrastructure as a service (IaaS):** Infrastructure as a service delivers basic storage and compute capabilities as standardized services over the network. Servers, storage systems, switches, routers, and other systems are pooled and made available to handle workloads that range from application components to

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high- performance computing applications. Commercial examples of IaaS include Joyent, whose main product is a line of virtualized servers that provide a highly available on-demand infrastructure

V. REASONS TO CONSIDER ADOPTING CLOUDCOMPUTING

The various reasons to adopt cloud computing are as follows:

- **Scalability:** The ability of the platform to expand and contract automatically based on capacity needs (sometimes referred to as "elasticity"), and the charging model associated with this, are key elements that distinguish cloud computing from other forms of hosting[3].
- **Cost Saving:** Research firm IDC summed it up the thus -"The cloud model offers a much cheaper way for businesses to acquire and use IT. In an economic down turn the appeal of that cost advantage will be greatly magnified"[3].
- **Business Agility:** Cloud computing allows organisations to react more quickly to market conditions and to scale up and down as needed. The flexibility offered by cloud computing enables innovative ideas to be rapidly tried and tested without the need to divert existing IT staff from their daily routine[3].
- **Built-in Disaster Recovery & Back -up Sites:** With cloud computing, the burden of managing technology is placed on the technology provider. It is their responsibility to provide built-in data protection, fault tolerance, self-healing and disaster recovery[3].
- **Device & Location Independence:** With applications and data located in the cloud it becomes much easier to enable users to access systems regardless of their location or what device they are using[3].
- **It's Greener:** This reduces not only the power consumption but also the amount of physical hardware required. With cloud computing virtual offices can be quickly setup[3].

V. IMPACT ON ECONOMY

Although cloud computing is a new technology but it is making significant impact on economy. A recent report by IT research and advisory firm Gartner forecasts worldwide cloud services market's revenue to surpass $68.3 billion in 2010 and reach $148.8 billion by 2014. Cloud computing is projected to increase to $162 billion by 2020 attainting compound annual growth of 19%.

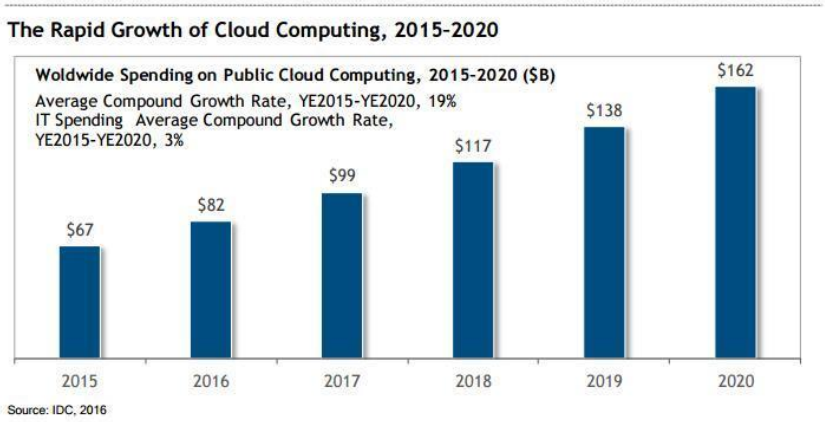

FIGURE 5: GROWTH OF CLOUD COMPUTING [7]

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Platform-as-a-Service (PaaS) adoption is predicted to be the fastest-growing sector of cloud platforms according to KPMG, growing from 32% in 2017 to 56% adoption in 2020. Gartner predicts the worldwide public cloud services market will grow 18% in 2017 to $246.8B, up from $209.2B in 2016.

Table 1. Worldwide Public Cloud Services Forecast (Millions of Dollars)

	2016	2017	2018	2019	2020
Cloud Business Process Services (BPaaS)	40,812	43,772	47,556	51,652	56,176
Cloud Application Infrastructure Services (PaaS)	7,169	8,851	10,616	12,580	14,798
Cloud Application Services (SaaS)	38,567	46,331	55,143	64,870	75,734
Cloud Management and Security Services	7,150	8,768	10,427	12,159	14,004
Cloud System Infrastructure Services (IaaS)	25,290	34,603	45,559	57,897	71,552
Cloud Advertising	90,257	104,516	118,520	133,566	151,091
Total Market	**209,244**	**246,841**	**287,820**	**332,723**	**383,355**

Source: Gartner (February 2017)

FIGURE 6: WORLDWIDE PUBLIC CLOUD SERVICES FORECAST [8]

VII. CONCLUSION

Cloud computing is the most popular notion in IT. Instead of building your applications on fixed and rigid infrastructures, Cloud Architectures provide a new way to build applications on on-demand infrastructures. Cloud Computing offers several benefits over the traditional models. It provides tremendous benefits to customers of all size. Cloud computing promises to cut operational and capital costs. It lets the IT departments to focus on strategic projects instead of keeping datacenter running. Economic environment is accelerating adoption of cloud solutions

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