How Virtualization Enabled Cloud Computing Technology

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'Virtualization' and the 'Cloud' are two terms that dominate information technology these days, and unless you work in the field, you may not understand just what is meant by them. These are two of the hottest topics in information technology today, and have not only taken the industry by storm, but they continue to enable businesses to become more and more efficient, adopting along the way many of the same concepts used decades ago.

In the beginning of the computer era from the 1940's through the 1970's, computers were very big and very expensive; some were as big as rooms and cost several millions of dollars. This led to what they called 'time-share' systems, where companies who couldn't afford to spend millions of dollars on computers could instead rent computer time for hundreds or thousands of dollars, so you would have one big computer running computer programs for many different companies who had a terminal connected to these big mainframes over phone lines. This was originally accomplished by running each program sequentially for each client. As these 'mainframe' computers became more powerful and their operating systems became more sophisticated, techniques were devised to logically 'partition' the operating system, allowing multiple clients to run programs simultaneously without interfering with any other client. These 'logical partitions' (known as LPARS) are the direct forerunner of what has come to be known as 'Virtualization' (Dimitrios Zissis 3).

As the personal computer revolution took off, and computers continued to become more powerful, less expensive and able to fit on or underneath a desk, 'distributed computing' became the watchword of the industry, and empowered individual users to use database and spreadsheet programs (among others) to recreate the work that formerly had to be done on a mainframe computer at much higher cost. The explosion of the use of personal computers from the mid-

1970's through the 1990's however created problems of a different sort for companies with large numbers of personal computer users, namely the increased energy costs required to run them, the increase in personnel costs required to manage and maintain them, and the increase in security risks due to so many people having access to corporate data.

'Virtualization' suddenly burst onto the scene to help solve all three of these issues, although the concept stemmed from decades earlier. As personal computers became more and more powerful, the software running on them needed less and less of the computers' resources, and so a method was devised to create what was now called a 'virtual machine' that would run within the operating system of a physical computer, sharing the resources but behaving as a totally separate computer. Virtualization software became increasingly sophisticated to where today a single (albeit well-appointed) computer can host dozens or hundreds of virtual machines (Dimitrios Zissis 3).

Virtualization technology, along with the increasing ubiquity of the Internet, emboldened people to start talking up this great new concept – 'Cloud Computing', which at its essence is virtualized servers in a data center running software and providing services, connected to over the Internet. Cloud Computing has been labeled as significant a development as the development of the national electrical grid: "When companies were freed from having to create their own electricity, they were able to focus on the core competencies of their line of business and the needs of their customers. Likewise, cloud computing liberates IT organizations from having to devote precious people and budget to activities which don't directly contribute to their bottom line, while still enabling them to obtain the necessary infrastructure functionality to continue to run their businesses" (Amazon Web Services).

Today, there are many flavors of Cloud Computing, but generally the fall into one of three categories, Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) or Software-as-a-Service (SaaS). SaaS is probably what most consumers are familiar with, whether or not they recognize the term. “The service delivered is the use of software at the supplier’s remote site.” (Bragonier 3) Some of the most popular SaaS products are Hotmail, Gmail and Google Maps. Platform-as-a-Service provides a more sophisticated and customizable environment to the user, often allowing you to modify the appearance of the user interface, but not the underlying computers or operating systems (Ibid). Some examples of PaaS include MySpace, Facebook, Blogger and many web hosting providers like GoDaddy and RackSpace. Infrastructure-as-a-Service provides “servers, operating systems, applications, databases” and allows the user to control “all aspects of the infrastructure” (Ibid). IaaS providers include Amazon Web Services and Infocrossing.

The most successful of all Cloud Computing projects thus far, and the one to which almost all other cloud computing initiatives are measured against has been Amazon’s EC2, also known as the Elastic Compute Cloud. EC2 allows you to rent a virtual computer by the hour, as many as you need and as often as you need then, hence the term ‘elastic’. EC2 grew out of Amazon’s experience and investment in large-scale IT infrastructure (Amazon Web Services 3). Today, EC2 enables users to ‘spin-up’ a virtual instance of Linux, Windows Server, and several other operating systems, and utilize your own software or predefined packages including databases, web servers and disk storage. EC2, along with other cloud offerings from other vendors, isn’t trouble-free. It relies on the Internet for access, which can be subject to an errant backhoe digging up a fiber optic communication circuit, a poorly-planned router software upgrade or even sun spot activity for wireless users. Amazon’s EC2 was down for many

customers in April, 2011 for several days, prompting Matthew Eastwood, a research firm analyst to say “This is a wake-up call for cloud computing” (Lohr). Even still, cloud computing continues to grow more popular. Customers have options available to reduce the risk of placing all of their eggs in one virtual basket. Many providers, including Amazon, have redundancy options, which allow the customer to decide which datacenters, and how many their services are provided from.

Cloud technology and its use of virtualization is an often misunderstood or even foreign concept to many people, even those who regularly use computers. It may be helpful to understand that cloud computing really isn’t a new technology at all, rather newer technologies have enable cloud computing to become not only more powerful, but more useful as well. The term ‘cloud’ is often thrown out into the vernacular without providing any context, leading many people to assume there is one all-encompassing, Matrix-like cloud, when in reality, what cloud technology is, is in the eyes of the beholder, and in essence not so very different from where this all began, although the capabilities are far greater than could have been imagined in the 1960’s and 1970’s.

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