Enterprise Mold Distinctiveness via Cloud Through Software-as-a-Service

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Abstract

Cloud computing is a disruptive technology with profound implications not only for Internet services but also for the field of information technology. The cloud uses resources in an optimal manner, which implies sharing of resources across a s et customer. The cloud business model is hosted for a web services on Internet, so that any type of application are interactive and uses centralized data center. As a r esult, vendors across the IT industry have announced cloud computing efforts of varying capabilities. The trend motivated the IT corporate companies there is an increasing interest in aspect of the cloud to incorporate innovative business model key process as service. Focus is made on t he new SaaS software delivery models, enterprise software and services in the cloud computing architecture. Finally, this paper is discussed on tracking and measuring the effective management of business model strategies, characteristics, implementation and pricing software applications.

Keyword: *Cloud computing, Grid computing, Services, SOA, SaaS, Virtualization.*

1. Introduction

The world of computing is changing. Cloud computing is an emerging computing model by which users can gain access to their application from anywhere, through any connected device. Consumer and large enterprises are increasingly utilizing cloud based applications for both everyday and the business-critical applications. The needs of operating cloud computing systems are vastly different from general computing.

Most of today's communication infrastructure is based on the advancement of information technology and business transformation, and to increase profits from its value chain, an enterprise should be able to rapidly modify and adapt its business process and collaboration infrastructure. Business Process Integration and Management is the key to building and managing an adaptive software-as-a-services solution infrastructure. As an enabling technology of business process integration, web services provide a standardized means to allow heterogeneous applications to communicate with one another.

From the business and applications point of view, knowledge obtained from the web service access patterns could be directly applied to efficiently manage activities related to e-business, e-services, e-education and so on. It is a technology which predicts future trends based on historical data. It helps business to take proactive and knowledge driven decisions.

Cloud computing is a computing model, where resources such as computing power, storage, network and software are abstracted and provided as services on the Internet or in the LAN in a r emotely accessible fashion. An infrastructure setup using the cloud computing model is generally referred to as 'Cloud'. The cloud offers a robust and flexible model of computing whereby the resources such as the computing power, memory and storage of normal commodity servers are abstracted and made available to end users in whatever configuration they may require.

Software-as-a-Service (SaaS) is a software distribution model in which applications are hosted by a service provider and made available to customers over an Internet. As benefits for their customers are numerous, many SaaS enterprises are struggling to adapt their business model and effectively offer their traditional application software in the SaaS model. They must provide an application delivery, management platform that will ensure consistent and end-to-end operation of business-critical applications with the same quality of service as before.

The Software-as-a-Service data management is a d ifferent model, with higher cost, differential price structure and usability. It reduces the infrastructure investment by not having to purchase servers or other software support to use and much more reliable.

2. Background Study

Cloud computing is TCP/IP based high development and integrations of computer technologies such as fast micro processor, huge memory, high-speed network and reliable system architecture. Without the standard inter-connect protocols and nature of assembling data center technologies, cloud computing would not become a reality. In October 2007, IBM and Google announced collaboration in cloud computing. The term "cloud computing" become popular from then on. Beside the web email, the Amazon Elastic Compute Cloud (EC2) [1], Google App Engine [3] and Salesforce's CRM largely represent a promising conceptual foundation of cloud services. The services of cloud computing are broadly divided into three categories namely, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software-as-a-Service (SaaS). Cloud computing also is divided into five layers service models shown in Figure 1: which include clients, applications, platform, infrastructure and servers [10]. The five layers look like more reasonable and clearer than the three categories.

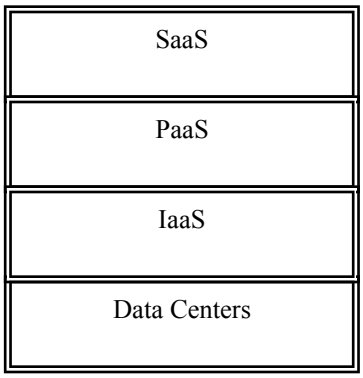

Figure 1: Service Models

There are more than 20 definitions of cloud computing that seem to only focus on certain aspects of this technology. Mean while, Oracle CEO L. Ellison thinks that cloud computing is nothing more than "everything that we currently do". All these make one to confuse about what cloud computing really is and what kind of service can be deployed as cloud service. To a certain extent the definition of cloud computing is not important if one understand its characteristics.

This paper tries to summarize general characteristics and implementation of cloud computing which will help the development and adoption of this rapidly evolving technology. The service oriented conception characteristic abstracts the details of inner implementations. As a technical characteristic, the loose coupling is the key technical feature of all kinds of cloud computing systems. The strong fault tolerant makes cloud computing much more adapting in the widely adopted network understructure. The economic pattern is the main reason why so many companies jump into the hot pool of cloud computing and distinguish it from other research area such as HPC and grid computing. The ease use of user experience characteristic hides the complexity of cloud service providers and supplies cloud users with very simple interfaces. There are also other kinds of characteristics such as TCP/IP especially Internet based, virtualization and high security.

Characteristic	Cloud Computing
Service oriented	✓
Loose coupling	✓
Strong fault tolerant	✓
TCP/IP based	✓
Virtualization	✓

Table 1: Characteristics of Cloud Computing

The cloud computing, grid computing, High Performance Computing (HPC) or supercomputing and datacenter computing all belong to parallel computing [4]. HPC focuses on scientific computing which is computing intensive and delay sensitive. So high processing performance and low delay are the most important criteria in HPC. Grid computing is based on HPC center. Many connected HPC centers form a large grid which owns a powerful underlying concept – Service Oriented Architectures (SOA). The characteristics of cloud computing are listed in Table 1. Some other creative and impressive concepts like utility computing and autonomic computing do not come into reality. The cloud computing which is based on data center is much more widely accepted than grid computing. Data center which doesn't only pursue powerful processing performance and low delay is more balanced than HPC center.

Software-as-a-Service aims at replacing the applications running on PC. There is no need to install and run the special software on your computer if you use the SaaS. Instead of buying the software at a relative higher price, one can just follow the pay-per-use pattern which can reduce the total cost. The concept of SaaS is attractive and some software runs well as cloud computing, but the delay of network is fatal to real time or half real time applications such as 3D online game.

There are also many cloud resources cannot rank into infrastructure, platform or software. Apple's App store is a creative and famous cloud computing in wireless area. Software services are sold in pay-per-use style. But running on terminals such as 3G phones instead of huge data centers is different from SaaS. In online game area, powerful game servers supply the interactions of millions game players. Game players use the capability of cloud computing without much waking up to this technology.

The electric books resources in Amazon are also services in cloud computing. These services hardly have substitution and building another EC2 is much easier than owning so many electric resources. All these services are as important as IaaS, PaaS and SaaS and should be fully studied.

3. Cloud Business Model Characteristics

It is best to understand the fundamental cloud business model characteristics behind the applications and the cloud computing environment in which they run so that one can use them wisely [13].

3.1 The Key Characteristics of SaaS Software

- Network-based access management for commercially available software
- Activities that are managed from central locations rather than in each customer's site, enabling customers to access applications remotely via the Web
- Application delivery that typically is closer to one-to-many model (single instance, multi-tenant architecture) than to one-to-one model, including architecture, pricing, partnering, and management characteristics
- Centralized updating feature, which obviates the need for downloadable patches and upgrades
- SaaS is often used in a l arger network of communicating software - either as part of a mashup or as a plugin to a platform service. Service-oriented architecture is naturally more complex than traditional models of software deployment
- SaaS applications are generally priced on a p er-user basis, sometimes with a relatively small minimum number of users and often with additional fees for extra bandwidth and storage. SaaS revenue streams to the vendor are therefore lower initially than traditional software license fees, but are also recurring, and therefore viewed as more predictable, much like maintenance fees for licensed software

3.2 Multitenant Architecture

A multitenant architecture, in which all users and applications share a s ingle, common infrastructure and code base on that it is centrally maintained. Because SaaS vendor clients are on the same infrastructure and code base, vendors can innovate more quickly and save the valuable development time previously spent on maintaining numerous versions of outdated code.

3.3 Easy Customization

The possibility for each user to easily customize applications to fit their business processes without affecting the common infrastructure. The way SaaS is designed, these customizations are unique to each company or user and are always preserved through upgrades. That means SaaS providers can make upgrades more often, with less customer risk and much lower adoption cost.

3.4 Better Access

Web services promise universal interoperability and integration. The key to achieving this relies on the efficiency of discovering appropriate Web services and composing them to build complex processes [14]. The problem is to enhance access data from any networked device while making it easier to manage privileges, monitor data use, and ensure that everyone sees the same information at the same time.

3.5 Obtaining SaaS Applications

The vendors that supply SaaS applications will give the business owners two options for using their applications.

- Having the applications hosted on the vendor's server
- Allowing the business owner to download the application to their own devices

In many cases the business persons chooses to use the applications while they are being hosted by the vendor's server and accessed through a web browser. This reduces the amount of resources that are used on the business's equipment and allows them to access the application from anywhere whenever needed. Many companies choose to use SaaS applications because they consider the products to be a low cost alternative when compare to purchase of expensive software platforms that may have additional applications which they do not need. It will also allow the companies to avoid acquiring license with numerous different devices with all the different applications that they may need, even if the application is used only once or twice. With SaaS applications, the company has all the benefits of procuring professional software applications with commercially licensed use without incurring the high cost of owning the entire software platform and installing the platform on every device.

The enterprises will provide SaaS applications and have the ability to control and limit the use of their products, ensuring that the business owners get exactly what they have paid, while allowing the vendors to make profit from each usage of the applications that they provide. The centralized control that is exerted over the usage of the software applications ensures that the quality of the software applications will not be compromised by third parties and allows the business to limit the applications that

they are paying to the applications, that will have a significant benefit of their business.

3.6 Pricing Model

The customer share increases, once the customer is using the services. This can be achieved in many different ways, most of them related to the "pay-as-you-go" model [4]. Thus, the customer should feel that spending more really means extracting more value from the cloud features and to predict intelligence of customer next goal. The problem very often found in SaaS offerings pricing model too complex that can denial the promoted services in the market slower and harder, and reduces the customer share for buying the more expensive bundle. The SaaS enterprise has to define metrics that should be measured customer usage; they are Monthly Recurring Revenue (MRR) and Annual Subscription (AS). The primary goal behind it is to identify opportunities to drive down the cost of service delivery and that helps to build customer support to success.

3.7 Software Upgrade

The SaaS provider usually keeps all their hosted customers on the same version instead of new version. This leads to a problem of incompatibility software version and functionality. The solution is to keep track of updates. So that, the new functionality will be incremental, so users will not get left behind.

3.8 Data Security

The SaaS provider provides the network and data security because the security is not under the control of customers [16]. It is cost effective for them, since they are securing data for hundreds of paying customers. It would be less cost effective for any corporate. The security wherein storage of highly sensitive information is concerned unless SaaS providers can deliver tight integration with sensitive back-end systems that makes it impossible from a remote system to create holes in the firewall. However, a dedicated server with a copy of an application running on an Internet-connected service makes possible access for customer, but it is required that each customer's data are safe and secure. Hybrid storage clouds are often useful for archiving and backup functions, allowing local data to be replicated to a public cloud.

4. The Business Vs Operational Benefits

There are many applications already available in the cloud that allows communicators to compare the business and operational benefits in these activities.

4.1 Business Benefits

- No capital expense, just operational expense. Pay each month for usage for the server and software
- One time implementation, professional services fee and fixed monthly fee
- Upgrade/update protection - No worry about annual maintenance, hardware/software obsolescence and upgrade etc.,
- Increased focus on business - Think about what solution you need to best run your business
- Elasticity of your solution - Adjust solution as per your need each month. No need to invest based on 3/5 year plans
- Service managed using best IT management practices and highly skilled experts at a fraction of what it would cost, if one were to do it

4.2 Operational Benefits

- No need to install intelligent pieces of software on your access terminal
- Just use your browser to start managing your business
- Secure, Safe and Assured availability of server - Responsibility to backup and restore with SaaS service provider
- Assured business continuity "Start in minutes by substituting, on repair or replacement of access device - No complicated setup required"
- Industry standard API access to your data to facilitate integration with other legacy applications/services

5. Cloud Business Model Implementation

Generally SaaS architectures belonging to one of four "maturity levels", the significant attributes are configurability, multi-tenant efficiency, and scalability. Each level is distinguished from the previous one by the addition of one of those three attributes.

5.1 Level-1: Ad-Hoc/Custom

At the first level of maturity, each customer has its own customized version of the hosted application and runs its own instance of the application on the host's servers. Drifting a traditional non-networked or client-server application to this level of SaaS typically requires the least development effort and reduces operating costs by consolidating server hardware and administration.

5.2 Level-2: Configuration

The second maturity level provides greater program flexibility through configuration metadata, so that many customers can use separate instances of the same application code. This allows the vendor to meet the different needs of each customer through detailed configuration options, while simplifying maintenance and updating of a common code base.

5.3 Level-3: Configurable, Multi-Tenant- Efficient

The third maturity level adds multi-tenancy to the second level, so that a s ingle program instance serves all customers. This approach enables more efficient use of server resources without any apparent difference to the end user, but ultimately is limited in its scalability.

5.4 Level-4: Scalable, Configurable, Multi-Tenant-Efficient

At the fourth and final SaaS maturity level, scalability is added through a multitier architecture supporting a load-balanced farm of identical application instances, running on variable number of servers. The system's capacity can be increased or decreased to match demand by adding or removing servers, without the need for any further alteration of application software architecture.

Virtualization also may be used in SaaS architectures, either in addition to multi-tenancy, or in place of it. One of the principal benefits of virtualization is that it can increase the system's capacity without additional programming [2]. On the other hand, a considerable amount of programming may be required to construct a more efficient, multi-tenant application. Combining multi-tenancy and virtualization provides still greater flexibility to tune the system for optimal performance. In addition to full operating system-level virtualization, other virtualizations techniques are applied to SaaS include application virtualization and virtual appliances.
Various types of software components and frameworks may be employed in the development of SaaS applications. These tools can reduce the time to market and cost of converting a conventional on-premise software product or building and deploying a new SaaS solution. Examples include components for subscription management, grid computing software, web application frameworks, and complete SaaS platform products.

6. System Architecture

The proposed service-oriented system architecture shown in Figure 2 consists of web-based interface, node controller and cluster controller and cloud controller are discussed in detail. Service-oriented system architecture simulation can play an important role in SOA software development as it can be used to verify the SOA application models and to demonstrate runtime and collaborative behaviors of the SOA applications [15].

6.1 Web-Based Interface

The flexibility of running a SaaS powered environment makes it easy for administrators to access the application anywhere at any time whenever there's an internet connection [4]. The end users are the clients who are accessing the cloud computing system. T he user can access the system based on the pay per use procedure requirements.

6.2 Node Controller

The node controller collects data related to the resource availability and utilization on the node and reporting the data to cluster controller. It also does the Instant life cycle management work [9].

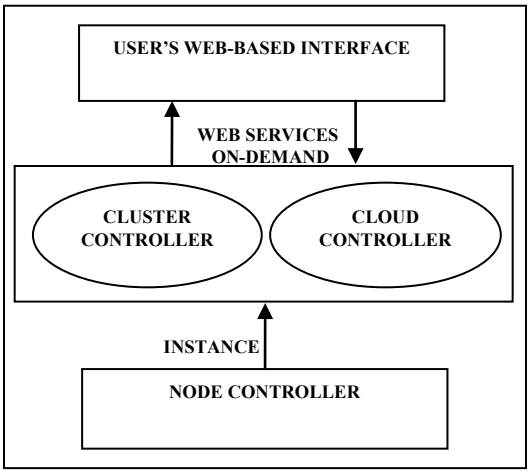

Figure 2: Service-Oriented System Architecture

6.3 Cluster Controller

The cluster controller receives the requests from cloud controller to deploy instances which node controller to use for deploying the instances on. I t controls the virtual network available to the instances and collects information about the node controller registered with it and report it to the Cloud Controller.

6.4 Cloud Controller

The cloud controller would monitor the availability of resources on various components of the cloud infrastructure, including hypervisor nodes that are used to actually provision the instances and the cluster controllers that manage the hypervisor nodes. It carries out the job of resources arbitration deciding which clusters will be used provisioning the instances and monitors the running instances.

The cloud based service-oriented architecture was designed for the SaaS provider. One does SaaS provider which supervises and controls the cloud infrastructure of storage and computing resources facilities. The Internet is the main communication backbone for exchanging information between the cloud customer and the computing cloud. The Figure 3 shows the success of one SaaS provider continuity solution start with a clear understanding of the performance in node controller and cloud controller in terms of number of request access, based on the performance can improve the business needs that the new technology architecture can support.

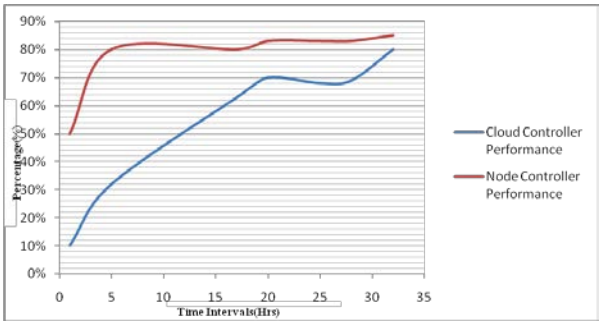

Figure 3: The graph above shows the performance of cloud in time intervals and percentage which is measured by the number of request access.

7. Conclusion

Thus Cloud Computing is one kind of emerging business accounting model which grid computation, public computation and the SaaS foundation develops. It calculates the duty to distribute on the resource pool with massive computers that will constitute and enable each kind of application system according to the need and to gain the computation strength, of the storage space and software service.

Cloud computing also refers to a network that distributes processing power, applications, and large systems among many computers. Social media channels and many other applications use cloud computing as their platform. But cloud computing goes beyond that, offering a way for people to expand their local computing power onto the (seemingly) infinite processing power of the Internet. One of the results is a changing method of communication. This paper deals with the various aspects of the cloud computing systems and also the realization of Software as a Service (SaaS) in cloud computing system. Thus, the appeal of cloud computing resides in its ability to offer creation, collaboration and portability for everyday work.

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