Cloud Computing: Benefits and Limits on SPI model

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Abstract

Cloud computing is a term to deliver software, storage and processing. It increases system's capability without changing the existing infrastructure, educating new people or taking license for the software. It improves the existing software capabilities and extends the Information Technology resources. In recent years, cloud computing has grown up rapidly and boosted the business concept in IT industry. This paper presents advantages and disadvantage of cloud computing from the view point of SPI model. SPI model is defined as: A term used to represent the most common cloud computing service models, Software as a Service, Platform as a Service and Infrastructure as a Service.

1. Introduction

Cloud is the architecture and a set of services that enable access resources on demand. It is a dynamically scalable, on-demand, multi-tenant and often virtualized resources which are provided as a self-service over the Internet/Intranet; Public, Private and Hybrid Models. Cloud gives you the flexibility to handle fast paced customer requirements and also provide a reliable solution for your applications, which can have an option to scale incrementally without having a downtime [12].

Recently, cloud computing has become a new paradigm in information technologies. It grants several promising technological and economic opportunities that have a prospective to become an evolutionary point in the new era of computing environment [4]. Cloud computing is the next generation in computation. Maybe Clouds can save the world; possibly people can have everything they need on the cloud. Cloud computing is the next natural step in the evolution of on-demand information technology services and products. The Cloud is a metaphor for the Internet, based on how it is depicted in computer network diagrams, and is an abstraction for the complex infrastructure it conceals [7].This paper is an introduction to the terminologies, characteristics, and services associated with cloud computing.

The Cloud is consisting of four models which based on their infrastructure. There are public cloud, private cloud, hybrid cloud and community cloud. The public cloud is available to large industrial groups or public. These are maintained and owned by organization selling cloud services. Private cloud is just kept accessible to the organization that designs it. Private clouds can be managed by third party or the organization itself. In this scenario, cloud servers may or may not exist in the same place where the organization is located [9]. Within the hybrid cloud there can be two or more clouds like private, public or a community. These constituting clouds remain different but yet bound together by standardized or preparatory technology that enables application and data portability. Hybrid cloud is shared by several organizations and supports a specific community with shared concerns. This can be managed by an organization or third party and can be deployed off or in the organizational premise [9].

Figure 1. Cloud computing

2. Cloud Computing Service Models

There are many services in cloud computing. But, the Cloud Computing model constitutes three main service deliveries. These main services are

Software as a Service, Platform as a Service and Infrastructure as a Service.

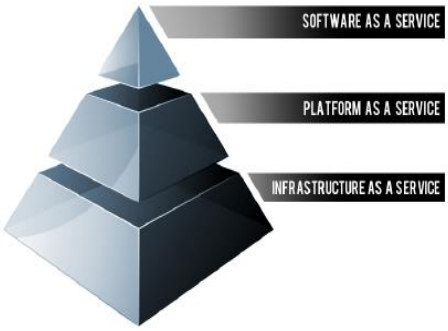

Figure 2. Cloud computing service model

2.1. Software as a Service (SaaS)

This is the simplest looking cloud offering. Most of us have been using services without realizing it to be a cloud platform. This model delivers software as a service over the Internet, eliminating the need to install and run the application on the customer's own computers and simplifying maintenance and support. The best example could be Gmail, Office 365 or even Hotmail [13].

With SaaS, a provider licenses an application to customers either as a service on demand, through a subscription, in a "pay-as-you-go" model, or (increasingly) at no charge when there is opportunity to generate revenue from streams other than the user, such as from advertisement or user list sales SaaS is a rapidly growing market as indicated in recent reports that predict ongoing double digit growth [9]. This rapid growth indicates that SaaS will soon become commonplace within every organization and hence it is important that buyers and users of technology understand what SaaS is and where it is suitable.

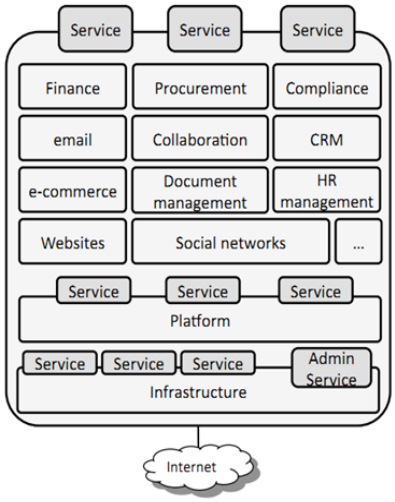

Figure 3. Software-as-a-Service (SaaS) Stack

Platform as a Service is a software delivery model where a cloud service provider (CSP) provides an online software development platform for an organization such as an agency. The agency's developers use the CSP's computing environments, tools, and libraries to create, test, manage, and host software applications. By moving the entire development platform to the CSP, agencies can lessen the cost and management burdens of application development.

Developers create applications on the provider's platform over the Internet. PaaS providers may use APIs, website portals or gateway software installed on the customer's computer. Force.com, (an outgrowth of Salesforce.com) and Google Apps are examples of PaaS. Developers need to know that currently, there are not standards for interoperability or data portability in the cloud. Some providers will not allow software created by their customers to be moved off the provider's platform.

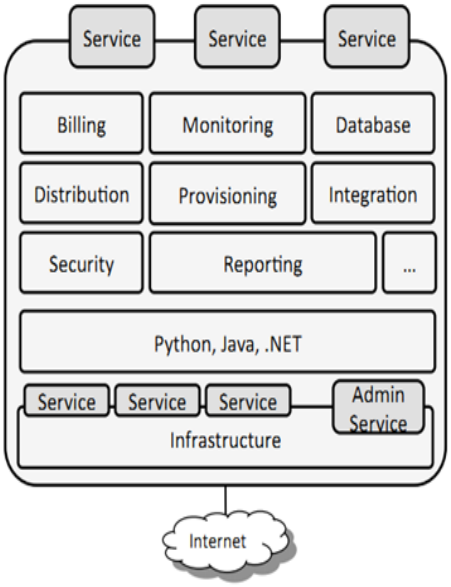

Figure 4. Platform-as-a-Service (PaaS) Stack

Infrastructure as a Service is a delivery model where cloud service providers (CSPs) provide the necessary hardware and software upon which a customer can build a customized computing environment or implement commercial off the shelf products. The CSP provides an environment that the customer can configure to meet their specific needs including the installation of third party or custom software. To facilitate this, the CSP may provide:

- Operating systems
- Servers
- Storage capabilities

- Firewalls
- Load balancers
- Networking components
- Software bundles.

The customer, or agency, can retain full control of the computing environment and can configure and maintain the operating systems and associated applications and resources. For an additional charge, the CSP may manage the environment on behalf of the agency. Nevertheless, the CSP is responsible for maintaining all of the physical equipment.

Infrastructure-as-a-Service like Amazon Web Services provides the customer with virtual server instances and storage, as well as application program interfaces (APIs) that allow the customer to start, stop, access and configure their virtual servers and storage. This model allows a company to pay for only as much capacity as is needed, and bring more online as soon as required. Because this pay-for-what-you-use model resembles the way electricity, fuel and water are consumed; it's sometimes referred to as utility computing.

Physical resources are abstracted by virtualization, which means they can then be shared by several operating systems and end user environments on the virtual resources – ideally, without any mutual interference. These virtualized resources usually comprise CPU and RAM, data storage resources.

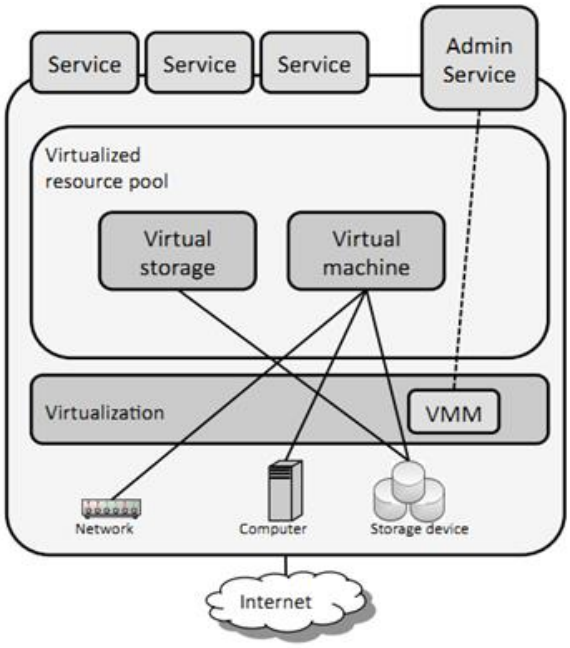

Figure 5. Platform-as-a-Service (PaaS) Stack

2.4. Storage as a Service

Storage as a service provides the ability to leverage storage that physically exists at a remote site, but is logically a local storage resource to any application that requires storage. This is the most primitive component of cloud computing and is leveraged by most of the other cloud computing components.

2.5. Database as a Service

Database as a service provides the ability to leverage the services of a remotely hosted database, sharing it with other users, and having it logically function as if the database were local. Different models are offered by different providers, but the power is to leverage database technology that would typically cost thousands of dollars in hardware and software licenses.

2.6. Information as a Service

Information as a service refers to the ability to consume any type of information, remotely hosted, through a well-defined interface such as an application programming interface (API). Examples include stock price information, address validation, and credit reporting.

2.7. Process as a Service

Process as a Service: refers to a remote resource that is able to bind many resources together, such as services and data, either hosted within the same cloud computing resource or remote, to create business processes. A business process is a meta-application that spans systems, leveraging key services and information that are combined into a sequence to form a process. These processes are typically easier to change than applications, and thus provide agility to those who leverage these process engines that are delivered on-demand.

2.8. Integration as a Service

Integration as a service is the ability to deliver a complete integration stack from the cloud, including interfacing with applications, semantic mediation, flow control, and integration design. Integration as a service includes most of the features and functions found within traditional enterprise application integration (EAI) technology, but delivered as a service.

2.9. Security as a Service

Security as a service is the ability to deliver core security services remotely over the Internet. While the typical security services provided are rudimentary, more sophisticated services are becoming available such as identity management.

2.10. Governance as a Service

Governance as a service refers to any on-demand service that provides the ability to manage one or more cloud services. These are typically simple things such as topology, resource utilization, virtualization, and uptime management. Governance systems are becoming available as well, such as the ability to enforce defined policies on data and services.

2.11. Application as a Service

Application as a service refers to any application that is delivered over the Web to an end user, typically leveraging the application through a browser. While many associate AaaS with enterprise applications such as "Salesforce" SFA, AaaS includes office automation applications such as Google Docs, Gmail, and Google Calendar.

3. Benefits of SPI model

The biggest advantage of SaaS, as with all cloud computing, is its scalability. Virtualized applications can be moved onto different hardware extremely quickly in response to increased demand. SaaS also shares the other standard advantages: easy backups, flexible pricing, portability, and so on. Compared to other forms of cloud computing, SaaS is extremely user-friendly, with the hosting company taking most of the maintenance burden. SaaS solutions also have the potential to be extremely cheap if consumers have simple requirements and don't expect a huge amount of traffic.

There are two notable benefits to procuring a PaaS solution: a common and consistent development platform and cost savings. The PaaS solution establishes a consistent development environment that all developers work within. Whether they develop their code locally on their own computers and deploy to the PaaS environment work directly within the PaaS environment, developers share common software, system components, and computing services. This reduces redundancies, and as a result, the agency's development manager spends less time and resources coordinating multiple system configurations for each developer especially as new developers are added to a team. The PaaS environment also enables developers to easily collaborate among themselves, content creators, testers, and users throughout the development cycle.

PaaS solutions help reduce costs by implementing shared development, testing, integration, staging, and production environments. Because the agency's IT department is not burdened with the management of the various platform components, they have more resources to dedicate to the actual task of application development. PaaS solutions also enable developers to work where and when they need to. The agency is no longer required to collaborate their development teams, which reduces the amount of physical space the agency must provide.

The General Services Administration (GSA) has created a Blanket Purchase Agreement (BPA) for procuring three IaaS offerings: cloud storage, virtual machines, and web hosting. This BPA streamlines the procurement process and enables agencies to acquire these cloud services more readily.

4. Limits of SPI model

Most of the disadvantages of SaaS are the same as those that apply to ordinary shared hosting; the relative severity of the disadvantages will of course depend on consumers specific circumstances. Much of the security burden falls on the hosting company. Consumers would have to trust them to properly secure the server(s) on which the virtualized application runs, as well as the firewall controlling network security. Consumers would have no control over what other applications are sharing the same server; each other application provides a potential point of entry for hackers, and poorly written software might have adverse effects on the stability of the operating system. This is slightly mitigated by virtualization; in the event of server instability, the hosting company could easily transfer the site to a different server. Consumers would however be reliant upon them to monitor their systems closely and expedite the move. Audit trails and service monitoring are more difficult to achieve in a virtualized environment, since consumers would have no direct access to the system logs. If consumers need log access, you would have to configure your application to handle it internally.

While licensing a PaaS has many benefits, there are several drawbacks as well. The agency could run the risk of being "locked-in" to unique and proprietary

services that the CSP provides. Because the agency's development platform is hosted on the CSP's servers, the data security and privacy become issues. The PaaS environments reside on servers that are physically far away from the developers. As such, latency (slow performance) can become an issue. It may be difficult for the PaaS to access data hosted by the agency's servers if needed. The agency's IT staff does not have direct access to the PaaS environments and cannot make quick adjustments if needed.

IaaS is a metered or "pay per use" service, which means that the agency only pays for the services that it needs. A CSP makes VMs available to the customer and can charge them for specific usage or a flat rate depending upon the solution purchased and the preferences of the agency. If the agency has a surge in demand for computational power, it can provision ("spin up") more instances of their VMs to handle the extra load or allocate more hardware resources to the existing VM.

Because the VM is merely a software emulation of a machine, the CSP can deploy new VM instances within minutes. The CSP usually charges for this extra usage but once the surge recedes, the agency can release ("tear down") the extra VMs and stop paying the extra cost. Accordingly, IaaS can be much more cost effective than building a traditional data center because it relieves the agency from procuring costly computing infrastructure that they do not need.

5. Conclusion

Cloud computing has recently emerged as a compelling paradigm for managing and delivering services over the Internet. The rise of cloud computing is rapidly changing the landscape of information technology, and ultimately turning the long-held promise of utility computing into a reality. This paper provides a better understanding of the factors of advantages and disadvantages on SPI models in Cloud computing area.

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