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CLOUD - An Emerging trend in delivering IT services

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ABSTRACT: This paper explores the framework of cloud environment, models, current technologies & trends in the space of Cloud. The Research elaborates on key benefits and barriers of moving IT Business Services to Cloud. Cloud is a way of delivering IT-enabled services in the form of software (SAAS), platform (PAAS) and infrastructure (IAAS). This research overall examines the definition of cloud computing and cloud services and how it will evolve over the next decade. The research targets to provide a clear understanding of the concepts and strategies around the Cloud technology and prepares readers for future enhancements which have become one of the most discussed IT paradigms of recent year.

KEYWORDS: Cloud, Cloud Computing, Cloud Service Models, Cloud Deployment Models, Hypervisors, Open Stack.

1 INTRODUCTION

With the excessive downsizing and striping organizations of their assets in the past decade, Cloud is an emerging trend in delivering IT Services. Cloud is a source of value and opportunity to achieve and sustain more competitive advantage. Delivering IT Services using Cloud presents untapped potential to achieve optimal performance and remain competitive in the ever changing landscape of boundary **less** business environment. Organizations deciding to move IT services to the Cloud is a paradigm shift as it represents a fundamental change in the way organizations deliver solutions to customers (internal or external). Youseff et al. were among the first who tried to provide a comprehensive understanding of cloud computing and all its relevant components. They regard cloud computing as a *"collection of many old and few new concepts in several research fields like Service-Oriented Architectures (SOA), distributed and grid computing as well as Virtualization"* [11].

With globalization and withstanding environmental pressures comes change and it is about this phenomenon, that Researcher aspires to produce some useful research. Common characteristics of cloud are that it runs across more than one operating system, has an application program interface (API) through which client can access resources and can provision and de-provision resources rapidly using automation.

2 THE DEFINITION OF CLOUD

Cloud

Cloud is essentially a flexible, scalable, pay-per-use model for the way IT services are delivered and consumed, typically through short-term contracts. With its pay-as-you-go model, cloud moves many IT costs from capital expenditure to operating expenditure; its "elastic model" means available IT capability can be flexed to mirror changing business demand; and it enables consumers of IT to have much greater transparency over their costs.

Cloud Computing

Cloud Computing as defined by U.S. National Institute of Standards and Technology (NIST) [1] seems to contain most common ingredients widely used and accepted in IT Industry. *Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service-provider interaction [1].*

3 CLOUD SERVICE MODELS

There are three cloud service models. (IAAS, PAAS, SAAS). The service providers and consumers can opt to use them individually or a full blown cloud model consisting of all three models mentioned above. Now let's see the definitions of all three cloud service models to get more clarity in schema of things.

IAAS (Infrastructure as a Service)

In IAAS, the server, computing, storage, networking responsibility and management lies with the service provider and organizations pay as per usage. Organizations buy the necessary infrastructure resources as needed and on-demand.

PAAS (Platform as a Service)

PAAS provides a platform and environment that allow developers to build applications and services over the internet. This provisioning model allows organizations to buy middleware, development tools and runtime environment as needed with scale-up or down options.

(SAAS) Software as a Service

SAAS applications are deployed in the cloud environment and are accessed by users within organizations. In this cloud model, Software is rented as a service rather than purchasing it. Installations, upgrades, necessary patches are responsibility of service provider.

4 CLOUD DEPLOYMENT MODELS

There are four main types of deployment models. Public cloud, Private cloud, Hybrid cloud and Community cloud.

Public Cloud

Public Clouds are usually available to all, or to large number of groups within an industry. Facebook, google, Hotmail are widely understood examples of public cloud. Public Clouds which are owned by service providers who make IT services available to multiple users over the internet. This offering can be free or there could be some nominal charges for the service usage.

Private Cloud

A private cloud offers many of the benefits of a public cloud computing environment, such as being elastic and service based. The difference between a private cloud and a public cloud is that in a private cloud-based service, data and processes are managed within the organization without the restrictions of network bandwidth, security exposures and legal requirements that using public cloud services might entail. In addition, private cloud services offer the provider and the user greater control of the cloud infrastructure, improving security and resiliency because user access and the networks used are restricted and designated. [12]

Source: Cloud Computing Use Cases, A white paper produced by the Cloud Computing Use Case Discussion Group, Version 4.0, 2 July 2010

Hybrid Cloud

A hybrid cloud is a combination of a public and private cloud that interoperates. In this model users typically outsource non-business-critical information and processing to the public cloud, while keeping business-critical services and data in their control. [12] Hybrid Clouds integrate cloud-to-cloud and/or cloud-to-enterprise to create a seamless IT environment.

Source: Cloud Computing Use Cases, A white paper produced by the Cloud Computing Use Case Discussion Group, Version 4.0, 2 July 2010

Community Cloud

A community cloud is controlled and used by a group of organizations that have shared interests, such as specific security requirements or a common mission. The members of the community share access to the data and applications in the cloud. [12]

5 KEY TECHNOLOGIES SUPPORTING CLOUD

There are some key technologies that complement and support cloud.

Virtualization

In computing, virtualization means to create a virtual version of a device or resource, such as a server, storage device, network or even an operating system where the framework divides the resource into one or more execution environments.

Even something as simple as partitioning a hard drive is considered virtualization because you take one drive and partition it to create two separate hard drives. Devices, applications and human users are able to interact with the virtual resource as if it were a real single logical resource. [13]

Hypervisors

A hypervisor is a hardware virtualization technique that allows multiple guest operating systems (OS) to run on a single host system at the same time. [14] The guest OS shares the hardware of the host computer, such that each OS appears to have its own processor, memory and other hardware resources. You can think of a Hypervisor as the kernel or the core of a virtualization platform. The Hypervisor is also called the Virtual Machine Monitor. The Hypervisor has access to the physical host hardware.

Orchestration

Orchestration describes the automated arrangement, coordination, and management of complex computer systems, middleware, and services.

In these systems, a centrally controlled set of workflow logic facilitates interoperability between two or more different applications. A common implementation of orchestration is the hub-and-spoke model that allows multiple external participants to interface with a central orchestration engine. [15] It is often discussed as having an inherent intelligence or even implicitly autonomic control, but those are largely aspirations or analogies rather than technical descriptions. In reality, orchestration is largely the effect of automation or systems deploying elements of control theory [15]

6 OPEN STANDARDS - AS PART OF CLOUD STRATEGY

The hype around cloud has created a flurry of standards and open source activity leading to market confusion. As important as current standards development efforts are, they are not enough. There is a lack of a customer driven prioritization and focus within the cloud standards development process. [8] The Cloud Standards Customer Council separates the hype from the reality on how to leverage what customers have today and how to use open, standards-based cloud computing to extend their organizations. Cloud Standards Customer Council founding enterprise members include IBM, Kaavo, CA Technologies, Rackspace & Software AG. More than 400 of the world's leading organizations have already joined the Council, including Lockheed Martin, SAP, Citigroup, Fujitsu, State Street and North Carolina State University. [8]

In general, the cloud-computing community sees the lack of cloud interoperability as a barrier to cloud-computing adoption because organizations fear “vendor lock-in.” [9] Vendor lock-in refers to a situation in which, once an organization has selected a cloud provider, either it cannot move to another provider or it can change providers but only at great cost.

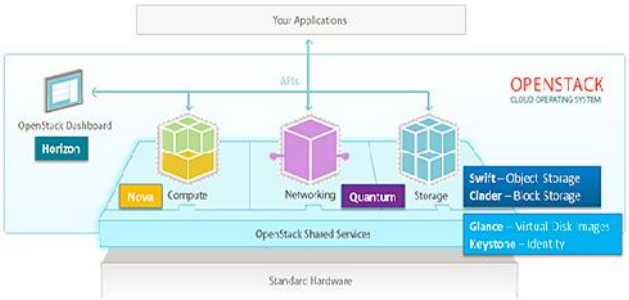
Businesses can take full advantages of Cloud service and deployments models when service providers enable these based upon Open Standards. Only when these have been designed and broadly adopted (and Open Source will massively help here) will we be able to call the Cloud a revolution.

Increasingly, a symbiotic relationship is emerging between open source and open standards. For instance, proponents of emerging open standards often turn to open source to implement the standards as a means of providing a reference, as well as providing a vehicle to drive adoption. As another example, communities developing an open source project formally document their project’s APIs and/or protocols when they feel that things are stable. [10]

7 OPEN SOURCE - AS PART OF CLOUD STRATEGY

OpenStack

Founded by Rackspace Hosting and NASA, OpenStack is a cloud operating system that controls large pools of compute, storage, and networking resources throughout a datacenter, all managed through a dashboard that gives administrators control while empowering their users to provision resources through a web interface. [2]. OpenStack is an open source software for building private and public clouds which delivers a massively scalable cloud operating system.

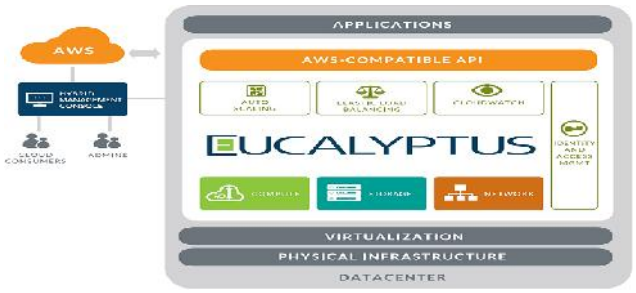


Source: Openstack website [2]

OpenStack has grown to be a global software community of developers collaborating on a standard and massively scalable open source cloud operating system. Their mission is to enable any organization to create and offer cloud computing services running on standard hardware. The project aims to deliver solutions for all types of clouds by being simple to implement, massively scalable, and feature rich. [2].

Eucalyptus

Eucalyptus is open source software for building AWS-compatible private and hybrid clouds. Eucalyptus is a Linux-based software architecture that implements scalable private and hybrid clouds within existing IT infrastructure. Eucalyptus allows you to use your own collections of resources (hardware, storage, and network) using a self-service interface on an as-needed basis. [3],



Source: Eucalyptus Datasheet [4]

Eucalyptus can dynamically scale up or down depending on application workloads and is uniquely suited for enterprise clouds, delivering production-ready software that supports the industry-standard AWS APIs, including EC2, S3, EBS, IAM, Auto Scaling, Elastic Load Balancing, and CloudWatch. The benefits of this open source software for private clouds are highly efficient scalability, organization agility, and increased trust and control for IT.

CloudStack

Apache CloudStack is a top-level project of the Apache Software Foundation (ASF). The project develops open source software for deploying public and private Infrastructure-as-a-Service (IaaS) clouds. CloudStack provides an open and flexible cloud orchestration platform to deliver reliable and scalable private and public clouds. [5] Apache CloudStack is a Java-based project that provides a management server and agents (if needed) for hypervisor hosts so that it can run an IaaS cloud.[5]

Joyent

Joyent uses true cloud-native technologies, like OS virtualization, to maximize the performance of its computing resources. Joyent is the high-performance cloud infrastructure and big data analytics company, offering organizations of any size the best public and hybrid cloud infrastructure for today's demanding real-time web and mobile applications. [6]

OpenNebula

OpenNebula vision is to bring simplicity to the private and hybrid enterprise cloud. OpenNebula combines existing virtualization technologies with advanced features for multi-tenancy, automatic provision and elasticity, following a bottom-up approach driven by the real needs of sysadmins and devops. [7]

8 BENEFITS OF MOVING IT BUSINESS SERVICES TO CLOUD

Cloud computing represents a significant shift in the way that IT resources are managed, operated, and consumed. This change exposes several benefits to enterprises, promoting greater IT efficiency and agility.

Capital expenses (CapEx)

Cloud promotes greater optimization and utilization of IT assets, allowing you to do more with less and achieve significant cost reduction. You can take on IT capital investments in increments of required capacity instead of building for maximum (or burst) capacity. [16]

Operating expenses (OpEx)

Public cloud offerings are billed to the enterprise on a pay-per-use basis and private clouds can be treated as OpEx by consuming business units, although IT would continue to make capital investments. Through automation, cloud reduces the amount of time and effort needed to provision and scale IT resources. [16]

Simplification

Cloud promotes simplification of the underlying IT infrastructure resources to fewer standardized products, technologies, and platforms. This standardization reduces operational complexity and promotes operational consistency. Cloud also encourages IT to develop a catalog of standard services on which to build business capabilities.

Flexibility

Cloud provides flexibility in the way you source, deliver, and consume the IT services you need to build business **capabilities**.

Agility

Cloud can compress the time needed to provision and deploy new applications and services from months to minutes. This increased agility allows you to experience the benefits of new applications and services and bring new capabilities to market sooner, creating a potential competitive advantage.

Overall, cloud offers a way for IT to create a platform for cost-effective and responsive innovation to become a partner for growth within the enterprise.

9 BARRIERS TO ADOPTION OF CLOUD

While most enterprises recognize the potential benefits of cloud, practical concerns and perceived challenges have hampered the widespread adoption of cloud. Many of these barriers can be understood as questions of trust: Can the cloud be trusted to deliver the same capabilities (or even better) at the same service levels in the same controlled way as traditional IT? [16]

Security

Security is one of the major concern for organizations planning to move to cloud. [16] As the usage and more deployments in cloud increases, so does the security threat to it. System and data security becomes prime concern for organizations.

Control

Organizations can be reluctant to handover the control of IT services to the external IT service provider Can application owners still have the same amount of control over their applications and the infrastructure supporting them in the cloud?

Fear of vendor lock-in

As it has already been proven and established fact that IT companies lock the organizations with their offerings. The answer to this question can be cloud but would this allow multi vendors integrations and offering to work seamlessly? There is fear of vendor lock-in.

Jurisdiction over data stored in the cloud?

Question is that where is the data stored in order to comply with privacy laws?. In the cloud, data flows around the globe, ignoring boundaries and time zones. Who has the jurisdictional control over the stored data? e.g. US data being stored in Asia?

Compliance

As cloud models are followed, there is a question which is asked by legal department of organizations i.e Can applications in the cloud meet the same regulatory compliance requirements as with the traditional IT models?

IT Service Provider - Out of business

What happens if the cloud service provider goes out of business and files bankruptcy? What will happen to organizational data?

Reliability

Can the same service-level agreements (SLAs) for reliability be met in the cloud, especially given the multi-tenant use of the underlying IT infrastructure?

Governance

The introduction of cloud computing requires an appropriate IT governance model to ensure a secured computing environment and to comply with all relevant organizational information technology policies.

Storage of Trade Secrets

Does the disclosure of the trade secret to a cloud service provider violate the Uniform Trade Secrets Act requirement to make reasonably effort to maintain secrecy?

Enterprises reluctance to change

Cultural change and resistance to change is one of the main factor affecting adoption of cloud in medium to large organizations. Could this be deciding factor in failure or success in moving IT business services to cloud?

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