CLOUD AS AN ENTERPRISE IT INFRASTRUCTURE

Gautam Deb
Lead Engineer, Software AG, Q City, Gachibowli, Hyderabad, TS 500032, India.

ABSTRACT

The purpose of this paper was to identify and establish the capabilities of cloud computing as an enterprises IT infrastructure. One of the path-breaking shift that we saw in recent past was instigated by cloud computing. It changed the way how technology and infrastructure is procured, used, managed, and how enterprises pay for those services. The aspects explored here are, the various service and deployment offerings that cloud can provide, the advantages cloud computing used as an infrastructure brings on board for an enterprise, like low capital expenses, economies of scale, no capacity guesses, agility, reliability, security etc. We also explored, the various quality of service requirements for an enterprise system, which are fulfilled by a cloud, based infrastructure solution, like availability, manageability, flexibility, scalability etc. We saw how big enterprises in various domains like retail and finance are evaluating and adapting to cloud based services. In the light of all these advantages and the quality of service capabilities provided by cloud, we were able to establish how a cloud based solution can prove to be a valuable investment for an enterprise, allowing it to focus on its core business competencies and delegating non-functional system requirements implementation, like IT infrastructure, to the cloud.

KEYWORDS: *Cloud computing, IT infrastructure, Enterprise Architecture*

I. INTRODUCTION

An enterprise is an organizational entity involved in the provision of goods and services to consumers, in a particular business domain [1]. Some examples of enterprise are, Amazon which is an e-commerce company, Google which is an internet based product and services company, financial institutions like investment and commercial banks.

For these enterprises to deliver services efficiently while meeting customer demand, and to provide same service-level agreement (SLA) to all users, one of the crucial aspect for them to consider is to layout a state of the art IT infrastructure.

IT infrastructure is a combination of hardware, software, networks, facilities, etc (including all of the information technology), in order to develop, test, deliver, monitor, control or support IT services [2].

Needless to say, to support this kind of massive infrastructure in-house, an enterprise needs a big investment and an array of support roles like DBA (for supporting databases), Network Administrator (for managing OS and network), Security Advisor (for ensuring enterprise application security), Deployment support teams and so on.

As an alternative, enterprises can evaluate and take a cloud based solution for managing their infrastructure which provides similar state of the art capabilities and considerably cuts down on various up-front costs, whether it is related to infrastructure procurement or managing it. In the coming sections, we will see what cloud computing is and what are the various offerings it provides in terms of infrastructure which can be used by an enterprise to operate seamlessly and efficiently without bothering about the non-functional system requirements.

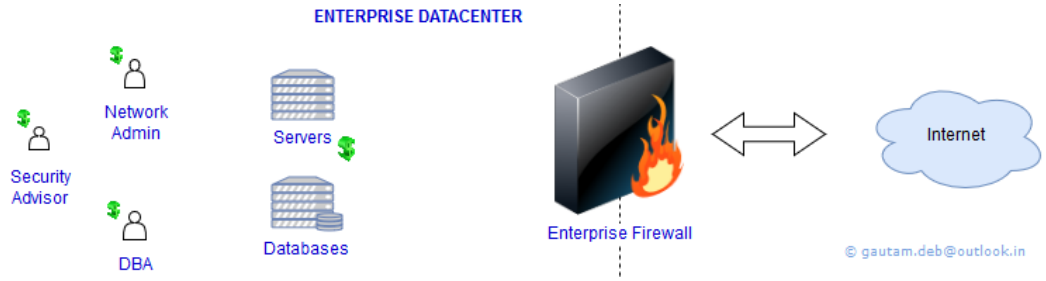

Figure 1. Traditional Enterprise IT in-house infrastructure (also indicates support roles and costs)

II. CLOUD COMPUTING

The term Cloud Computing refers to the delivery of computing services – servers, storage, databases, networking, software, analytics and more – over the internet. Companies offering these computing services are called cloud providers and typically charge for cloud computing services based on usage, similar to how you are billed for water or electricity at home [3].

With cloud computing, cloud providers manage and maintains the technology infrastructure in a secure environment and enterprise access these resources via the Internet to develop and run their applications. Capacity can grow and shrink as needed and enterprise need to pay only for what they actually use. Typically, the enterprise needs to ensure the application security within the cloud.

For example, Amazon Web Services (AWS), which is one of the major cloud provider, uses a shared responsibility model where AWS is responsible for the security "of" the cloud and the customer (enterprise) is responsible for the security "in" the cloud [4].

2.1 Cloud computing: service models

There are many types of cloud computing offerings by cloud providers, SPI is the acronym used for the most common cloud computing service models, Software as a Service, Platform as a Service and Infrastructure as a Service [12].

2.1.1 Software as a Service (SaaS)

A service provider delivers software and applications through the Internet. Users subscribe to the software and access it via the web or vendor APIs.

SaaS Examples: Google Apps, Salesforce, Workday, Citrix GoToMeeting, Cisco WebEx.

SaaS Use-Case: Replaces traditional on-device software.

2.1.2 Platform as a Service (PaaS)

A service provider offers access to a cloud-based environment in which users can build and deliver applications. The provider supplies underlying infrastructure.

Enterprise PaaS Examples: Amazon Web Services (AWS) Elastic Beanstalk, AWS CloudFormation

PaaS Use-Case: Increases developer productivity and utilization rates while also decreasing an application's time-to-market.

2.1.3 Infrastructure as a Service (IaaS)

A service provider offers the clients pay-as-you-go access to storage, networking, servers, and other computing resources in the cloud.

IaaS Examples: Amazon Web Services (AWS) EC2, Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE), Joyent.

IaaS Use-Case: Extends current datacenter infrastructure for temporary workloads (e.g. increased end-of-season sale site traffic).

2.2 Cloud computing: deployment models

There are many ways one can orchestrate cloud deployments, for the sake of simplicity and to be relevant on this paper's topic, we will focus on two of them: All in cloud based deployment approach and hybrid deployment approach [5].

2.2.1 All in cloud based deployment

An all-in cloud based deployment model, the enterprise applications are fully deployed in the cloud along with the required IT infrastructure.

With this model, all the heavy lifting of maintaining the IT infrastructure is done by the cloud provider, who have expertise in maintaining such large network and infrastructure in a secure, efficient and cost-effective way. The enterprise can deploy its complete focus and resources on the functional business priorities.

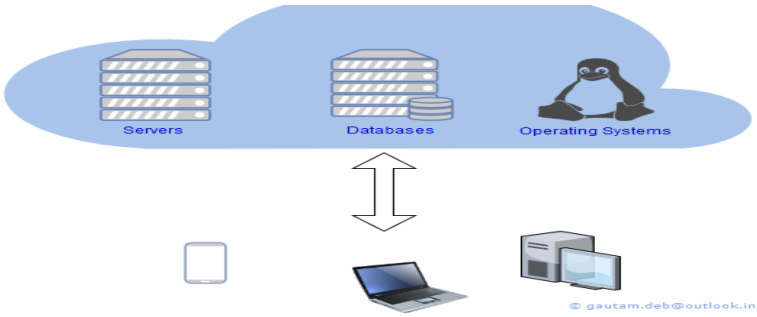

Figure 2. All in cloud based Enterprise IT infrastructure

2.2.2 Hybrid deployment

A hybrid deployment is a common approach taken by many enterprises as this allows the existing on-premises infrastructure, typically in a datacenter, to extend and grow by connecting it to a cloud. For this model to work enterprises uses dedicated connectivity (between the datacenter and cloud), identity federation (for existing enterprise users/roles to function in cloud) and integrated tools.

This model works well for enterprises having legacy systems which cannot be migrated or systems with confidential data, which, mainly because of compliance reasons cannot be placed outside enterprise network.

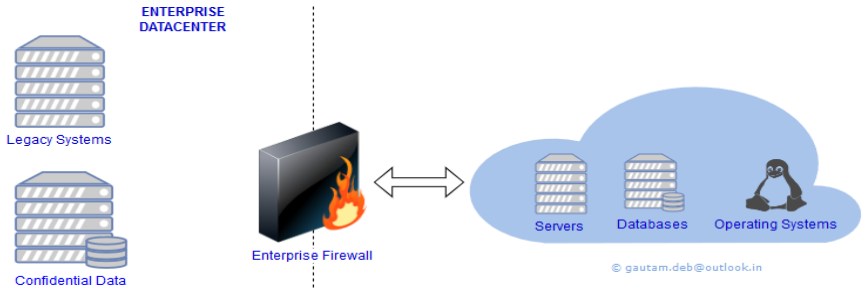

Figure 3. Hybrid Enterprise IT infrastructure

III. ADVANTAGES OF CLOUD AS AN ENTERPRISE IT INFRASTRUCTURE

While each enterprise experiences a unique journey to the cloud with numerous benefits, six advantages become apparent time and time again as listed below [3][5]. They are depicted in this figure followed by detailed explanation:

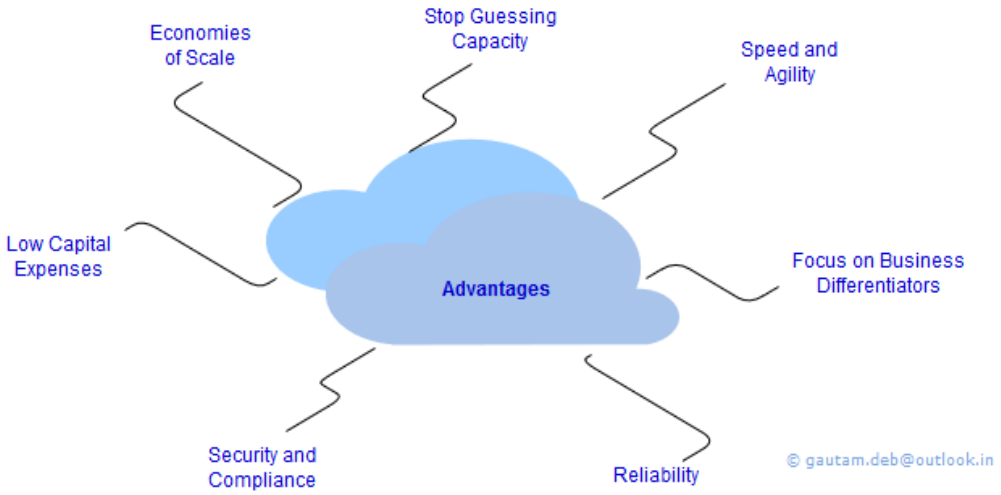

Figure 4. Advantages of using cloud as an infrastructure for an enterprise

3.1 Low Capital Expenses

Instead of an enterprise to invest upfront in data centres and servers before knowing how they will be used, enterprises have to pay only for the used cloud resources.

3.2 Economies of Scale

By using cloud computing, one can achieve a lower variable cost because of usage from hundreds of thousands of customers is aggregated in the cloud, by doing so, providers such as AWS can achieve higher economies of scale, which translates into lower prices for customers.

3.3 Stop Guessing Capacity

Enterprises can stop guessing about capacity requirements for the infrastructure necessary to meet their business needs. They can use as much or as little they need and scale it up or down as and when required.

3.4 Speed and Agility

With cloud computing, new IT resources can be made quickly available as compared to traditional setup where such action would take weeks to complete. This results in a dramatic increase in speed and agility for the enterprise as the cost and time it takes to try out different things is significantly lower and it also reduces the time to market (TTM).

3.5 Focus on Business Differentiators

Cloud computing allows enterprises to focus on its business priorities which are specific to their domain, the heavy lifting work of managing IT infrastructure, which is a generic concern and not a business requirement, is done by the cloud service provider.

3.6 Reliability

Cloud computing makes disaster recovery and business continuity easier and less expensive, because data can be mirrored at multiple redundant sites on the cloud provider's network at a very low cost.

3.7 Security and Compliance

When enterprise move their production workload to the cloud, both parties become responsible for managing the IT environment in a secure way. The enterprise data, both at rest and in motion, can be secured using various encryption strategies provided by the cloud provider.

Enterprise retain complete control and ownership over the geographical region where their data will be located thus allowing them to meet regional compliance and data residency requirements. This is crucial requirement for financial institutions dealing with client and trading data.

IV. CLOUD AND ENTERPRISE QUALITY OF SERVICE REQUIREMENTS

There are many quality of service standards that enterprises must achieve. While considering cloud as an infrastructure solution, enterprises will have expectations from cloud provider to meet these criteria. We will define them here and see how cloud infrastructure supports those standards.

Note that Amazon web services is cited here as the cloud provider to demonstrate cloud capability. Other cloud providers are equally capable and efficient and provides similar functionalities.

4.1 Availability

Availability is the degree to which is system is accessible. It is the ration of (a) the total time a functional unit is capable of being used during a given interval to (b) the length of the interval [6]. An example of availability is 140/168, if the unit is capable of being used for 140 hours in a week.
For example, in Amazon Web Services, cloud computing resources are hosted in multiple locations world-wide. These locations are composed of regions and availability zones. Each *region* is a separate geographic area. Each region has multiple, isolated locations known as *Availability Zones* [7].
If we keep our deployment strategy to use multiple zones with redundant application and database instances, then in case of failure in a single zone, the application services will not be impacted.

4.2 Manageability

Manageability is the ability to administer and thereby manage the system resources to ensure that the availability and performance of a system.

For example, in Amazon Web Services, by using *CloudWatch* service, enterprises can gain system wide visibility into resource utilization, application performance and operational health [8]. By using these insights, organization can react, as necessary, to keep applications run smoothly.

4.3 Flexibility

Flexibility in this context is the ability to address hardware configuration changes without great deal of impact to the underlying system.

For example, in Amazon Web Services, a huge range of sophisticated functionality is provided that allows you to replicate everything you might have in your own data centre. This spans from control over low level networking and compute through to providing multiple critical infrastructure products like logging, monitoring, access control and load balancing; and application level services like search, email delivery, file sharing and databases.

4.4 Scalability

Scalability is the ability to support the required availability and performance of a system as the number of users and transaction volume increases. A system can be scaled horizontally by adding servers, and vertically by adding capacity (memory and CPUs).

For example, in Amazon Web Services, *Auto Scaling* feature allows enterprises to scale Amazon compute server (EC2) up or down automatically according to the conditions defined for the particular workload. Also, *AWS Elastic Load Balancing* automatically distributes incoming application traffic across multiple compute (EC2) instances in the cloud [9]. It enables enterprises to achieve great level of scalability and fault tolerance in their application.

V. CONCLUSION AND FUTURE WORK

Cloud computing erupted as a path-breaking way on how technology, infrastructure and services can be used and has impacted everyone in some or the other way, big enterprises are no exception to that.

For an enterprise to consider cloud as an IT infrastructure, there are few initial apprehensions which they need to overcome. Enterprises think in terms of security, compliance, cost, agility, performance, manageability, scalability amongst other things when they think of IT architecture.

In this paper, we saw how cloud effectively and positively addresses various enterprise architecture concerns and comes as a winner solution for various real-world enterprise computing challenges. It can be used as-is, to minimize the non-functional work at the enterprise end and allows them to focus on their core competencies, that is delivering business value. Also, cloud is flexible enough to blend with the existing enterprise systems as an extension to increase the capacity needs.

Cloud computing is already getting wide consumer acceptance, Amazon e-commerce is fully operated from cloud, even start-ups are using cloud based IT infrastructure because of its flexibility in capacity usage and pricing. Big financial institutions like Goldman Sachs [10] and JP Morgan Chase [11] are exploring and investing in cloud computing as part of their long-term strategy. Cloud solutions are still evolving and with coming time cloud providers will make their products and platform more robust, adaptable and innovative. Also, with customers exploring new possibilities like multi-cloud, there is no doubt that it will turn out as a good option for enterprises and businesses looking for flexibility, cost savings and ultimately better solutions. The prominence of cloud computing is beautifully encapsulated in this quote by Paul Maritz, CEO of VMware:

"Cloud is about how you do computing, not where you do computing."

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AUTHOR

Gautam Deb is currently working as a Lead Engineer with Software AG in Hyderabad (TS), India. He has overall 12 years of industry experience in designing and developing large scale, highly available, fault tolerant and scalable enterprise software systems. He holds a MCA degree from JNV University Jodhpur, India and also an AWS Certified Solutions Architect – Associate certification for cloud computing.