Cloud Computing & its Aspects

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Abstract—Cloud computing **promises to radically change the way computer applications and services are constructed, delivered, and managed. It is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. Thus, clouds promise to enable for their owners the benefits of an economy of scale and, at the same time, reduce the operating costs for many applications. For example, clouds may become for scientists an alternative to clusters, grids, and parallel production environments.**

***Keywords*— Cloud, Xpud, Windows Azure, Salesforce.com, Amazon.com**

I. Introduction

CLOUD Computing has been envisioned as the next-generation information technology (IT) architecture for enterprises, due to its long list of unprecedented advantages in the IT history: on-demand self-service, ubiquitous network access, location independent resource pooling, rapid resource elasticity, usage-based pricing and transference of risk. It will calculate the duty to distribute on the resource pool which the massive computers constitute, enables each kind of application system according to need to gain the computation strength, the storage space and all kinds of software service. This kind of resource pool is called “the cloud”. “The cloud” is virtual computation resources that can maintain and manage itself, usually for some large-scale server cluster, including calculating server, storage server, the broad band resources and so on. A quick look around shows that any company worth its salt claims to be a cloud company or at least claims to have a cloud strategy in place. The acceptance of cloud computing as a main stream technology is gaining momentum rapidly because of a strong alignment between cloud computing and the demands of an enterprise.

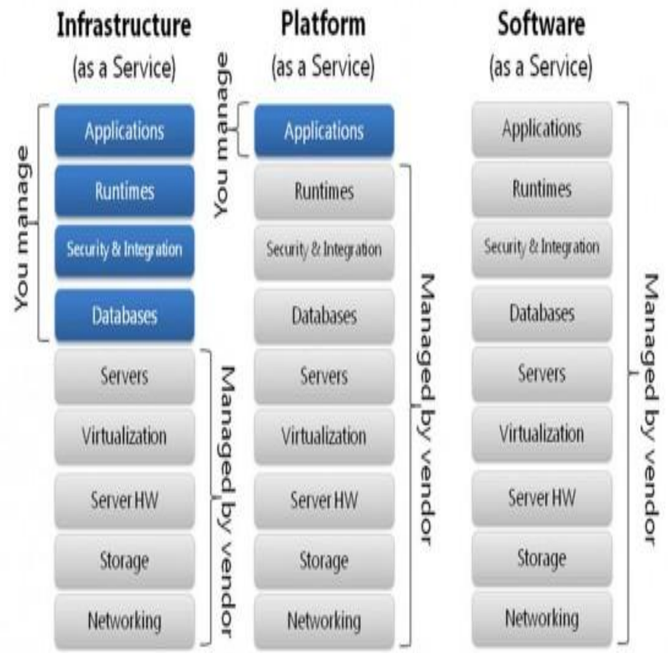
It is interesting to note that we have all been touched by cloud computing in some way or the other, irrespective of whether or not we are aware of it. Every time we access emails through applications like Gmail and Yahoo, view content on Youtube, or post on Facebook, we are making use of cloud computing. Many production clouds, including the largest publicly-accessible commercial clouds such as the Amazon Web Services and the Google App Engine, use virtualized resources to address diverse user requirements with the same set of physical resources. Virtualization can introduce performance penalties, either due of the additional middleware layer or to the interaction of workloads belonging to different virtual machines.

Our approach to cloud computing has the following key facts:

1) An operating system (OS), Windows Azure or Xpud or any other cloud based operating system that will manage the geo-distributed cloud computer. Our operating system based platform approach provides two benefits:
   a) First is cost. The OS efficiently owns and manages all the computing resources and also automates all management functions. This helps us drive the costs in data center down, both capex and opex.
   b) Second is agility. Cloud is complex environment with tens of thousands of computers operating in data centers across the globe. The OS masks the complexities by providing a rich set of abstractions that developers can use to write their own cloud applications. This allows developers to focus only on their business logic and quickly take their application to market.
2) Cloud is an extension of the on-premises IT. Cloud and IT are not an either-or option. Unlike some who believe that everything will move to the cloud, we believe customers should have the choice to decide what runs in their IT and what runs on the cloud. Many customers will continue to rely on their on-premises IT for some class of applications. For example, some data has to be kept on-premises due to issues like compliance, security and privacy. Applications that require special hardware or have special connectivity and bandwidth requirements for performance reasons will continue to be on-premises. At the same time there are many workloads that will benefit from cloud. So, rather than forcing customers to pick cloud or IT and let the customers decide what to run where.
3) Developer’s existing skills transfer to cloud. For Ex. On Windows Azure, we can use the same Windows programming model and the same development tools still work on cloud.

II. THE CLOUD ARCHITECTURE

It is generally supposed that there are three basic types of cloud computing: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS).



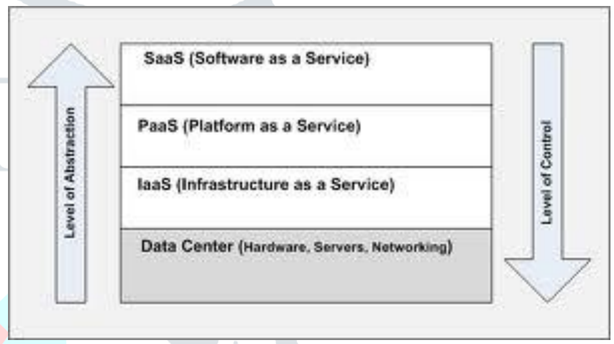
In IaaS, cpu, grids or clusters, virtualized servers, memory, networks, storage and systems software are delivered as a service. Perhaps the best known example is Amazon's Elastic Compute Cloud (EC2) and Simple Storage Service (S3), but traditional IT vendors such as IBM, and telecoms providers such as AT&T and Verizon are also offering solutions. Services are typically charged by usage and can be scaled dynamically, i.e. capacity can be increased or decreased more or less on demand.

PaaS provides virtualized servers on which users can run applications, or develop new ones, without having to worry about maintaining the operating systems, server hardware, load balancing or computing capacity. Well known examples include Microsoft's Azure and Salesforce's Force.com. Microsoft Azure provides database and platform services starting at $0.12 per hour for compute infrastructure; $0.15 per gigabyte for storage; and $0.10 per 10,000 transactions. For SQL Azure, a cloud database, Microsoft is charging $9.99 for a Web Edition, which comprises up to a 1 gigabyte relational database; and $99.99 for a Business Edition, which holds up to a 10 gigabyte relational database. For .NET Services, a set of Web-based developer tools for building cloud-based applications, Microsoft is charging $0.15 per 100,000 message operations.

SaaS is software that is developed and hosted by the SaaS vendor and which the end user accesses over the Internet. Unlike traditional applications that users install on their computers or servers, SaaS software is owned by the vendor and runs on computers in the vendor's data center (or a collocation facility). Broadly speaking, all customers of a SaaS vendor use the same software: these are one-size-fits-all solutions. Well known examples are Salesforce.com, Google's Gmail and Apps, instant messaging from AOL, Yahoo and Google, and Voice-over Internet Protocol (VoIP) from Vonage and Skype.

A. Functionality

Hardware as a Service. Hardware as a service was coined possibly in 2006. As the result of rapid advances in hardware virtualization, IT automation, and usage metering and pricing, users could buy IT hardware - or even an entire data center as a pay-as-you-go subscription service. The HaaS is flexible, scalable and manageable to meet your needs



Data as a service. Data in various formats and from various sources could be accessed via services by users on the network, in a transparent, logical or semantic way. Users could, for example, manipulate remote data just like operate on a local disk or access data in a semantic way in the Internet.

III. PRONS AND CONS OF CLOUD COMPUTING

The great advantage of cloud computing is "elasticity": the ability to add capacity or applications almost at a moment's notice. Companies buy exactly the amount of storage, computing power, security and other IT functions that they need from specialists in data-center computing. They get sophisticated data center services on demand, in only the amount they need and can pay for, at service levels set with the vendor, with capabilities that can be added or subtracted at will.

The metered cost, pay-as-you-go approach appeals to small- and medium-sized enterprises; little or no capital investment and maintenance cost is needed. IT is remotely managed and maintained, typically for a monthly fee, and the company can let go of "plumbing concerns". Since the vendor has many customers, it can lower the per-unit cost to each customer. Larger companies may find it easier to manage collaborations in the cloud, rather than having to make holes in their firewalls for contract research organizations. SaaS deployments usually take less time than in-house ones, upgrades are easier, and users are always using the most recent version of the application. There may be fewer bugs because having only one version of the software reduces complexity.

This may all sound very appealing but there are downsides. In the cloud you may not have the kind of control over your data or the performance of your applications that you need, or the ability to audit or change the processes and policies under which users must work. Different parts of an application might be in many places in the cloud. Complying with federal regulations such a Sarbanes Oxley, or FDA audit, is extremely difficult. Monitoring and maintenance tools are immature. It is hard to get metrics out of the cloud and general management of the work is not simple.3 There *are* systems management tools for the cloud environment but they may not integrate with existing system management tools, so you are likely to need two systems. Nevertheless, cloud computing may provide enough benefits to compensate for the inconvenience of two tools.
Cloud customers may risk losing data by having them locked into proprietary formats and may lose control of data because tools to see who is using them or who can view them are inadequate. Data loss is a real risk. In October 2009 1 million US users of the T-Mobile Sidekick mobile phone and emailing device lost data as a result of server failure at Danger, a company acquired by Microsoft.

Cloud computing is not risky for *every* system. Potential users need to evaluate security measures such as firewalls, and encryption techniques and make sure that they will have access to data and the software or source code if the service provider goes out of business.

Cisco, EMC and VMware have formed a new venture called Acadia. Its strategy for private cloud computing is based on Cisco's servers and networking, VMware's server virtualization and EMC's storage.

IV. APPLICABILITY

Not everyone agrees, but McKinsey has concluded as follows. "Clouds already make sense for many small and medium-size businesses, but technical, operational and financial hurdles will need to be overcome before clouds will be used extensively by large public and private enterprises. Rather than create unrealizable expectations for "internal clouds", CIOs should focus now on the immediate benefits of virtualizing server storage, network operations, and other critical building blocks". They recommend that users should develop an overall strategy based on solid business cases not "cloud for the sake of cloud"; use modular design in all new software to minimize costs when it comes time to migrate to the cloud; and set up a Cloud CIO Council to advise industry.

V. SERVER VIRTUALIZATION

Server virtualization is very effective at increasing utilization rates. If you can go from a model with one application per server to a model with 10 or 15 applications on the same compute node, you get much higher utilization. You can scale from utilization rates around 15 to 20 percent all the way into the 80 or 90 percent range. That results in less infrastructure, lower power consumption, and lower cooling requirements.

"One way to think about it is to consider application workloads within the data center infrastructure. The new atomic unit of work is the virtual machine, because it enables business processes to be encapsulated and mobilized across multiple computing nodes to wherever resources are needed. In a generalized sense, our approach must consists of three core sets of capabilities for virtualized environments.

The first one is to provide quality of service to virtual machines that is consistent.

The second one is to provide persistence of connectivity so that when a virtual machine moves between compute nodes, the connections and resources within the network will automatically follow the virtual machine to its new compute location.

And the third objective is to provide tools for monitoring the performance levels being delivered and reporting back to end users so they can be sure they're actually receiving what they're paying for.

VI. SECURITY

From the perspective of data security, which has always been an important aspect of quality of service, Cloud Computing inevitably poses new challenging security threats for number of reasons. Firstly, traditional cryptographic primitives for the purpose of data security protection cannot be directly adopted due to the users' loss control of data under Cloud Computing. Therefore, verification of correct data storage in the cloud must be conducted without explicit knowledge of the whole data. Considering various kinds of data for each user stored in the cloud and the demand of long term continuous assurance of their data safety, the problem of verifying correctness of data storage in the cloud becomes even more challenging. Secondly, Cloud Computing is not just a third party data warehouse. The data stored in the cloud may be frequently updated by the users, including insertion, deletion, modification, appending, reordering, etc. To ensure storage correctness under dynamic data update is hence of paramount importance. However, this dynamic feature also makes traditional integrity insurance techniques futile and entails new solutions. Last but not the least, the deployment of Cloud Computing is powered by data centers running in a simultaneous, cooperated and distributed manner. Individual user's data is redundantly stored in multiple physical locations to further reduce the data integrity threats. Therefore, distributed protocols for storage correctness assurance will be of most importance in achieving a robust and secure cloud data storage system in the real world. However, such important area remains to be fully explored in the literature.

VII. Impact of Cloud Computing on Resarch Infrastructure

The common notion of a research infrastructure is often restricted to the hardware component. The software infrastructure is neglected. The hardware must be provided by experts to achieve efficiency and to control expenses. The interface between researchers and (hardware) infrastructure experts is not always clearly defined and may produce inefficiencies.

VIII. Cloud Storage

A central challenge of cloud computing is providing scalable, secure, self-managing, and fault-tolerant data storage for long-running services. What data models are supported by existing cloud-based storage systems? What are the technical trade-offs between the key-value stores commonly provided and relational databases? How do application developers choose a particular storage system? How does one design cloud-based storage systems to ensure that a user's data survives for 100 years, even as companies come and go?

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When a company considers outsourcing all or part of its IT infrastructure, one frequent concern is the loss of visibility of that particular technology. Customers need the ability to understand the state of their environment from both a capacity and performance perspective. To address this concern, robust storage reporting through a customer portal is needed to instill confidence that storage is operating effectively.

Storage-related reporting in the mass market cloud has been fairly basic up to this point. Most vendors provide standard reports on usage; in some cases they also provide some basic performance stats are available — either from the provider, or via shareware or third-party tools.

The enterprise cloud has some advantages over traditional enterprise storage in that the infrastructure usually lends itself to a single storage vendor solution. This makes reporting more straightforward, since data from multiple vendor platforms doesn't have to be translated to produce a report with a single look and feel. Detailed information on historical and real-time usage, along with a few key performance indicators — both historical and real-time — should be visible 24/7 via the customer portal. Ultimately, to allay enterprises' fear of loss of control, the cloud provider should enable the most comprehensive and accurate reporting capabilities possible and make visibility into the storage system utterly transparent.

IX. Conclusion

The Cloud Computing is one kind of emerging business accounting model which in the grid computation, the public Computation and the SaaS foundation develops. It will calculate the duty to distribute on the resource pool which the massive computers will constitute, will enable each kind of application system according to need to gain the Computation strength, the storage space and each kind of software service. This article introduced the Cloud Computing evolution process, has analyzed the Cloud Computing essence, its architecture, pros & cons, applicability, server virtualization, security, storage. In the current economic climate where the expectations of efficiencies and cost savings are growing from IT organizations, enterprise private clouds provide a good opportunity to get started with cloud computing and reap the associated benefits of agility, cost savings and on-demand services while meeting the stringent enterprise security, performance and reliability requirements.

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