


# Cloud Computing - The Complete Cornerstone Guide to Cloud Computing Best Practices



Concepts, Terms, and Techniques for  
Successfully Planning, Implementing and  
Managing Enterprise IT  
Cloud Computing Technology



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**service**

# A Complete Guide to Cloud Computing

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# Table of Contents

- 1 Introduction .....6**
  - 1.1 *What is Cloud Computing?* ..... 6
  - 1.2 *The Idea Behind Cloud Computing* ..... 7
  - 1.3 *Key Characteristics of Cloud Computing*..... 9
  - 1.4 *What Cloud Computing Really Is* ..... 12
  - 1.5 *Major Goals of Cloud Computing* ..... 14
  - 1.6 *Brief History of Cloud Computing* ..... 17
  
- 2 Common Terminology .....22**
  
- 3 Companies involved in Cloud Computing .....30**
  - 3.1 *Insightful Solutions* ..... 31
  - 3.2 *Salesforce.com*..... 34
  - 3.3 *Facebook* ..... 36
  - 3.4 *Joyent* ..... 37
  - 3.5 *Mosso* ..... 37
  - 3.6 *Amazon*..... 38
  - 3.7 *IBM* ..... 39
  - 3.8 *Microsoft* ..... 41
  - 3.9 *Yahoo*..... 43
  - 3.10 *Google*..... 44
  - 3.11 *Oracle*..... 46
  - 3.12 *EMC*..... 47
  - 3.13 *Sun Microsystems* ..... 48
  
- 4 Why Cloud Computing? .....50**

- 5 Benefits of Cloud Computing .....54**
- 6 Cloud Computing Drawbacks.....58**
  - 6.1 *Dependability* ..... 58
  - 6.2 *Security*..... 59
  - 6.3 *Little or no Reference*..... 60
- 7 Cloud Computing Technologies .....62**
- 8 Architecture Requirements .....64**
- 9 Major Components to Cloud Computing .....66**
  - 9.1 *Application*..... 66
  - 9.2 *Client*..... 66
  - 9.3 *Infrastructure*..... 67
  - 9.4 *Platform*..... 68
  - 9.5 *Service* ..... 69
  - 9.6 *Storage* ..... 70
  - 9.7 *Processing Power*..... 71
- 10 Migration from Standard Environment to Cloud Computing .....73**
  - 10.1 *Migration Guide*..... 77
  - 10.2 *Top Tech Trends to do with Cloud Computing* ..... 83
  - 10.3 *Top Tech Trends against Cloud Computing* ..... 101
- 11 Cloud Computing Issues .....113**
  - 11.1 *Support Issues*..... 113
  - 11.2 *Capacity Issues*..... 116
  - 11.3 *Considerations of Security* ..... 120
- 12 Contracts and Agreements .....129**
  - 12.1 *Outages*..... 129

A Complete Guide to Cloud Computing

- 12.2 *Server failures* ..... 130
- 12.3 *Elastic IP Address* ..... 131
- 12.4 *Amazon Machine Images (AMI)* ..... 132
- 12.5 *Peer-to-Peer* ..... 133
- 13 Cloud Computing – Hype or the Next Big Thing .....137**
  - 13.1 *Hype* ..... 137
  - 13.2 *Technology Media* ..... 138
  - 13.3 *Cloud Computing and Maturity* ..... 139
- 14 Financial Benefits and Pitfalls Around Cloud Computing .....141**
  - 14.1 *Benefits* ..... 141
  - 14.2 *Enterprise Resource Planning* ..... 142
  - 14.3 *Open Standards* ..... 143
  - 14.4 *Terms and Conditions* ..... 145
- 15 Cloud Computing for SMEs .....149**
  - 15.1 *Case Study*..... 150
- 16 Legal Implications .....155**
  - 16.1 *The Legal Implications of Google on the Cloud*..... 155
  - 16.2 *Territorial Issues* ..... 157
  - 16.3 *Policy*..... 158
  - 16.4 *Average Users and Legal Issues*..... 159
  - 16.5 *Contract Issues*..... 160
  - 16.6 *Protection of Privacy*..... 161
  - 16.7 *Data Segregation & Recovery*..... 163
- 17 References.....165**

# 1 Introduction

## 1.1 What is Cloud Computing?

Cloud computing can be defined as the use of computer technology that harnesses the processing power of many inter-networked computers while concealing the structure that is behind it.

This is what creates the backbone of the networks that we access today. While this technology has been around for some time, the way that people within IT organizations view cloud computing has changed because of the flexibility it can now give them through providing services and applications for users to apply it in what is known as the back office.

The origins of the term “cloud” can be traced to the concealing nature of this technology’s framework; the system works for users yet they really have no idea the inherent complexities that the system utilizes. What they do not realize is that there is a massive amount of data being pushed globally in real time to make these applications work for them, the scale of which is simply amazing.

The idea of connecting to the cloud in fact is something of a familiar notion among technologists today because it has

become a popular buzzword among the technology media. The only thing users need to be concerned about is the terminal that they are using and whether or not it is connected to the internet so that they can have access to the tools that the cloud can provide.

Unknown to many people is that much of the structure in the information technology industry today is now done within a cloud computing environment or is moving towards that end. A slow migration towards this has been going on for several years, mainly due to the infrastructure and support costs that go into standalone hardware.

It is also due to the economies of scale in larger data centers providing enhanced performance and processing power. This can be attributed as well to the shift of emerging technologies on the internet towards vast amounts of data that need to be mined, parsed and organized for users to easily understand.

## ***1.2 The Idea Behind Cloud Computing***

The major benefit of the concept behind cloud computing is that the average user does not require a computer that is extremely powerful to handle complex database indexing tasks that server farms can.

Instead, with the use of broadband, users can easily connect to the cloud, which would commonly be referred to as the point of contact with the larger network. With this



point of contact, cloud computing users from all across the world can reap the benefits of enormous processing power without major capital or technical know-how.

While this concept was explored in the mainframe days of the 1960s, it was not until huge infrastructure investments in broadband were made in the late 1990s that cloud computing as it is utilized today could become possible.

The heavy consumption of bandwidth that encompasses the internet of today is what makes the technology work, as previously networks were much less dynamic due to slow upload and download speeds that were available at the time.

The global economy has made a large shift and as opposed to being manufacturing based, an era of information is now prevalent. Information will someday itself become a commodity just like manufactured goods are today, and a server farm could be thought of as the modern equivalent of a factory.

This new “factory” is the engine behind information growth driving data processing and capacity to become less of a factor in terms of cost. It’s an idea that is being explored, and these new data centers that are being constructed are just like factories, with information becoming the commodity of the future.

Another major factor that changed the landscape was the

idea that multitudes of cheap computer hardware could be harnessed to create a vastly networked data center just as good as a smaller amount of more expensive, higher quality server hardware.

While it was once the conventional wisdom that expensive servers stood less risk of failure, when you have thousands of low cost servers employed in a data center the chance of an outage of service to users is just as diminished as the latter option.

Having this much power in terms of data capability creates a flexibility in information that has never before been seen until today. The largest technology companies currently are capturing this concept and making available information that can help make our lives easier and more convenient. For companies, it helps them to become more efficient and profitable.

### ***1.3 Key Characteristics of Cloud Computing***

The most important element in play for cloud computing is the server structure. This plays a major role as it is the brains behind the entire processing environment. For cloud computing the hardware in the server environment does not necessarily need to be high end.

Rather, the key benefit of this technology is the ability for an organization to harness the power of cheap hardware on a

larger scale as opposed to using a smaller amount of servers that are higher grade in quality.

It is helpful for the global organization to have cloud computing capabilities because it allows all of their users to have access to information from any computer when needed, which can help prevent lost data or bad organization of digital files. This makes an organization have true portability, and can allow for better data security if all the information can be stored on the cloud away from potentially prying eyes.

It also can help break down the command structure in an organization into many nodes located across the globe, which is an organizational style that is becoming quite popular as businesses are trying to integrate globally and have more flexibility at the same time.

The fact that all of the information for a client is hosted in one physical site also allows for hardware and software to be managed more efficiently by a specialized on-site team who can then take care of managed specifics; for example, the updating of hardware and software. In effect, this process is much more seamless because there are no outages required in the cloud. Only portions of processing power are down, and the average user would have no idea that anything was going on, nor would they care.

Along those lines is that this managed-care of the technology hardware is something that companies are

looking for in a cloud computing solution because it is simply cheaper for them to have someone else take care of managing the technology so that they can focus on their business. Again, it is almost to the effect that processing power will someday become another commodity.

The big factor companies are thinking about is the economies of scale for a system. What this means is that they realize that someone who hosts a bigger server operation is going to do it faster and more efficiently than they would be able to themselves. As their business becomes bigger and more complex, the “cloud” will need to become bigger and the system, using economies of scale, will become bigger without the company in question even knowing about it or having to deal with it.

There are many issues that are no longer part of the business’ problems when outsourcing the processing work to a server farm including issues with having to provide space for equipment, costs associated with hiring technicians and providing them with benefits. For many companies, this may be unnecessary overhead that can be avoided.

These server farms require a lot of power. As such they are usually located near power plants or near large sources of hydroelectric power. Along with needing a lot of space and energy, they need a large cooling solution to keep the machines running at an optimal temperature. They also need to have solid backbone access to the internet so that

data can flow freely all over the world to the users.

Data center managers are increasingly concerned with power efficiency within the server environment. One of their major management issues is to make sure that costs remain affordable, especially in the past couple of years with concerns about energy security.

One of the major problems leading to inefficiency of data center environments has to do with air conditioning. Often the heavy use of air conditioning in a server environment can cause more problems because blowing cold air around often does not solve the problem and wastes more energy than it is able to conserve.

## ***1.4 What Cloud Computing Really Is***

In simplistic terms, cloud computing can be broken down to a browser based application that is hosted on a remote server. To the average user, that is all he or she really needs to know about cloud computing. But there is a lot more to it than just that. What cloud computing really represents is huge: it's a way for small organizations to compete with much larger ones, it's a way to save a lot of money and it's a way to utilize energy efficiency in operations.

Cloud computing as it relates to Internet technology is all around us. When we access our email, when we search for information, we are using the power of processing technology that exists at a distant location without us

knowing about it. In fact, even the most basic computer applications require a network connection these days to do simple tasks. As an example, the thesaurus function within Microsoft Word requires a network connection to look up alternative words.

In effect, the cloud provides networked users with an extension of their own machine. As long as a user is connected to the internet, the power of cloud computing comes into play and many benefits can be reaped. One example would be processing power. Applications can be run on the fly from a terminal machine when processing power is not a concern; the only thing that users need to worry about would be their bandwidth connection and its reliability on the network.

One of the biggest benefits would be storage. Server farms possess massive amounts of storage. An example of this would be the free email services that are available on the web. Often times these email services offer a large amount of storage to their users because it is cheap for them to do so by using the available space that is in the cloud.

This is a characteristic that is to be noted, because the prevalence of cheap storage on server farms will benefit users immensely in the future. One major benefit of this is data loss prevention. With the cloud managing data across a multitude of networked computers the chance of data loss becomes less likely and is indeed a feature that cloud computing companies tout to their potential clients.

A lot has been said in the past few years with large companies such as banks losing important customer information. If this information had theoretically been stored in a cloud environment, the likelihood of lost data would be much smaller.

## **1.5 Major Goals of Cloud Computing**

All companies want to be able to save money on operational costs. Usage of cloud technology can help this issue by taking huge capital investments out of the equation.

With the pace of technological change it is beneficial to let a server farm take care of processing needs for smaller companies instead of trying to do everything in house. Many companies see this as a major goal when considering the use of cloud computing; however there are other motivations as well.

Many of the largest companies that have cloud computing services available to their customers have in place service level agreements. For those unfamiliar with service level agreements, also know as SLAs, what this entails is a binding contract whereupon service companies agree on a specified level of service or uptime.

An SLA gives potential customers the confidence for them to use cloud computing services over what may be a long standing tradition for an organization to have their IT

services hosted in-house.

The major role of a system administrator is to make sure that uptime is constant. Usage of cloud technology can help administrators achieve this because of the redundancy of cloud computing. However, a bigger issue may lie in the event of a disaster recovery or backup failure issue. Most server farms are located in a well planned and secure location but one cannot be too careful to ponder the fact that something could always go wrong. The possibility is always out there to consider.

Most SLAs promote an uptime level of 99.999% but cannot always provide for data redundancy to be at that level. This is something that many administrators must look out for. Although the cloud may always be online, the data necessarily may not be if something were to go wrong somewhere.

Although the chances of this are slim, it can indeed occur. Many administrators do realize this as an issue. So while it may be a major goal for the purveyors of cloud computing to offer SLAs with defined uptime it cannot always be true that the data will be “up”.

Administrators would be keen to advise their CIO or supervisor that this may become an issue. In fact, the problem itself could be solved by simply making sure that data integrity is written into the SLA agreement itself to prevent any kind of confusion that may ensue if there were to be some type of data loss or downtime.



Another goal that cloud technology avails to its users is combined processing power. Instead of users having to always be concerned with updating the hardware on their machines it is easier to just pay someone else to do it. The average user does not care about the technical specifications of their computer.

What they are mostly concerned about is getting their work done and not having computer problems in the process of doing so. It is much easier to manage this for people that having to deal with technical questions that are repetitive and unimportant from a technical perspective.

Another sought out goal for the cloud computing movement would be the ability for users to utilize collaboration tools. There is software out there today that makes it appear to people that they are using standalone software when in fact they are using cloud software that can be configured and changed on the fly. Users from all over the world are able to make modifications to documents and pictures.

This allows for files themselves to become like living things for their users. People are able to get more done using software like this as it will increase productivity. Using this method, projects can be worked on in real time with several people all at once. The best part is that when files are saved it is done on the cloud where it is stored for safekeeping.

The price of energy has increased a large degree with the

fast pace of globalization. As such, cloud computing can also achieve the goal for organizations to have energy efficiency. It is more efficient for power hungry servers to all be in one location so that data center managers can better optimize them using power saving procedures.

This can be done through a variety of methods which could include having servers in a timed power saving mode to reduce power usage to even being located near a renewable energy source.

## ***1.6 Brief History of Cloud Computing***

The concept of cloud computing is not new. In fact, much of what we do on our computers today requires it. What is changing is the way that we look at what cloud computing can actually do for us today. The power and scale of the cloud has changed immensely from what it was in the beginning.

Over time as the technology and business environments had progressed, the status quo of cloud computing has changed. What was known as cloud computing long ago was the same in principle, but the uses in information today have changed by an immense degree.

But there is no doubt that this type of processing power is indeed becoming more prevalent by larger companies that have an almost unquenchable thirst for the ability to process tasks such as crunching numbers and providing

users with Web 2.0 functionality. More and more information is out there in the digital realm and there is so much of it that needs to be organized in ways that we can fully understand it and use to our advantage.

The beginning of what is known as the concept of cloud computing can be traced back to the mainframe days of the 1960s when the idea of “utility computing” was coined by MIT computer scientist and Turing award winner John McCarthy. Utility computing ended up becoming something of a big business for companies such as IBM. The concept was simple: that computing power could be broken down as a metered service for businesses much like how the power and telephone companies operated for their customers.

Indeed, it was an article “The Computers of Tomorrow” for the Atlantic Monthly in May of 1964 where author Martin Greenberger pointed out the concept that “advanced arithmetical machines of the future” were now being used not only institutionally for scientific calculation and research but for business functions such as accounting and inventory. He envisioned in his piece a future in which computers would be universal almost like the major power companies running wires everywhere in due time.

The “information utility” would soon rise, but the question was, would it become regulated like the power industry or be a private entity in and of itself? IBM of course, saw the potential for enormous profit to be made in this type of

business and took the reigns in providing computing services to companies for top dollar.

What IBM was providing with utility computing could be referred to almost as server rental in allowing, for a fee, large organizations (such as banks for example) access to computing power from their gigantic mainframes; often too expensive, large and complicated for most businesses to acquire and operate on their own.

Of course, once the personal computer became ubiquitous the concept of utility computing came to be known as more of an operational extravagance that most companies did not need. This was also coupled with the fact that computers were becoming affordable and small along with being relatively easy to operate.

There was another component to the idea of utility computing that allowed interest to wane during the rise of the personal computer. The technical limitations on bandwidth as well as disk space were a huge constraint on what could have been. The infrastructure for this type of technology was simply not in place as of yet for cloud computation to take the limelight, although the use of rented mainframe processing still proved to be profitable for quite some time.

It was in the late 1990s that companies such as Sun Microsystems began touting what seemed at the time the marketing concept that “the network is the computer”. Or the idea that Oracle founder Larry Ellison (who later

invested in Salesforce.com) had for terminal machines that would cost less than \$300. These ideas were indeed profound, but they never really took off as consumers were looking for more complete personal computer solutions that had, for example, some storage capacity available.

The personal computer as we understand it today is no dummy terminal. In fact, the rise of the Internet beginning in the mid-90s changed how computers could be used and how information could be disseminated. With the idea of utility computing long gone, companies such as Amazon began to harness the power of server farms to offer a gaggle of products to would-be buyers.

In fact, despite popular belief, Amazon is far from being a company that specializes in retail. Its contributions to cloud computing will be discussed later in a profile of companies using cloud technology, but it is clear to any IT professional that Amazon is first and foremost a company built on the foundations of technical innovation beginning especially after the dot-com bubble era.

Interestingly, the motives behind most dot-com companies at that time were not based on profit but on traffic. Traffic was mistakenly seen at the time as some kind of cash flow to investors of dot-com companies.

This in turn led to a lot of investment into infrastructure. That included fiber optic backbones and building up what was known as the “last mile”, the final distances that were

in people's homes and hopefully to these dot-com companies, ultimately their wallets.

The idea of indexing the internet and the rise of first Yahoo, and then Google, has shown us how plugging in to a vast network of knowledge was somewhat of a precursor to the interactivity that we can enjoy today with cloud computing. But search was really where the first version of cloud computing as we know it began.

Whether it is for business or just for fun, these search engines were the dawn of the organization of vast amounts of information that existed on servers around the world. Although today the concept of search engines seem very basic it took many years before the founders of Yahoo came up with a way to easily navigate the Internet.

But Yahoo was the tip of the iceberg, as soon the Google founders, Sergey Brin and Larry Page, found a faster and better way to index the Internet. Before long even Yahoo was licensing the technology for a time before Google went public.

The rise of Google brought a massive investment in huge server farms which would then lead to the vast array of applications and Web 2.0 features that Google now offers as a titan of the industry, probably the cornerstone of what cloud computing is today and leaving software and network companies such as Novell and Microsoft in the dust trying to find their way.

## 2 Common Terminology

There are several terms that are frequently associated with cloud computing technology, including Web 2.0, on demand computing and software as a service. Increasingly technology companies are finding that the use of cloud computing technology is of great benefit to customers, as it rids users of intricacies that potentially could be problematic and befuddling.

| <i>Term</i> | <i>Definition</i> |
|-------------|-------------------|
|-------------|-------------------|

**Back Office** Making technology easier for customers saves companies money, by taking the technical issues out of the equation so that businesses can focus their energy on creating a superior product or service. This is commonly known as back office tasks, generally rudimentary data parsing procedures that are time consuming as well as tedious.

An example of a back office service that is out today is Amazon's Web Services platform. The customers that Amazon is

targeting would be the small programming shop that needs to have a powerful server platform from which to try out its services. Of course, Amazon will be a big winner if the application actually takes off because it means more processing power will be required.

## **Web 2.0**

Web 2.0 cloud computing is a blanket term, but it is usually associated with some type of social networking technology – that is, a large number of social users that are interconnected via their relations with the people and things they find interesting. The impact of social networking on cloud computing technology is now beginning to show its true colors as this is an innovation that piques the interests of the general computer user.

One of the biggest Web 2.0 companies today is Facebook. Started as an electronic yearbook for college students, Facebook is now open to anyone and offers a way to connect with people across long distances. It offers some interesting user generated applications as well as some recently implemented instant messaging functions that look very promising.



**On-Demand Computing** On demand computing is a business terminology and would refer to back office processing power, for example a remote data processing center that processes payroll functions for a company located thousands of miles away. Many back office functions are performed in this manner, using the prevalence of cheap and reliable bandwidth to push data around.

This type of model was created to overcome the challenge to enterprises in being able to meet fluctuating demands. Because a business's demand on computing resources can vary dramatically from one period of time to another, maintaining sufficient resources to meet peak-time usage requirements can be expensive. If the business cuts costs by only maintaining minimal computing resources, there will not be enough resources to meet the requirements.

**Software as a Service** Software as a service or software as a server (SaaS) is somewhat in between the previous two terms in the respect that social business functions such as a sales department that has to know its customers, for example, would use this type of term. Software as a

service is set to become the preeminent way to provide technology solutions to organizations within the coming years.

A good example of a SaaS product would be online email. At face value, services such as Google's Gmail do not appear to be full blown cloud computing in that it does not take a lot of infrastructure to host an email account. However, Google offers its users a huge amount of storage space online which would not be available without the use of its massive network of server farms.

**Platform as a Service**

Platform as a service (PaaS) refers to renting server technology in order to use its development capabilities. Many small tech companies need a platform from which to process their customized code. Platform as a service offers these organizations the ability to do this all while saving huge amounts of money that would otherwise be wasted on hardware resources.

Salesforce's Force.com is an example. What the service does is take away the entire infrastructure and allows for its customers to simply worry about developing applications for business needs. Although many

customers use the company's customer relationship management software, known as Salesforce.com, with Force.com customers are able to expand that capability over to other parts of their business such as accounting and enterprise resources.

**Thin Client** A thin client would be a term used for a terminal that connects to the cloud. This could be a computer, a cell phone or even an mp3 player. It can be referred to as software as well. As long as the device can connect to the cloud, it is known as a thin client for all intents and purposes. The meaning behind it being "thin" is that it does not require much processing power to be a client to the cloud itself.

Recently Google has come out with their own web browser to compete with the others that are out there, and it is known as Chrome. This is significant because Chrome is probably the first generation of internet browsers whose purpose is to be able to run online applications. Its ability to read more complex code is streamlined. Also, its tabbed functions are each its own running process to keep applications running smoothly and securely.

**Workload Migration**

Workload migration is the concept of optimizing server farm technology to be data and energy efficient. With so much processing ability coupled with an enormous amount of power consumption, companies managing server farm technology are finding that they need IT people who are well versed in workload migration technology to be able to manage all that this entails.

Some cloud computing companies tout services to help companies with workload migration, offering services that assist their clients with the “internal cloud” process. It is true that many companies require this kind of service to have someone who is specialized in offering services to clients to keep their workloads optimized and ready at any moment’s notice.

**Server Farm**

Another popular term in cloud computing is the server farm. A server farm is a cluster of computers whose sole purpose is to provide processing power greater than what a single machine would be able to do on its own. A perfect example of this would be what companies use for web hosting of individual websites. Even though there is one website,

the server farm provides failover capability in case something were to happen to any single machine hosting the website.

It is ideal for server farms to be located near a reliable source of power. Microsoft's newest \$500 million data center near Chicago is taking up three substations, using almost 200 megawatts of total power.

A popular location for data centers has become Quincy, Washington where there is ample amounts of cheap hydroelectric power due to be close to the dams on the Columbia River. Cooling is an important element of server farms; with so many servers whirring and clicking all at once it becomes expensive to be able to keep the machines cooled down. This is another reason why Quincy is so popular because water can help to keep the servers cooled down.

Also, companies are looking at colder climates. Microsoft is looking into building a server farm in Siberia. Iceland has also become a popular location for companies to build data centers as well.

**Utility  
Computing**

This term is referred to as cloud providing companies being service providers just like your local power utility. In this way, a customer utilizing cloud technology would pay for the services for how much he or she used just like how a customer of a power utility would pay only for the power consumed.

Many cloud vendors are taking an interest in the utility business model. But the question remains as to what the difference is between the term utility computing and cloud computing. Cloud computing encompasses more than what utility computing can provide, as cloud technology included scalable applications and application servers from which they are hosted on.

It is easy to see why the utility model may become outdated because with cloud computing vendors are able to provide so much more to their customers. They have more flexibility and can offer more services in one than utilities would be able to.

## *3 Companies involved in Cloud Computing*

Many companies, large and small, are getting involved in cloud computing. What is interesting to see from a technological standpoint are what positions each of the firms profiled below are taking in regards to the media's portrayal of what cloud technology really means for business.

Some companies, like Insightful, have been able to use their small size and flexibility to take on the open source movement and as such are able to compete against larger competitors such as Salesforce.com and Oracle.

A few of the big firms are taking a stance of moving their products and services over to a more on-demand model, but it is readily apparent that they do not want to let go of their old ideals; its admirable that they would want to do that because the existing ways provided them with so much profit.

So while many of these companies are moving slowly, in step by step fashion, almost all of them are pouring money into infrastructure that they will need to compete with one another. It is apparent that economies of scale will win the

infrastructure wars. It's very likely that the companies that come out on top are the ones most willing to provide their customers with the most bells and whistles.

Extra features are fine, but what is really important is that these companies are able to overcome the perceived shortcomings of cloud computing. The main issues of reliability and data security are of utmost concern to organizations looking for a cloud vendor.

It may be that the biggest names in the industry today will win out, as cloud vendors because they have been known to be both reliable and secure in their past endeavors.

### ***3.1 Insightful Solutions***

In today's sales environment for any competitive organization, account managers must use a software package called a Customer Relationship Management (CRM) solution to prospect and understand their client's needs and wants.

This software is essentially a complex database used to store important records about existing customers as well as potential sales leads. Some of the information stored about these contacts includes their geographical locations or territories, the types of products and/or services that the contact is interested in, and other pertinent data that can be used in the different stages that make up the sales process.



In the late 1990s and early 2000s, a version of this type of sales software would typically be a packaged solution installed directly onto each individual personal computer in a company. But over the past few years, with the explosion of cheap bandwidth and server technology as well as the burgeoning open source movement, companies are gravitating towards a sales database package that is not managed on an individual machine but hosted upon a server and viewed entirely through an internet browser.

The result is that sales oriented organizations have the ability to access secured customer data from any computer terminal that has an internet connection.

One such company that provides this type of CRM technology is Australia's Insightful Solutions, which uses an open source software platform called SugarCRM that is customized for its individual clients' needs.

SugarCRM allows individual sales people to keep their sales contacts organized just like an Outlook calendar on steroids: they have all the requisite sales information at their fingertips so that while on a sales call or at a meeting, they know exactly what their client's needs are by using sophisticated data reporting software.

SugarCRM offers a host of sales features, like the ability to run projection reports as well as to perform marketing campaigns via an integrated mass emailing function that

even allows reporting on whether or not a potential prospect opened a particular sales email or not.

The analytical functions within the SugarCRM solution allow an organization's sales managers unprecedented access to their individual sales teams' statistics and goals. A manager has access to all the information available to each of his reports to offer clues as to which salespeople have the biggest potential sales lined up - all in real time.

The software also is fully configurable based on whatever products and or services the business is involved in. If you are selling automotive parts, for example, the critical information that is needed can be coded into the software so salespeople can seamlessly up-sell other products for the same car model, for instance, that the company has to offer their clients.

And of course, the biggest feature of Insightful's software package is that it is connected to the cloud, which would allow a salesperson at an internet café in Shanghai, China to use the SugarCRM internet portal to gain information on how to approach a customer's needs from Phoenix with whom he has a conference call in fifteen minutes to discuss a potentially big sale. How about that for globalization?

But globalization would not be what it is today if it were not for the huge technological leap that has been made in creating seamless technologies for which we rely on to get even the most simple office tasks completed. Companies

like Australia's Insightful use this to a distinct advantage. While part of what their business plan is all about is to perform customization of the internal workings for the SugarCRM software, where they make their money is on a per user basis and the support that they provide to the cloud.

This concept is commonly known in the technology industry as the software as a service business model. Thus, Insightful does not charge a flat rate for their software; instead they understand the inner workings of cloud computing require a solution that has scalability. It allows sales organizations that use Insightful's platform to work together with the company towards a common goal, which is to expand both of their businesses.

Insightful is simply a very good example of a small company that has successfully learned how to take advantage of cheap bandwidth for cloud performance, yet they are certainly not the most profitable or the most innovative in the CRM industry.

## **3.2 Salesforce.com**

The crown achievement for that would have to go to Mark Benioff's Salesforce.com. Benioff, who was a former Oracle executive and therefore no stranger to database software, started the company in 1999 and it now has over 2,600

employees servicing over one million salespeople in fifteen different languages.

Today, Salesforce's motto is "Success on Demand", which follows their strategy of software as a service, which is marketing lingo for offering up the possibilities and flexibility that sales organizations now have. The reason that Salesforce.com has been so successful was they were one of the first to recognize the niche needed for sales organizations, and also because unlike Insightful, they tend to target larger businesses with their proprietary software model as opposed to open source.

Salesforce.com has also just recently taken off of the SaaS pathway and has launched Force.com, which is a Platform as a Service (PaaS) service that lets organizations develop their own software with the underlying Salesforce.com engine. This is an example of the company having the vision to understand what their customers' need – which is ultimate flexibility and scalability with cloud technology.

The idea of software as a service is a different model from the concept that once prevailed in Silicon Valley circles as software being a product. The thought was that once the software product shipped it was something final, with patches for bug fixes forthcoming. Now, with cloud computing and open source technologies, a software platform can be more like a living and breathing entity that can be fully adaptable to business needs unlike proprietary packages.

### **3.3 Facebook**

Leading the Web 2.0 movement is Facebook, which was something of an online yearbook for college when it was started by a Harvard student in 2004 but now it is the leading social networking site on the internet. Many have pegged the market value of Facebook today in billions of dollars.

The structure of Facebook allows its users to belong to different social networks. For example a social network would be where someone went to school, or where someone works. Other social networks include political affiliations and other interests that people may share with each other. Old friends are able to meet up with each other using the site, and people can keep track of each other even if they have lost touch with one another for whatever reason.

The impact of Facebook on cloud technology is huge. Because of Facebook, companies are trying to figure out new ways that they can link people with each other via networks of commonality. The only way to be able to parse this type of information is by using raw processing power.

What Facebook represents is an all in one package for people to communicate, and as such requires a lot of servers. It has been said that Facebook is running over ten thousand servers right now, and will need many more in the future.

### **3.4 Joyent**

In what began as a web hosting startup, Joyent has now come up with something that is different from anything else that is being done with on demand computing: offering it all for free. Indeed, its business model is to help fledgling Facebook application developers find their niche by offering them free hosting for their applications on Joyent's own servers.

Apparently the company has an association with Facebook through venture capital, and it will be providing a direct link to the Facebook servers with a high speed fiber connection. This will save developers from time out problems that have plagued them in the past on Facebook. If someone were to open an application and it did not load in five seconds, in the past it would time out.

Of course, the thinking here is that if an application gets big, Joyent could reap benefits along with Facebook. The concept of opening infrastructure to the potential of getting the next big idea is a good and profitable way to conduct business in the cloud computing movement that is going on today.

### **3.5 Mosso**

Backed by server company Rackspace, Mosso is an on demand hosting startup. Their offer is for \$100 a month

they give you 50 GB of disk space, 500 GB of bandwidth and up to three million web requests. Of course, anything over that is charged on a per usage basis. The target market for this service is small startup companies and web application developers.

While different from Amazon's pay as you go service, the pricing structure is simple to understand and will capture the interests of small companies who do not have a whole lot of money to spend. The founders of Mosso are calling what they do a "hosting cloud".

### **3.6 Amazon**

One of the biggest proponents of the new paradigm revolving around cloud technology is Amazon. Once known as a book seller, Amazon has become a huge technology organization and they have one of the largest cloud businesses out there today.

It was built upon the idea that Amazon itself would need to use all of this processing power for themselves but in the course of developing their business development sessions they came up with a better business plan than they had thought of initially.

Instead, Amazon was one of the first companies to sell its processing power to other companies who need it. A large majority of customers for this service have ended up being

small start-up companies, many of which do not have access to large sources of cash.

In lieu of spending venture capital dollars or other sorts of funding that they do not have on infrastructure equipment, these small companies are harnessing the use of the Amazon computing system for a few cents an hour. The best part is that they do not use what they do not need, and they are not charged for it.

The service, known as Amazon Web Services, has a few products: Simple Storage Service, Simple Queuing Service and the Elastic Compute Cloud. Their prices are set by only by usage statistics. For example, Simple Storage Service provides customers with a predefined set of space for music, videos and pictures for fifteen cents per gigabyte per month.

The pay as you go structure is what intrigues a lot of people about this service, and it gives people the knowledge that there is scalability and flexibility in what Amazon is offering. For example, when someone signs up for the Simple Storage Service, they can specify where their data is stored, either Europe or North America.

### **3.7 IBM**

Companies such as IBM are getting back into the cloud computing business after the utility computing craze that



happened thirty years ago. Their product, called Blue Cloud, is targeting the financial services market to assist those clients with their back office processing work.

The idea is to make corporate data centers more open and accessible like the internet. A highly lucrative market, IBM hopes to add this as a meat and potatoes service to their range of consulting services that they avail to Fortune 500 companies. IBM knows what they are doing on this, since they have decades of experience with building and managing corporate data centers.

IBM is doing a lot of research on the topic of cloud computing technology, and has opened several research centers around the world dedicated to studying the potential uses of the technology in the future. In fact, it was its Almaden Research Center where IBM first started researching cloud technology for engineers to run DB2 databases on Linux servers.

One such research center, located in Shanghai, China is working on many different issues related to cloud computing which includes factors such as, resource utilization, application workload and power consumption for smart scheduling on workload migration and saving unnecessary power consumption.

Outside of the business sector, IBM and Google have decided to partner up and provide cloud computing research to science foundations as well as institutions in

hopes of doing advanced research on how the cloud can best benefit what will probably become mass scale enterprise cloud computing at some point in the next few years.

While IBM offers its expertise in building out large scale networks, Google has the data to parse through all of those servers for study.

### **3.8 Microsoft**

In the past, Microsoft was the type of company that leased the majority of its data center operations. Now that cloud computing is now something that is in vogue, they are working to design their own server farms and just recently completed one that is located near their headquarters in Washington.

Called “software plus services”, Microsoft’s strategy is not to have everything migrated to the cloud. Indeed, it is their belief that for whatever reason, that companies will be too concerned about security, or dependability – that software will remain a fixture on terminals for the long haul.

Although they are used to a different type of software model, they are not going to get caught behind on the cloud computing technology wave that many are called the future of software. That’s not a bad position for Microsoft to be in because that has been their strategy for years on end to

provide software to computers because it provides their business with large operating margins.

They certainly have the money to plow into data center operations even though in the past this was not something that they would spend capital on, if they can provide a hybrid of their software along with cloud services that would be their ideal business plan.

With most of their software targeting the largest of businesses, Microsoft's Sharepoint, which allows users to share enterprise files in one database accessible via a browser, would have to be the one that has the largest customer following that is cloud-based. In fact, Coca Cola reportedly has signed up 30,000 users for the service. Not too bad of a start for them so far.

For the Windows platform, Microsoft will soon be coming out with a service that allows for synchronization called Live Mesh to help integrate with Windows and the Windows Live services.

Microsoft offers other services that are cloud based, and one that is notable is Xbox Live, which is a service for gamers on the company's Xbox 360 platform. Xbox Live has been out for some time, but is interesting because it is for online gaming and social networking. Microsoft charges users on a per month basis and it is a very popular service among the young video game crowd.

### **3.9 Yahoo**

Yahoo has just recently announced their plans cloud computing services for both individuals and businesses. They are calling their own service known as Zimbra. The service so far has relied on what is known as the software as a service platform. But since Yahoo has a multitude of data centers, it makes sense for the company to let its customers use a cloud computing service which is value added to what already offer.

What Zimbra does is offer a collaboration suite much like Microsoft's Office/Outlook software. While previously the package was hosted on the servers of its customers, which are primarily educational institutions, Yahoo is pushing to have the service on its own server farm.

The reason most universities wanted to have Zimbra on their own network hosted internally was primarily for security purposes. Indeed, it makes sense from an institutional standpoint to keep sensitive student information locked internally in a university's own systems.

What is unique about this new service is that it is exclusively for the university environment only. In fact businesses are not eligible to use Zimbra. This represents the movement by educational institutions to move towards a software as a service platform within cloud computing.

Not long ago Yahoo decided to form a partnership with Hewlett-Packard and Intel to research cloud computing. They have set up a laboratory for their work on this type of digital research. This is probably part of an effort to compete with the larger cloud computing competitors such as Google and Microsoft which in early indications has the leg up against companies such as Google, Intel and Hewlett-Packard.

One of Yahoo's biggest customers of this service is Kansas State University. Already Kansas State has 30,000 users for Yahoo services. Based on a per user model that is used in cloud computing this is a significant development for Yahoo and shows that in the long term they will cater to the educational market for cloud services.

But Yahoo has been around for a long time, and they have the resources to compete with Google and Microsoft. In fact, they acquired the company that provides the Zimbra software as a service platform in 2007. They have the capital requirements to make infrastructure investments in cloud computing technology, so there is no doubt that they will be a formidable player based upon what is happening in the search market and how they need to continue to compete against their large search competitor in Google.

### **3.10 Google**

Google has made huge leaps in cloud computing services over the past few years. As a matter of investment, they

have put in about \$2 billion a year worth of infrastructure in their data center operations. They have completed or are in the process of completing four new data centers, costing over \$600 million a piece.

Many experts are predicting that Google may have up to a million units of cheap hardware servers for their cloud and they have recently announced a partnership with IBM on researching cloud issues much like the ones listed previously for IBM's center in China.

Google's mainstay application for the cloud that a multitude of users employ is known as Google Apps, which lets users make use of a Microsoft Office-style suite of productivity software. This allows for collaboration and storage of documents online. The best part of the software is that it is free for anyone to use as long as they have a Google account.

Office software by Microsoft can cost almost \$500 per user. Google apps users can pay \$50 per year for premium software which would allow them to be able to store and collaborate on large sized files.

There are large organizations that are using Google Apps – General Electric being one of them – but it seems unlikely that this platform will be able to unseat Microsoft's Office dominance. Although Google reports that there are 10 million registered users on Apps, it appears small businesses and college students are the majority using the software as a way to cut down on costs.

For developers, Google offers a service called the Google App Engine, which allows developers to write software on the Python platform to be hosted on Google servers with free storage up to 500 megabytes. This service is also offered at the enterprise level for a per-usage-per month storage basis. Pricing is expected to hover around 10 to 12 cents per hour of CPU time and 15 to 18 cents per gigabyte.

### **3.11 Oracle**

In 1998, Oracle launched their first on demand service called Oracle Business Online which offered many of the company's standalone products delivered through the web. This signaled an early foray for Oracle into cloud computing, and although CEO Larry Ellison sometimes seems combative about the future of cloud technology, there is no doubt that Oracle is one company that can achieve operational efficiency at high levels by using cloud technology.

It was Ellison himself who was quoted not long ago saying that he did not believe that companies could make money using the internet to host applications. But he may want to retract that statement seeing how his competition appears poised to do just that. The approach that Oracle will take probably means that they will slowly migrate their software online as they see the market shifting.

In 2005 Oracle bought the Siebel Systems which is a company that, like Salesforce.com, provides an online

customer relationship management software. Most of Siebel's CRM offerings have now been packaged into what is known as Oracle On Demand, and includes the powerful database software that the company has been known for. On Demand happens to be Oracle's fastest growing business segment, and it right now boasts 3.6 million users.

For 2008 Oracle is spending almost \$300 million on a huge 200,000 square foot data center facility in Utah. This is just goes to show that Oracle is committing themselves to the coming wave of hosted applications. Given the immense processing power that some Oracle applications require, that makes sense for the company to break new ground on new infrastructure.

### **3.12 EMC**

The core product of EMC, VMware, is virtualization software and so it is imperative for a company like EMC to get on the cloud bandwagon. VMware is a software package that allows users to run on servers and create several virtual machines on a single server, which can save users money on expensive hardware purchases.

The year 2008 brought EMC the acquisition of the company Pi, which specializes in information management. This pairs well with EMC's core business; their main business is comprised of life-cycle management of information resources for companies.

EMC would be targeting with cloud computing a focus that is definitely on storage. They have a well-worn history in



providing data storage as well as backup functions. It is possible that they could be the first to foray into the cloud backup business, which could become a burgeoning industry in its own right at some point.

It seems clear that the VMware product will need to be put into play for EMC to be successful in the cloud computing marketing and it appears that their pathway will be as the infrastructure or “plumbing” as they call it, provider for many companies. Information management is what EMC specializes in, and as such they are well aligned with where cloud services are going right now.

### **3.13 Sun Microsystems**

The company whose slogan has been “the network is the computer” is not one to think of the cloud as a new concept. They have been trying to sell the technology to businesses for years, but one that they have learned is that they need to make cloud technology seem easy for users. In the past, that was not always the case for Sun. They had a redundant product known as the Sun Grid, but it did not take off like it probably would if it were to be introduced today.

Now they have something more evolved in their fold: Network.com, which will be an online applications service that will charge users on a pay per use basis. The idea that Sun has for this is to be an on-demand server farm so that as customer needs change, Sun can adapt to that and provide users with the processing power that they need.

Also, they have an open source hosting service known as project Caroline for developers. The idea is to capture the SaaS provider market with this service. Sun feels that they are better adept at managing server resources than individual companies or developers, and they are right. They would be able to reallocated processing more efficiently by using their own expertise.

Customers would be able to take advantage of Sun's powerful Blade servers for a fraction of the price, but they don't expect their customers to completely rid themselves of all server hardware like some other companies. In fact they are preparing a new server product to complement Project Caroline and keep some data in house.

Called the Blackbox, the unit is basically a data center to store secure files. The idea from Sun is that the cloud element will simply be "spillover" for what servers like the Blackbox cannot handle. While Sun is prepared for Internet services to become prevalent, it appears that they do not quite believe that larger enterprises are going to become early adopters of the technology.

## 4 Why Cloud Computing?

What is the benefit for companies to employ cloud computing? For those providing it, they are on the cutting edge. And cutting edge means that there are going to be some really good profit margins for them. The competition is scarce in the beginning and therefore it is easy to dominate the market. The potential that is out there for companies to provide these services are immense.

As the trailblazing cloud computing providers continue along their path of innovation, there is no doubt that they will reap the benefits not only from being the first to market, they will have massive amounts of infrastructure built up that will already be contributing to the cloud resources that are available. This in turn gives these companies an edge over the competition.

Many estimates have put the cloud computing industry value at \$11 billion. By 2012 analysts are expecting this to grow to \$34 billion. With this type of growth many companies are attempting to strategically grow with this new sector in the technology industry and since so much money is going to be spent, cloud computing companies are spending large amounts of capital in order to gain potential market share in the future.

For those looking at cloud computing providers to connect

with their technology, the biggest benefactors would have to be small businesses with relatively no capital. With very little revenue, these small companies are able to use major data processing and storage capability at very little cost to them. The scale with which they will need this processing power can change on the fly, giving them more flexibility than their larger competitors could possibly have without cloud computing available to them.

If a company were to create a network-based application, there would be no risk to giving that application away for free on the Internet. If the idea becomes popular and they need to pay for business expenditures, it would be easy for them to limit free access and offer a premium subscription option to pay for the usage of cloud power. In fact, this business model can be beneficial to these companies as marketing expenses: allow free users to use the processing power paid for by premium users as a marketing expense.

The type of business that requires maximum flexibility would be another key proponent of cloud technology. Such businesses out there include globally integrated enterprises that require their employees to be all things in all places. Ideally this would be some of the largest Fortune 500 companies out there, but for security reasons the biggest Fortune 500 companies using cloud computing are primarily technology companies.

Where global integration comes to mind is that with users being able to connect to the cloud with a thin client, they would be able to work as if they were at their own

workstation, with the applications and settings that they require on hand at all times.

Security notwithstanding, this has potential for employers to flatten down the barriers related to time and location which has been an issue for companies since they started handing out laptops to people. Instead of handing out laptops, hand out thin clients or a way to securely access the cloud by giving out a link and a security code so that users can find a client wherever they are at.

One element that may indeed have some appeal for organizations would be companies who do research that requires sudden spikes in computing power. Research and development departments, in this case, would be able to employ cloud processing for huge spikes of data testing that would need to be done on a periodic basis without requiring heavy infrastructure investment.

Flexible platforms are becoming prevalent, and an example noted previously would be Salesforce's Force.com. The interesting thing about their service is that they do not charge their customers a fee for developing on their platform – they plan on charging license fees per user. What that means is they expect PaaS to become a popular service for organizations who want to be able to run custom software on the cheap. And really, what company wouldn't want to?

Although cloud computing has not exactly gone mainstream yet and so it remains to be seen just who will become the biggest users, it's pretty clear that the businesses and organizations that make the largest capital expenditures on IT

technology hardware year in and year out will be the ones to best benefits, and therefore use on a large scale cloud computing resources.

# *5 Benefits of Cloud Computing*

There are immense benefits from utilizing cloud computing. Of course, with any new technology there will be inherent risks, but companies that intend to provide cloud computing resources will tout many features that can benefit organizations using cloud technology to become more efficient organizations.

## **Flexibility**

With the idea of a “server rental” model in place, it is easier to become more flexible in terms of technology resources. The reason is that businesses are able, with cloud computing, to have lateral options when it comes to technology. They can decide how much storage space to use, and how much processing power is required.

While working to update software applications, the process can be pushed out much faster and more efficiently. Administrators can choose when to update an application enterprise-wide all in real time. It is up to them and how much they want to spend on IT with cloud technology.

## **Scalability**

With cloud computing one person can go from small to large quickly. Research organizations would be a great example in that they would be able to process heavy amounts of data at a specified time, and then go back to the norm – all without requiring those heavy servers.

It's better for many organizations to simply rent the use of powerful computing as opposed to buying equipment outright. It makes more sense for them to pay per cycle or per gigabyte to rent than to own the infrastructure outright.

Cyclical and seasonal businesses would be a great fit for the rent-a-server structure that cloud computing avails to the. One cyclical business, like tax preparation, would be able to utilize their resources within the first six months of the year – when they are busy – and then retract their usage instantly when they are not needed.

## **Capital Investment**

Companies who anticipate a huge surge in cloud usage over the next few years are investing hundreds of millions of dollars into infrastructure for massive server farms. Many of them don't really even know what it will all be used for specifically, but they know that the need will be there in the next couple of years.

IT spending takes a large portion of money out of general funds that companies could use for other pressing business needs such as marketing, research and development and human resources. With cloud computing, many rudimentary



IT purchases for things like hardware are no longer an issue as long as that task or set of tasks can be performed by the cloud.

Since much of the equipment will sooner or later be obsolete, why not let cloud vendors deal with the problem?

## **Portability**

In today's global economy organizations need to have people on the ground, far from headquarters, to manage things. With cloud computing technology, organizations are able to use their computing power wherever their people are as long as users are able to access thin clients. Thin client access is pretty much available everywhere that companies do business today, so this should not even be an issue.

With thin client technology the scale of geography and time variation is flattened somewhat and this allows companies that are trying to globally integrate to be able to be more flexible than ever before.

# A Complete Guide to Cloud Computing

# 6 Cloud Computing

## Drawbacks

Along with any technology that is new and cutting edge, there are potential downsides that are to be expected out of cloud computing. These types of issues need to be seriously looked at by organizations that are going to rely on outside resources to handle complex tasks. While the benefits seem immense, professionals in IT always have to consider the negatives that may develop down the road.

### 6.1 Dependability

For those planning on providing cloud resources to their customers, they will need to project an image that shows that they can be very reliable, to the level of the electric utility model. Energy is a very dependable resource outside of force majeure and cloud computing vendors must strive for the same level of service, included in their SLAs.

This could be a problem for companies that rely on the cloud to keep critical business functions up and running. One solution around dependability would be to plan around the most critical functions to be hosted from within the company while much of the non-critical processing can be done through a cloud vendor. This approach requires some planning but can be beneficial.

There are also concerns about what might happen to data. While unlikely, it is very possible that data could be lost. Companies that are interested in working with a cloud vendor may want to look deeply into the vendor's back up plans should something happen. Ideally knowledge geographically where the data is stored would be helpful but many cloud providers are reluctant to give out sensitive information like that.

One idea would be to make geographical information a deal breaker for a provider. If you are willing to enter into an agreement with them on everything else, most vendors will probably be accommodating for requests like these. If they are unable to give out the information still, it probably means that even they do not know where all the information is stored, which is not a good thing.

In fact, just recently it was reported that Google's App Engine service suddenly went down. While Google blamed the issue on a server bug, there should be enough redundancy in cloud services so that users never experience downtime unless it is something like a major world event that is happening – much like a utility.

## **6.2 Security**

Being able to keep important data secure has always been a priority in IT, but with a technology that takes information outside of the virtual secure walls most corporations have up will raise red flags. The usage of thin clients could possibly be high-jacked if people are carless with data.

Also, SLAs will need to have provisioning within them that directly specifies how cloud computing providers plan on protecting data.

This could become a lawsuit-threatening issue someday soon if companies are not careful. With reports coming out all the time about data being lost or stolen and the rise in identity theft as the result of stolen data this could be a huge deal breaker for some companies hoping to utilize cloud technology.

The idea of “private clouds” is a term that had been coined to help ease people’s concerns. But until vendors are able to easily classify what that means many technologists are going to remain concerned about the feasibility of cloud computing to secure data which is private and should not be out in the open.

### ***6.3 Little or no Reference***

Because of privacy concerns, cloud vendors for the most part are unable or unwilling to present case studies about companies that are currently using their services. As a matter of fact, there are very few large companies that are publicly reporting their usage of cloud computing at a large scale level.

This leaves many organizations feeling shy about using cloud computing resources as of yet even though it has become popular terminology in the tech world.

So the other two disadvantages of this technology are compounding along with the fact that very few companies are reportedly using the technology cause the entire cloud movement some problems. It may be possible that the smaller start-up companies will have to take advantage of some larger ones before they begin to adopt cloud computing.

# 7 Cloud Computing Technologies

Simply put, the way the companies prepare for their cloud structure is done by how much of a bandwidth load they feel that their servers will need to handle. What this means is that they have to make sure that they have enough power to take on the busiest scenario that is out there.

Server farms have to be able to scale up as demand increases. This is the hard part in purchasing hardware: how do you know how to anticipate demand?

Not only is anticipating demand difficult, it is even harder to try to anticipate demand volatility. There was a Google study that an additional 500 millisecond delay in returning a "search results" page decreases user traffic by 20 percent. That's volatility. It has been shown, however, that using an on-demand service like cloud computing can help companies overcome this volatility because it is simply easier to manage overflow to the cloud than to try to anticipate the oncoming rush of demand.

Instead of wasting time trying to forecast, it is easier to just have a contingency plan in place whereupon these issues are taken care of, and in effect companies using cloud computing are able to do more with less. With forecasting in

place, it's already expected that many companies are going to slow down their IT spending and allow cloud services to take up some of the slack.

The basic technology surrounding cloud computing is clear: servers. Lots of servers are needed to be networked together to power the cloud. And what used to be powered by expensive Sun servers is now done by cheap Dell servers. The usage of thousands of them is what makes the cloud scalable; they don't need to be excessively expensive.



# 8 Architecture

## Requirements

The architecture required for cloud server environments are many servers with lots of storage that are running virtualization software so that several application programming interfaces (APIs) can be run at once. Virtualization is the key in optimizing server resources, often software noted previously known as VMware is utilized.

This allows for users to have a set standard for performance while running on the cloud, and could be an important factor in application programming instances. It is also important to note that most server environments will run a stable open source operating system such as Linux which is preferable to developers because of its inherent stability.

Often times IT professionals will map out the architecture of the cloud as something that spills over from existing resources. Others will put the cloud in the middle, with the thin client on one end and the existing infrastructure place on the other side. In this way, the cloud is behaving as a buffer between resources.

This makes the cloud resources more of a “buffer” so that

scalability can be utilized. By virtually integrating the cloud into the architecture of the enterprise it is easy to visualize how the cloud can provide for maximum flexibility as well as scalability and harness those resources as they are needed by the enterprise.

# 9 Major Components to Cloud Computing

## 9.1 Application

The application itself, which is the component that end users will spend most of their time using, is hosted on servers that are remote from the user and can be run in real time from a thin client that hosts the application through a web browser. The majority of applications that are hosted on clouds are run via browsers.

This has major benefits in that there is no installation of the application, no maintenance required and support issues are streamlined because the software is hosted on a machine that is dedicated to that software so there is no worry of external influences of the thin client on the software itself.

Cloud applications are also referred to as software as a service (SaaS), software plus service or data as a service.

## 9.2 Client

The client, or thin client, is generally a web browser such as Mozilla Firefox or Microsoft Internet Explorer. A newcomer has been Google's Chrome, which brings an interesting

discussion into play as to how much the web browser that is known as today will become more powerful. It may soon be able to disseminate dynamic application interfaces so that it becomes more of a portal or perhaps an operating system in and of itself.

It should also be noted that there are other types of thin clients out there. For example, in the mobile telephone environment Apple's iPhone or Google's Android platforms run a suite of applications that can be considered run from the cloud.

Also certain web sites can be termed clients, for example Facebook, where there are thousands of applications available for its users to utilize. This in effect may be a sort of "virtual client" itself that has yet to be defined.

### **9.3 Infrastructure**

The infrastructure of cloud computing is comprised of computer hardware and the buildings that contain that hardware. As discussed before, the hardware consists of cheap, mass produced server technology which has become prevalent in the computer industry today.

The server environment itself is running virtualization technology which means that inside the server farm it is irrelevant how many specific machines there are. Rather, it make more sense to run software that can harness the machines' inherent multiple processing power so that the cloud companies can reap more benefits out of each customers processing ability.

Some companies use a process known as full virtualization which is a technique where the user is able to completely simulate the hardware that is run on the individual sever. Often this is use to emulate new hardware types. A few companies that are running full virtualization today include Go Grid and Skytap.

Another infrastructure process is called gird computing. Unlike full virtualization, which has a one to one ratio in software to computers, grid computing is the usage of sever machines network together for heavier processing power. Generally done for very heavy tasks like mathematics, grid computing can be implemented via several geographic locations. One company that is running grid style computing is Sun Microsystems' Sun Grid.

One newer infrastructure process is known as paravirtualization. Paravirtualization utilizes more than one machine, and often several machines, to emulate one process. Although IBM has done this in the past, the concept has changed somewhat and it was known as using a "parallel workstation". The company most famously using this technology is Amazon with their Elastic Compute Cloud.

## **9.4 Platform**

The cloud platform is referring to the way that applications can be deployed, most likely the name derived for by Platform as a Service (PaaS). Also the name solution as stack service comes to mind as well. This would include the

web application frameworks that are out there such as the language Ruby on Rails, which is an open source web application format.

Some other examples of the cloud platform is Force.com, Salesforce.com's proprietary PaaS service, the Google App Engine which runs off of Python and the web hosting service Mosso. All of these are examples of how platforms can potentially be run in the cloud environment today.

## **9.5 Service**

Service is referring to what users can reap from their cloud experience. To date there are a ton of services out there on the Internet for users to take advantage of. Some of them are quite unique, while others enhance services that were already out there.

One of the most popular services in recent years that uses cloud computing would be mapping services. A few examples include Yahoo Maps, Google Maps, and Mapquest. These services require a lot of database storage. They also need a lot of processing power to perform tasks such as giving people accurate directions.

Another service requires a lot more back office tasks, and that is payment services. These payment processors require a lot of processing power to accurately do the accounting that is required in the background for deposits and withdrawals. Two of the most popular payment services include both Paypal and Google Checkout.

Customized search functions require cloud technology to work. That is why search services are out there to help people find what they need. This technology also requires a lot of computing power. Services such as Google Custom Search and Alexa, even Ask.com utilize massive server farms to properly keep their pages indexed.

## **9.6 Storage**

Physical storage can be expensive for companies looking to expand their storage needs. It is cheaper to go with the cloud to be able to expand and collapse as the business dictates. One of the biggest features of cloud computing is in fact storage.

The main reason is that in hardware terms storage devices are the first ones to fail on a computer. By using cloud technology it is more redundant in the respect that companies can rest assured that their data is indeed safe. Cloud vendors will usually be able to provide service level agreements to let their customers know that their data is safe.

Sever farms and thus cloud computing offer a great way to keep data safe in case there is an emergency situation. Because there are so many computers in the cloud environment, the chances of complete failure of all systems is very slim. In this way, cloud vendors are able to entice customers with incentives of protecting their data from harm.

Some of the current companies that are offering database

storage services in the cloud include Amazon's SimpleDB and Google App Engine's Bigtable data storage service. Microsoft offers an online synchronization service called Live Mesh, which is part of the Live Desktop service that they are now offering. Regular storage services include Amazon's Simple Storage Service.

## ***9.7 Processing Power***

The processing power that cloud computing is capable of is immense. In fact, to 99.9% of people who will use cloud computing, the resources that are available will seem to have no boundaries. All of this is generally available at the cost of around ten cents per server per hour. Companies are able to use this type of capacity for a number of things: namely testing out new markets, and trying out new applications over the web.

Some opponents of cloud computing contend that there will not be a benefit for large corporations to use cloud technology but to use their own in house servers. The reality, however, is that most corporate servers are left unused during off peak hours. Therefore, they are wasting valuable processing resources that are available.

Some statistics point to corporate servers being idle more than fifty percent of the time. That is a large waste of money and energy resources. Larger corporations should do the time to fully research the drawbacks and benefits of using shared resources instead of wasting money on processing power that they do not fully utilize.



The cloud companies out there today are willing to scale up their infrastructure if needed, at some point when their customers are requiring more processing power it will be available to them on the fly. That is a major benefit: companies do not have to worry about infrastructure purchasing or costs. And they also do not have to be concerned about how much power is being used or if the server has gone down, because it's not their problem.

# *10 Migration from Standard Environment to Cloud Computing*

For companies that are thinking about moving their data off of their own servers, there are some considerations present regarding how to work with companies to do this. Indeed, this would not be an easy task for most organizations to undertake. Because of different systematic requirements, the result may be more problematic than many would think.

Developing a strategy to get data over to the cloud is not the specific issue. The fact of the matter is that some cloud vendors themselves are in a proprietary technology platform. So the issue at hand here is what may happen if the data needs to be migrated once again.

Why would this be an issue? Well, for starters, each system in general is proprietary in nature. So portability may not be so easy for companies to do. Take an example of launching application X onto a server. The launch itself takes some time. Once the company realizes that application X is going to be successful, they need to pull it off of the server and put in onto another platform.

But it is not that easy. Many companies who have embraced cloud computing so far have experience the problem known as lock-in. Lock-in is where data-loss occurs due to migration of data from one proprietary system to another one. While no one can ever guarantee a company that they will not experience lock-in, the risk of experiencing this problem while switching from one proprietary cloud system to another is immense in scale.

Why put it on another platform? There maybe uptime issues. There may be bandwidth issues or limited storage. Whatever the reason, and it could even just be a fall out with a vendor – companies need to be prepared for the event in which they are going to have to move their data once again.

This is a problem that so far has not been explored. Because in essence, going off the datacenter grid and onto the cloud means that data is floating out there. For some IT professionals and CIOs, that is going to be a scary proposition for them. And thus there will be a lot of hesitation to go off the secure data center altogether.

An example that has been pointed out frequently has been a company switching from the Google Applications service to a lesser-known rival such as Zoho. These are both office productivity applications, mind you.

For the migration to be successful, is it going to be possible to move all of the information to the new platform without losing anything? Sure, it is possible but more often than not

it is highly unlikely.

This brings up an interesting discussion that is happening at cloud computing conferences right now and that involves using open standards. Really, the only way that the system will be able to survive is if these platforms can all talk a similar language to each other so that these types of problems will not be an issue.

Without a common language available, this could turn into a huge problem because then a company would be under the mercy of the cloud which is exactly the opposite of the purpose of cloud computing. Instead of being free of infrastructure, what has happened is the infrastructure is no longer yours, and no longer under your control.

In essence, an organizations' entire IT budget could become hostage to a cloud computing vendor if they are not careful. This brings up an interesting idea to think about in how important data really can be for an IT organization. The thinking in many circles is that it is probably more important than money to the organization.

In fact, without data what is an IT organization? All it would be is infrastructure, and without the infrastructure, which theoretically is now in the cloud, the IT department would be rendered useless to a company. This may all sound quite alarming, but the prevailing notion here is simply that companies need to consider caveat emptor or the concept of buyer beware.

This brings us back to the issue of open standards for

migration technology throughout cloud computing platforms. The reality is that if a situation as described above were to arise, there would be a serious issue in migration of data. If a particular cloud vendor were able to take data hostage, the methods for capturing back that information would indeed be slim.

The reality is that system administrators are not going to want to deal with this issue. If data migration is not fully thought through then this will likely be an end result that will go on.

What will be the actual cost of migration? There will certainly be a price, but what the focus should be on is that cost versus benefit equation. Dealing with missing data and broken links for a period of time may be issues to be considered as well. Or how about misrouted emails, corrupted database and malfunctioning programs? None of these things would seem apparent while implementing a cloud solution, but the ugly head of errors would likely show up.

One idea to help remedy this issue is to ensure that cloud vendors will help support these issues. After all, wouldn't they be most familiar with these kinds of issues occurring? They should be the ones to have written the book, so to speak, on how to solve common issues related to how to properly migrate information over.

System integration will be weakened by any type of data move. Indeed, there will need to be a support plan in place that helps front line support work through issues. How do

you find missing data on the cloud? These are problems that will in fact need to be worked out ahead of any migration schedule.

## **10.1 Migration Guide**

### **Planning**

The first element to be considered when performing any migration elements over to a cloud resource would first be to ensure that some systems remain separated. What this means is that some systems will need to ideally remain just where they are because of their secure nature.

This could include several different systems, including ones that provide for complex financial data, servers that administer network administration tasks, and of course IT security functions. These groups of servers usually would stay in house. Systems the require integrity are not good candidates to move outside of the internal infrastructure of the company as there would be inherent risk involved should something happen.

If an agreement over security and durability can be made, it would be wise to turn over storage capability to a cloud vendor for service. Data security is important, and making sure that there is a contingency plan in place if something were to go wrong with the data integrity of the servers is an imperative planning measure that needs to be thought out.

Some other ideas would be application development servers, web servers and email servers. These are non-core functions that act as a support backbone and as such are great candidates to switch over to cloud computing. Any infrastructure problems that come up related to the servers on this end would be the cloud vendor's sole responsibility to manage.

The consideration to move application servers to a cloud environment would be a hard one depending on the organization. Some organizational cultures embrace the idea of having open source software, while others prefer the proprietary approach. The reality is that if an organization is only interested in using proprietary solutions that the idea of using cloud applications will probably not work for them.

## **Execution**

After the planning phase, the execution of migration is something that may take some time to prepare. Legacy systems will require specialized data conversion. It would be important to note at such a time that making sure data is in a form where migration runs smoothly is beneficial as to avoid corruption of files at a later date.

This is something that will require a lot of hours and thus patience will be needed. The important thing is that if the planning phase was thorough, then all the back up phases and other failover plans are in place and people know what to do in case something goes wrong.

These days, execution of data migration usually does not

require a lot of human tedium in order to work. Most of the time, there are automatic programs that can help the progress of the conversion go smoothly. The first process of execution is usually known as data extraction. This is where the data from the old system is systematically taken out of the old system and prepped for the new system.

The next phase is known as data loading. This phase is dependent on the cloud vendor for their guidance. Often for larger project, the vendor will charge a consulting fee for its services in guiding the organization through a successful data load. This is an ideal option because even the most seasoned IT professionals can come across bumps in the new system with which they simply are not familiar with solving.

Once the data loading has finished onto the new system, the next phase is the data verification stage. This process is important to make sure that the transition went smoothly. The verification is usually a program that is able to go through all of the new data that is on the system and it generally asks a few logical questions.

Some of the logical steps that a typical program will go through is to make sure of some key concepts. The first one is to check both sources to make sure that the extraction and the loading was properly translated. This is an important initial step; if the data did not get properly place in the new system it could be an error that could eventually turn out to be quite costly.



The next step in this process is to check to see if all data is complete. Incomplete data is something that frequently happens during a conversion, and although it cannot be deemed as fatalistic as translation issues, being aware of incomplete data can save countless productivity hours in the future should an opportunity to rectify the situation presents itself early in the data conversion process.

The reason for this is that it may be possible to troubleshoot the issue at hand. Although the data is being correctly translated, it does not necessarily mean that all of the information being loaded into the new system is being correctly read. Many companies are able to bypass this situation by using a process called emulation.

Emulation is when you are able to simulate an old systems' environment onto a new system. This is a way to remedy issues related to data not being able to be read by a new system that supports newer technology and syntax. Often times the way that things were done in the past on computers were not done technically efficient. Because of this sometimes new systems are unable to properly read what is fed into them.

When a data conversion requires emulation, it does not always completely solve the issue at hand. There can be several reasons for this. One reason is that by using emulation, you really are not taking advantage of the new system's capabilities for that dataset because you are simply viewing the data through "old eyes"

Another reason is that the data once again is not portable in the environment. This was discussed previously, but it must be pointed out one again that if data hosted on a cloud environment is not capable of being easily portable organizations could stand a chance that their own data could be taken hostage.

Another problem is access. Emulation generally handcuffs users with arcane methods of access, often requiring commands not frequently used in the PC environment. Instead, users are forced to use keyboard shortcuts that are difficult to back out of, not to mention that the user interfaces are notoriously hard to navigate around.

It could become a point of contention that this type of data not even be migrated over to a cloud solution. With thorough planning before executing a data migration plan, this decision is usually the case. Sometimes there are situations where organizations have to make that choice while in the middle of the process, however.

Data migration is an expensive proposition, and emulation can help shoulder the burden of migration over to a new system. In effect, although it is not always the ideal solution for a migration problem, it is usually something where people can meet halfway and continue onwards. It can also save an expensive project from not going through to completion.

Of course, it is always a good idea to keep close contact with the cloud vendor to make sure everything is going

smoothly. Some vendors might not even be cooperative in helping with migration issues if they know that a particular system is going to be problematic. Make sure that that can be easily understood by what the vendor both says and does regarding certain systems. It can be a tough road once the execution has begun.

## Support

Once again, hopefully a support system has indeed been put into place during the planning stage of the migration. Support after the execution phase is no doubt important to the organization success of migration to the cloud. Training will be an important issue to get people on board and ready to move on to the new system.

The leaders of both the planning and execution stage must have previously put together a successful support plan so that everything is capable of running smoothly in the end. This is an important requirement. Cohesion is imperative to the success in the long run.

There is going to be bumps in the road, no doubt about that. The key is to make sure that steps are properly taken so that everything is capable of going smoothly. Not everything probably will, but it is better to think that everything is capable of that in the long run.

Conversion is not an easy thing but if cloud migration is something than and organization wants to do and they think that they will be able to save money and have less hassle that is related to the infrastructure computing that has been

done in their past, then the benefits of a project on this scale are indeed immense.

## ***10.2 Top Tech Trends to do with Cloud Computing***

### **Mobility**

With the advent of cloud computing, everything is now on the go. Employees are able to go anywhere and do anything provided that there is electricity available. Work projects are now a focus of time instead of the old way which was a focus of being attached to a desk. This is a new paradigm that companies will have to deal with in terms of productivity.

The question is will it go up or down? Most likely, productivity will go up as any new technology seems to bring an increased efficiency to those who use it. Plus the ability for people to go mobile gives them a sense of freedom and gives people new ideas. That sounds like a good platform for creativity and productivity.

There is always someone who is capable of abusing technology. But that doesn't mean everyone will. Most people are good with technology, and know how to use it to make their jobs more productive. Cloud computing will help with that in the long run, and it is not just computers that can be discussed in this space.

Mobile devices will also see a significant change in the way people use them as a result of the cloud computing movement. The reality is that for some time now people have been able to check their email on their mobile devices. But what has changed is the fact that now the capability has increased exponentially because of processing power that does not have to reside within the mobile device or application itself.

Devices such as smart phones would now be able to run office productivity applications or other processing intensive programs directly off of the cloud beamed on to the mobile device through a wireless internet connection. The possibilities are endless when thinking of what could be done next when the thin client is in fact truly that thin.

## **Search**

Over the years since the internet has promulgated, the complexities of search have been well noted. Years ago, there was even a browser-style search war being waged on the Internet until Google came along and trounced everyone. Now that Google has taken the lead in search, it has of course set on to conquer other things. But the bread and butter for them will always be search, and cloud computing is allowing them to take searching for anything to a new level.

With all the processing and storage power at a server farm's disposal, there is no question that everything digital is now becoming indexed. Things that people previously did

not think would be able to come up in search engines are now popping up.

Everything on the personal computer today is easily searchable, and there are applications on the horizon that are able to search for a users' complete digital space; as an example every piece of data that the user has worked with in the past 30 days could potentially be searched for regardless of the location where he or she last accessed it.

There is also the idea is that the digital world is becoming “unflattened”, that is to say, the future of technology exists in the things that humans have not yet thought of for the digital world. One of these elements is three dimensional worlds, which is where the idea of the digital world becoming unflattened. With the use of large scale databases that can be easily accessible through database search, this concept becomes possible.

Lost something? In the future with cloud computing, it will be possible to find the things that you need no matter where they are. In fact, if thin clients are able to fit on almost any device (which they most certainly will be able to someday) then almost anything can be found using search technologies that are anchored by the cloud.

## **Translation**

One of the most labor intensive tasks that need to be performed by humans is language translation. Not only is it time consuming, it is also expensive to have to pay someone for their translation services. With cloud

computing and some smart coding by programmers, the work of translation can be shot over to the cloud and back to thin clients with no problem.

A big issue with global business today is the language barrier. Because businesses operate in so many different countries today it is hard to fathom being able to understand individual customers and their needs without efficient translation help.

Human translators should beware because there are several electronic translation services that are coming in the near future that are able to perform these tasks for people.

One example that has emerged lately is a new feature embedded within Google Talk, which is an instant messenger program. It is a translation tool that allows people speaking two different languages to be able to understand each other. All of this provided by Google with their software development, global touch and server farm technology.

Translation tools could expand into other computer applications, and their benefits would be significant. For example, being able to read emails from someone in another language would be highly useful for some people. Also, having a way to translate documents in another language would be a key benefit as well to the power of the cloud.

This is something that could only be derived from cloud computing technology in the way that it could be used by

such a large amount of people and the processing power that languages require. With so many languages and dialects the ability to use language as a way to break down barriers between cultures is an excellent way to harness the power of cloud computing.

## **Collaboration**

Being able to plug into the cloud from anywhere, and being able to access important documents from anywhere allows for extensive collaboration to become possible by using cloud computing.

It is easy to keep track of changes and who is making those changes. Security would make it simple to see who has access to a particular document and who is accessing what and when. With collaboration tools there is no excuse as to why someone could not help to make a change.

Technology like cloud computing requires people to own up to their own faults; if they are not pulling their own workload like they are being requested to, then the other users will be able to see this going on through what the cloud is able to track, which is virtually everything.

So organizations are able to use an application service like Zoho to create their documents, for example. In this way, they are able to make files like living entities that are constantly changing with new ideas. This is a concept that can change the way that people work, and can increase efficiency in regards to the speed at which projects are able to be completed.



## Organize

One of the biggest problems that people have in the information age is the organization of information. The big issue in today's technology world is that there is so much data out there that it can become overwhelming how to properly organize it in a fashion that makes the most sense to users.

Utilizing cloud computing, however, users are able to use technology on itself to gather data from several different sources and put it all together much more easily and into a format that is easily understood.

One example where data is tough to organize is during travel. Often times travel information is dispersed over several different sites due to the variety of travel arrangements that have to be made on a single trip.

Using cloud computing can help travelers to make sure that all of their information is located in place, which makes things easier while on the go at different destinations. This would be especially beneficial for business travelers.

One site that is already utilizing this type of technology is called Tripit.com. With Tripit.com, users are able to have all of their travel confirmation emails forwarded to a Tripit.com email address that is able to read and understand that information is sent to it. The site then organizes trip itineraries so that it is easily viewable for users.

Tripit also has some other interesting features that go along

with it, it can do a lot more than just being able to view all itineraries all in one place. The site is able to put trip information into calendars, it can synchronize with weather information and users have the ability to share their trip calendars so that their friends and business associates can see where they are going and what they are doing.

This is just one example of how streamlined information organization can become with cloud computing. There are potentially thousands of other applications for things like this. Another amazing thing is that a site like TripIt right now is completely free; users can enjoy the organizational services for completely no cost to them and their friends.

Many startup sites using cloud computing processing resources will do this in the beginning to get users interested in the convenience of organization sites so that they will become hooked and when these types of companies need to raise capital, they can begin to charge fees to their core users that find that the ability to organize information like this would be very useful.

## **Data Collection**

Being able to gather information resources together can be difficult. Many companies and individuals rely on consulting companies to gather information about people, places and things for them. But by using a cloud vendor and having the infrastructure in place, it is much easier to do this without the need of outside resources other than the cloud itself.

One way of doing this is to set up a form posted on the

internet and allow people to access it and enter in the data. If this is done through a dynamic web page, then it is possible to use some cloud resources so that the data can be easily parsed and place into an online application or database, for example Google Apps or Zoho for analysis. The information could even be put back into the cloud for further analysis if it is needed.

This is an interesting point, because there are several cloud vendors out there offering database resources. The biggest is Amazon's SimpleDB, but there are also a lot of little start up companies that offer this service as well. Some database tasks require a lot of processing resources to work, and so the demand for cloud computing to help with database tasks will increase.

Google has a product to fit this organizational niche, as it seems like they have everything covered. It is called Google Forms, and what it does it create a web form that can be posted online. The great thing about this product is that it can be used with Google Applications to place the data once it has been entered into a spreadsheet form. That way the information can be shared between a wide range of users.

This could be effectively used in the case of doing online surveys. Many companies, for example, contract surveys to outside companies. Instead of doing this, they could easily create their own surveys, post them on the web, and once the information has been gathered they could parse it using the cloud or with whatever database resources they have

available to them.

## **Scalable Businesses**

Many young companies do not face the same economies of scale that companies five years ago had to face. There are several reasons for this, but one of the biggest luxuries that startups today benefit from is the plethora of cheap bandwidth and software resources that are available today at a fraction of the cost that it was just a few years ago.

A lot of times in the past companies had to deal with a barrage of costs that do not exist any longer. For example, it is possible to bypass certain software applications such as office productivity software and media applications because this type of software is readily available on the web.

Businesses that take advantage of these types of resources from the early stages of business benefit in the long run because they are able to seamlessly scale up as needed. That's the benefit of using cloud technologies.

The per user licensing model is no longer effective because of the existence of all these new cloud computing companies offering, sometimes for free, scalable products and services that benefit the small business environment.

This type of approach can also be seen within the application development arena because of the amount of resources that applications can hog. Instead of worrying about how much processing power an application will eat

up, small companies can focus on building the best software that they can.

Sometimes building redundant and powerful applications results in requiring a lot of processing power. But that is not a problem when working with cloud computing. The resources used in cloud computing can be budgeted based on the cash flow requirements of the business.

Internet based applications typically require a lot of bandwidth and server power, depending on the type of application. There is no doubt that most small companies will be able to use cloud computing for their benefit as they will be able to use those server resources on the cloud instead of trying to purchase their own.

Scaling up for a startup has indeed never been so easy. Most businesses need to purchase an internal server at some point during their growth stage, but in today's environment, is it really necessary? There really are not many functions that the cloud cannot do.

One concern for companies is still security, and this may inhibit the ability for cloud vendors to capture the market for a company's servers, regardless of the size of the company.

## **Templates**

By providing an environment of collaboration through the cloud, companies are able to guide their employees much better when things suddenly change. Again, as long as

there is a thin client and an internet connection, organizations will be better able to interact with their employees.

A way that this could be done would be by templates. The way that this would work is that documents and spreadsheets would already be online for employees to access. This way, they can be sure that the information that is being collected out in the field is accurate and reliable, and there are clear guidelines on how to perform a specific project.

Using collaboration is helpful, but without direction it is impossible to organize what is going on. This is where templates come into the picture. Basically, what it means is that there is a select group of people who are able to fully edit the functionality of documents to steer the direction of work projects.

This is a hidden element from within the collaborative environment. Most people when they hear about the benefits of collaborative software, all they think about is the chaos that is caused by supposed disorganization. With templates, however, that does not have to be the case at all.

With this method, it is possible to keep projects on track and keep people on task. This is an easy and simple way of managing how things are done. With cloud computing, it becomes possible to manage collaboration projects with a much lighter touch and less management bureaucracy

involved.

## Running Secured Web Applications

In the past, running web applications was somewhat of a clunky process. It was not that easy to get web based applications to run smoothly or securely, and they usually had to be done behind an internal server. Now that there have been huge build-ups in servers over the past few years there is a lot of resources that web developers are able to take advantage of.

One of the main problems with running web applications in the past was the browser technology that was available at the time. An example of this would be Microsoft's Internet Explorer would frequently run into problems related to script errors while processing code intensive web sites.

Exacerbating the problem was that Internet Explorer's proprietary interface made it so bug fixes would have to come directly through Microsoft, and the patches would only be released when they felt that they had a handle on a particular problem.

Then along came Mozilla Firefox. With Firefox, the open source browser came into the spotlight, and it became popular relatively quickly. One of the most innovative things that Firefox came up with was the notion of tabbed browsing.

With tabs, users were able to open multiple browsing sessions within one window and it was possible to flip

through several different sites without having to minimize and maximize windows, a time consuming task.

Firefox has also been known to be much more secure than Internet Explorer. Most IT professionals would attribute this to the fact that it is under less attack because of its open source nature. Most people would agree that when Firefox first came out, it was much faster than the Internet Explorer version at the time and that was an added benefit.

Firefox has been able to show a lot of promise in allowing users to run secure applications fast using cloud technology. The fact that it has become so popular in a short amount of time attests to that reality. Internet Explorer has not backed down, however, and it has also begun to incorporate features such as tabbed browsing and plug-ins in its newest version.

## **Google Chrome**

Google's new browser, Chrome, which was just recently released, offers a new generation of browser that is capable of taking on any browser that comes its way. The reason for this is because of the way that the browser itself was built because it offers more capability for application processing power compared to anything else that is out there.

The architecture of Chrome is all new, and it is an open source blend of a few other browsers, most notably Mozilla's Firefox. The main goal of Chrome is to allow users to have more stability from a browser environment so that there can be more versatility in what it can view. It also tries



to achieve simplicity by being extremely streamlined.

Chrome takes every tab and window that is open and turns it into its own process. What this does is provide more stability for each session that is opened. If one session were to crash, the others would be able to stay open because of each one having a separate process status.

This is important when dealing with sessions that have important saved data so that they do not all have to close at one time if something were to go wrong.

In fact, if something were to go wrong in a Chrome window, you do not get some arcane error message instead you get a window that is grayed out, explaining that something went wrong with the browser environment. This is much better than the standard in browsers today, which usually causes the entire application to have to be shut down in the event of an error.

Chrome also uses a different security model compared to what the status quo is for browsers. This browser uses standalone security for each tab that is open (also known as a sandbox) as well as an overall security mode for any plug-ins that may need to be run in the browser. That helps Chrome run plug-ins much faster because the security is run in its own session.

What is very striking about Chrome is its simplicity: save for a small bar at the very top that has a few icons, the entire space of the application is all browser space for web sites. There isn't even a command bar at the top left. The reason

for this is because Google understands that with applications being run over the internet, there will probably be enough icons and toolbars to deal with without Google interfering with having all of its own.

It becomes pretty obvious that Chrome is trying to appear less like a browser and more like an operating system for the cloud environment that will soon encompass the internet. In fact, Chrome has its own process manager within the browser. With this process manager, users are able to see what sites are taking up the most memory of the ones that are loaded into the browser.

It has been noted that Chrome is much like the early Windows graphical user interfaces that used the DOS operating system as the underlying code from which to run the system. Basically, it is Google's belief that all programs will be someday run via a cloud environment onto a thin client, and that hopefully for them, the window to all of this will be Chrome.

Indeed, if one were to use a free open source operating system and combined that with cloud storage to save preferences and miscellaneous files they could have their own cloud operating system if they paired that with Google's Chrome. This basically means that the way that we now think about thin clients is subject to change relatively soon.

## **VoiP**

In some countries, it still costs a lot of money to make a

long distance phone call. The reason behind this usually has to do with local government entities still retaining control over phone systems. There are some good reasons as to why they do this; one is because of the desire to keep telecommunications under a watchful eye. Another reason is for profit. Governments know that they can make money from keeping control of the telephone infrastructure.

But in the past couple of years internet users have been able to use a technology known as voice over internet protocol, or VoIP, to bypass plain old telephone systems, or POTS. Basically VoIP is a telephone connection made over the internet. There are many companies out there that are doing this and people all over the world are able to communicate for less money and thus more freely because of this technology.

One of the biggest providers is the United Kingdom's Skype Technologies. Skype uses a computer application that acts much like an average instant messenger client. But in addition to the chat functions, users can also call people who have Skype. They can also call regular landlines. These Skype to land connections are where Skype makes their money by offering lower rates than regular analog services.

There are also services, such as the company SunRocket, that allow their customers to make phone calls using a telephone. They can either use an analog telephone with a digital converter, or they can use a digital VoIP phone.

These VoIP services are pretty much just like using the regular phone. Telecom engineers have created software that is able to simulate all of the things that make an analog phone what it is and put it into a digital VoIP phone. The best part of the technology is the flexibility and cost savings that companies and individuals can reap through using VoIP.

The idea of VoIP is not new. The concept was first introduced in the dial-up days of the internet. But without proper bandwidth requirements back then the idea of digital telephony was more of a pipe dream at the time, there were also serious security considerations to take into account.

But now that cloud technology has progressed to what it is today, VoIP has really taken off. While Skype mostly relies on internet backbones and their own servers, many other VoIP providers are seeing that there is an immense benefit in using cloud technology because they do not have to worry about server upgrades or outages when they can farm that out to someone else.

Small and large organizations alike can use VoIP and cloud computing to their advantage by making sure that their systems are scalable and secure. It is very much possible to implement digital telephony and find a cloud vendor that is willing to host it, the problem of security and reliability is something that the largest organizations are probably still not comfortable with.

But smaller organizations might be able to properly benefit

from a technology such as this. By using an open source phone technology called Asterisk, small companies can have a cloud vendor host the technology on their servers. This way, the companies are able to save money not only on long distance phone calls but they can also eradicate their expenses towards costly digital telephone switching hardware.

## **Video**

The past few years have seen a huge boost in the amount of videos that are viewed online. It was the startup YouTube and their video technology that made watching clips online very popular. Now that Google owns YouTube, the amount of infrastructure backing YouTube has gotten much larger. That is a good thing because it appears that video streaming sites such as YouTube are going to need it because of how popular it has become.

Just like telephone technology, video has been on the internet for years. In the beginning the best way to get video on the internet was to download it. A user would have to wait until the clip was finished downloading before he or she could view it.

With streaming technology, users were able to view video as it downloaded, but this technology was ahead of its time as well because when it was initially introduced, it could only be used on the fastest networks that were available. Of course, most users are not on the fastest networks available, but now with download speeds always getting

faster video on the internet has become a popular pastime.

In fact, the average person today spends more time with their eyeballs in front of a computer than in front of a television screen. So it was only inevitable that video would become popular on the internet. Video is just another example of a technology that will utilize the power of cloud computing.

But it is not just the user sitting at home that can take advantage of streaming video. Businesses will take advantage by using real-time streaming to conduct videoconferences. Network television will have the capability to be streamed to places like thin clients such as mobile phones and other devices.

Cloud computing will help to change the way that we watch TV as well. It is entirely possible that the television as we know it today will change. The differences between the personal computer and television will be blurred into something different, something that will be defined by where cloud computing is taking us.

## ***10.3 Top Tech Trends against Cloud Computing***

### **Bureaucracy**

There is a lot of decision making that has to go into effect when considering using a cloud vendor to source server operations. In the beginning there are always going to be

people who are against the idea of outsourcing infrastructure tasks to an outside organization.

What are the motives? For one, many people will be concerned about their jobs much like the offshoring movement that went on a few years back. When that happened, however, the majority of the jobs that went away in some companies were back office jobs that people did not want to do anyways. People do not trust major technological change for the very fact that it may mean a shift in job roles.

This is what concerns some people and will cause managers to get involved in bureaucratic politics for a long time over whether it should be done or not. That is simply the conservative nature of larger companies and by the time cloud computing hits the limelight is probably about the time that larger companies will find the time to adopt it.

The reason for this is that it appears for the time being that cloud computing is too risky. With profits on the line and stockholders to appease, making a leap of faith on a technology as disruptive as cloud computing could cause a lot of problems from a technological standpoint, and could cause some in management to potentially lose their jobs.

## **Internal Clouds**

Small companies notwithstanding, larger ones generally have internal clouds already set up in their systems that are probably working just fine for them right now. As an example, companies that run SAP software (mostly large

ones) already run a dedicated server to host the applications that employees run on their workstations.

The list could go on with internal cloud examples. Most companies administer workstations through dedicated Novell or Active Directory authentication servers, most data that employees use on a day to day basis are stored on internal servers and mail is administered through enterprise mail server technology.

So while the cloud computing may be a new emerging technology, the reality is that large organizations have been maintaining internal cloud structures from years. The big difference is that these structures are not flexible and do not have the ability to change to adapt to the needs of the business with out major capital expenses involved.

Another issue is technological progress. The reality is that all of those internal cloud servers at some point will have to be replaced as things change. This is a reality that data center administrators face because servers will get old and eventually fail if they are not replaced. Also, hardware capacity needs to be continually updated as information becomes more prevalent.

Internal IT departments will try to prove that sourcing to a cloud vendor is cost prohibitive and inefficient. And in the coming years, that may still hold true. Unless IT organizations can continually stay competitive with cloud vendors, at some point organizations are going to have to look at outside resources as a way to reduce operational



costs.

That's not always a bad thing though. Because the internal environment is probably still the safest place for data right now, keeping IT departments within organizations within check is also a successful method in making sure that costs stay down. It will help keep certain groups from becoming too complacent about the technology that is out there.

## **Latency**

Although bandwidth has steadily increased from the days of dial-up internet access, which does not necessarily mean that companies are willing to rely on internet resources that they do not control in order to save money on their data processing costs. In fact, barring some kind of deal for a direct connection, most companies will not give a sniff to a cloud vendor because their data is so valuable to them.

The problems lie with the fact that the cloud is not ambiguous about specifically where data is going to reside. For all an unsuspecting company may know, the data may be in a server across the country from where it is actually accessed.

While there may be some cost savings in allowing this to happen, cloud vendors are going to have to realize that corporate users are accustomed to having high speed access to data and they will not settle for less once they have already had it once. Latency issues are something that needs to be taken seriously in cloud computing.

Microsoft's new Live Mesh product is one example where offline synching can help to offset the problems associated with latency issues, but the service doesn't exactly quell it because constant access to data is what companies crave because that is what they already possess with their own internal clouds that they have right now.

## **Location of Physical Servers**

Regardless of how networks are set up, geographic location still plays a role in the cloud environment, and it can cause glitches along the way if cloud vendors are not careful, and not always in a technical sense.

Currently the way that cloud computing is set up is in a fashion that takes away the boundaries of countries. That is not always a good thing for organizations for several reasons. One of those reasons would be the laws that govern certain countries. For privacy reasons, having specific data hosted on a certain server in another country may constitute a violation of laws.

A good representation of this would be the United States' Patriot Act Law. Under that law, the U.S. government is allowed to examine all data that is going through U.S. servers. Some companies as well as governments would obviously feel pretty uncomfortable about a situation like that.

A company that has an engineering presence in China may not feel particularly comfortable having their information on servers in Taiwan, as another example, but it brings up an

interesting point regarding data that is probably being hosted in servers that could indeed be the same ones that competitors use.

This is more of a security issue, but it needs to be brought up nonetheless, it is entirely possible that sensitive data could show up on servers that host data on the competition. This could indeed pose grave risks, and is something that needs to be considered. Cloud vendors should have the candor to tell potential clients this information, but it never hurts to do a little research to find this information out independently.

Regardless, it is also a good idea to check out the laws and regulations of intellectual property issues. Government entities have very specific laws, so certain organizations should probably be careful about where a particular cloud vendor is located to avoid having data be possible compromised.

## **Environmental Sustainability**

With concerns over the environmental impact of technology today, many people who attempt to go “green” are questioning how it is possible that gigantic buildings that are packed with servers can ever really be sustainable for the environment. And that is something that organizations need to consider because consumers are paying close attention to how companies react to wasting energy and other precious resources.

There are always two sides to an argument. One side of

this argument is that by centralizing power-sucking servers, by sheer scale data center managers will be able to effectively manage power more efficiently by using large scale power save modes. The idea is that with the majority of server in once place it is easier to find ways to save power.

The other side claims that data centers are not really even paying attention to energy efficiency and therefore companies are simply writing off being able to make any positive impact when it comes to reducing the power usage needed for running today's technology.

The latter may be true in some countries where energy efficient is not a major concern. But in countries within Europe as well as the United States, energy conservation is increasingly an issue that comes up and due to pending laws most new data centers in these countries are most likely attempting to pay close attention to conserving as much energy as they can because it translates into dollars and cents.

It is true that massive amounts of power are being used. There is no doubt about that. But cloud vendors are keen on saving money just as much as any other reputable business out there. And they can recognize that by achieving maximum efficiency while proving to their customers that they can do will be the best way for them to dispel any arguments about cloud computing and its potential for energy efficiency.

## **Lack of Portability Standards**

While it is easy to paint a picture that makes it look like in the future it will be easy to go from thin client to thin client and be able to access whatever data a user needs on the fly, cloud computing has not gotten that far yet and there is still a long road to travel to get there.

The reality is that the industry is in such an infant stage that there is a lack of standards available to allow for interoperability between the different platforms. One of the biggest battles that could come to fruition would be between the open source movement and the old guard proprietary systems that are out there.

Open source is a way to get new software out, but it doesn't exactly have a good track record in terms of support issues. Generally if a user were to have a problem with open source software, the best method of support exists on the internet in a forum. This contrasts starkly with proprietary systems, which traditionally are known for offering a customer support hierarchy so that users have someone to talk to about their issues.

With that being said, it is readily apparent that open source proponents would be those in smaller organizations that are more inclined to attempt to fix software issues on their own while proprietary users are ones who do not have a lot of technical know-how. It is traditional that larger conservative companies would be apt to embrace a culture of the proprietary software,

Unfortunately, cloud computing changes the game because the open source movement has made some huge headwinds into the proprietary market. While proprietary companies such as Microsoft are using the step by step approach towards cloud computing, there are other organizations such as Google that are just jumping right in head first with the goal of dominating the market.

From Chrome to Apps, Google has so many established products out and others in the pipeline that it is going to be difficult for proprietary companies to easily compete with what Google has to offer. If there were a way for these companies to come together to agree on a standard it would be very helpful for everyone that is involved

One promising move that has been made is IBM's partnership with Google, and hopefully the two can readily agree on some sort of open standard. The problem with not having a common language for thin clients to speak in is that it makes the entire concept of cloud computing seem segmented and rigid, which is the exact opposite of where the technology should be going.

Hopefully, one of the purposes of the IBM-Google Partnership is not only to research some serious cloud computing issues, but to also adopt a standard that all organizations can agree upon for the sake of all the users depending on technology to improve their lives.

## **Reliability**

This is one of the chief problems with cloud computing in

that when you move your information off of your own grid, you risk reliability issues when you simply cannot control the infrastructure anymore. This one issue that large companies cannot stand to face because even in house they face this risk, but when the servers are part of their property they feel more confident that they are able to control this.

A few instances recently include Amazon's S3 service going down, as well as startup Mosso having "rolling brownouts". Although that term would generally be used at a utility company, to have it said in the context of cloud computing is concerning. In fact, it sounds more like public relations jargon for some servers experience an outage, causing loss of services.

So how reliable can these companies really be? That remains to be seen, but based on a large company like Amazon already having some issues, it is obvious that this certainly will make businesses suspect of what Amazon is really capable of unless they are able to offer written service level agreements that can take a lot of worries out of the equation for potential customers who want to use cloud computing.

## Logging

For sheer compliance purposes, some companies are required to log all computer activity. Using something known as a "cloud" could pose a lot of problems for companies and their security departments.

A lot of the problem rests with security departments that reside inside of most IT departments in organizations. What security professionals need to be doing is work out ways to make it safer and come up with better ways of logging.

It is probably time to stop fearing change and learn about cloud computing technology and what it can and cannot do for the business. Working through a risk assessment, working through measures and counter measures and doing all the things that security engineers should do is what should be done to be innovative about the future of logging,

## **Security**

There are a lot of things to worry about when it comes to security issues and cloud computing. Privacy, control of objects, legality and who has access to what. Other questions that arise in a corporate environment include e-mail security, database security. Also, what about the cloud provider going out of business?

Or, there are also a host of other legitimate concerns about the security, privacy, access and availability.

There is also very little usable information from the security viewpoint on these issues. Some of it will mean that information technology professionals learn as they go using their best practices. They will also have to fall back on what they know, what they are legally responsible for, and what the real issues are to help management make the best decision that they can.



There are some great resources for good information, like IBM, Google, Amazon, Microsoft, Oracle and others. They have figured out that this can be a very useful technology and help companies expand and contract according to business need and market conditions.

While it is not inevitable it is pretty likely that companies are going to have to move some operations off of their local corporate network and into the cloud. The best bet right now for IT professionals is to work through a security process and get smart about cloud technology now so that upper management can benefit from what has already been learned.

Are companies ready for this? Probably not, but security will have to work through it and come up with feasible solutions for what is wrong with cloud computing. Security experts will say that you can never be too careful, and they are right. Cloud computing could be a dangerous proposition that should strike fear in the hearts of IT professionals so that they can get the right mindset of what it is all about before they gush about the sheer benefits.

# 11 Cloud Computing Issues

## 11.1 Support Issues

The way that cloud vendors are able to support their clients will need to be different from the way that traditional IT departments operate. Although all IT organizations say they focus on customer service, only few can show serious metrics that indicate they really are capable of offering world-class service to clients. The way that cloud vendors approach this issue will be a key indicator as to how far cloud computing can go in the next few years.

At issue is the fact that in order for companies to really feel safe with their cloud computing issues, they must be given certain promises of service level should something go wrong. Ideally this would include cloud vendors being able to provide solid 24 hour one call support within their service level agreements.

Amazon, for example, has added a new wrinkle that will cause its competitors to rethink how to compete against them. Their newest premium support service for their EC2 S3 and SQS provides clients with a guarantee to respond to

support issues within an hour. They are also allowing clients to be able to open as many support incidents as they would like to. This will all be administered through a ticketing system available online.

Of course, the service costs money. For the Gold level of this plan, clients have to pay \$400 a month as a minimum. For clients that use even more resources, the monthly rate is even higher. The Gold plan offers support every day of the year, 24 hours a day. It allows clients to be in contact one on one with support personnel via telephone.

There is also a cheaper Silver plan as well that is not so expensive. The two things that it lacks that the Gold plan possesses are the 365-24 support schedule, as well as the one to one telephone support. The Silver plan is much cheaper, costing only \$100 a month and then scaling based on the amount of usage there is in any given month.

Either way, both plans offer some good features besides those two major differences. Some of the other support options include regular business day support, guaranteed response times for urgent issues, client-side diagnostic tools and a directory of named support contacts, much like any other support structure that is out there.

Providing support in a model that is contracted is not easy to do. Many companies are just not going to feel comfortable about “farming” support out to anyone. The best thing that a cloud vendor would be able to do is provide a guaranteed level of uptime while making sure that

the channels of communication are open between the two parties to ensure that when problems do arise that they get handled in the proper manner.

When both Google and Amazon released their initial cloud services there was no talk from either of them regarding potential support or customer service programs for each of their respective offerings. But as time has gone by and there have been sporadic outages of each of their clouds they have had to concede to adding technical support.

It is easy to understand, based on the low cost for each service why they did not offer any support. But the reality is that there has to be some sort of model out there for mission critical applications to fall back upon in regards to cloud computing. There is simply no way around not having someone for customers to talk to.

Its possible that by adopting this model from the outset that they ran into serious issues relating to driving away their own brethren from becoming customers. Now the support process has become a value-added proposition, some out there that had initially considered becoming a cloud supporter have fresh questions that need to be answered.

They way in which Google and Amazon started adding support for a fee has to make some wonder what else the two companies will be capable of adding to cloud computing as services absolutely necessary to running data on the cloud.

For example, will it cost extra for failover capabilities? Will it

cost more for extra backup plans? Right now these cloud vendors are reluctant to disclose just which data center specific information is store. Will that also be available for an extra per month charge? What about extra for better bandwidth speeds?

It is troubling what the ala carte system could do. It may in fact become a harbinger of more fees than expected. Sometimes when users go to register a website they find this to be the case as well in added charges and hosting fees as an example. But the costs for this may remind some users of a very expensive cell phone bill if they are not careful with usage specifics.

Prior using a particular service, it would probably be wise for customers to ask questions about the quality of cloud computing and while trying to chose, find out about a vendors' customer support capabilities.

This would really be no different from the way that users have been asking about the reliability, security, customization and integration capabilities of on-demand services. One thing that they also may want to consider is what the cost on a per month basis it will be to run a functional cloud computing system with what it is they already have in house.

## ***11.2 Capacity Issues***

There is always going to be someone within an IT

organization whose job is to make sure that capacity resources are up to snuff for the benefit of the greater organization. This is generally known as capacity management, and it exists to make sure that performance and functionality are running at a high level to keep the business processes flowing.

With that being said, it has to be noted that capacity management personnel would be the ones to help with the resource planning that goes into implementing a cloud computing set up. In this new age of both cloud and virtualization technologies, what is involved in the role of capacity management has begun to shift from internal resource planning to something very different from what is seen today.

The way that most organizations today face capacity management is by keeping things under control by what resources are finitely available from an internal infrastructure standpoint. Everything can be looked at from a perspective that there are particular boundaries for every pool of resources that are out there. Basically, this involves calculating what peak usage would be for the organization and learning how to adjust accordingly using a traditional yearly budget.

This was something that almost changed years ago with the advent of utility computing, which was discussed here previously. But technology was not up to the speed of utility computing just yet. Now that it is and there are a multitude of large IT organizations out there, many in performance

and capacity management need to start rethinking what their jobs really entail.

Of course, the challenges that were faced during the utility computing era are once again resurfacing. While the technology now exists for companies to utilize cloud computing resources on the application level, many cloud vendors want to go way beyond this level to provide clients with the unlimited possibilities of cloud resources.

The question then becomes how do capacity managers handle this supposed unlimited resource? Well for starters, capacity is still the highest usage point that is expected to be had during peak times. Being able to have the cloud there for assistance is indeed helpful, and the ability to scale up for an organization is an asset that some companies want to try to utilize instead of having to plan for peak times that are in the distant future.

The big concern would be how the idea of cloud computing is viewed in the eyes of the IT professionals involved in managing capacity. For many of them, it becomes an issue of whether they are able to properly control issues that appear to be beyond their own infrastructure. How much are they really going to enjoy having to dictate something to support levels that are well beyond their own physical boundaries?

While the rules for capacity management change when using cloud computing, the traditional cycles still exist for overall management of the organization. This includes the

processes of modelling, provisioning, monitoring, maintaining and modifying. Evaluated performance, concerns about cost and the ability of the business to profit will pretty much stay the same.

With this in mind, more emphasis is placed on the last two steps of the cycle: maintaining the use of the cloud-based resources and modifying their use over time. This is where the unknown comes in for many administrators because the arena with which they are working in is new and still unknown from the one that they had known before.

Provisioning in a cloud environment changes drastically because the hardware to so this is controlled by remote software that is plugged into the cloud. But there also may be IT assets that need to be utilized and provisioned in house for certain clients. This is where capacity managers make their money: they are able to determine what requires sourcing out to the cloud environment and what does not.

This gives these types of IT professionals a new job description to those outside of IT. For some time now it has been thought that IT departments were mere gatekeepers of digital equipment that was very expensive and business critical as well as very hard for anyone outside of the department to properly understand.

Now the reality is that capacity management entails having less ownership of equipment and running as little in-house IT equipment as possible, knowing what is important to the internal structure of the business and what is not. This



means that there is a deeper business and overall organizational focus than there ever was before.

The developers must create applications whose capacity can be managed in an elastic fashion for companies interested in using the cloud. This results in more efficient business process, lower costs and the ability to more quickly give the business what it needs to make money.

### ***11.3 Considerations of Security***

Cloud computing will indeed become a prevalent and valuable concept that IT professionals should use to the benefit of organizations. Yet, there are dangers of hosting and accessing services and applications through the internet that need to be recognized: when in the cloud an organization can lose their ability to keep track of resources. This refers to who controls them and who is currently using which resources.

Some organizations have a lot of issues with trying to use cloud computing. There is no doubt that IT security managers should be in fear of innovations like this because of what opportunists may consider a golden chance to pierce inside a corporate network.

It's an exciting concept, and it enthuses IT professionals all across the globe. However moving data and applications to an internet type model improved the dangers legal issues for some. Until these types of issues are completely

resolved full-scale adoption will not be possible.

As a result of these types of security issues in cloud computing there will still be a need for company workstations that can provide user functionality. Although the idea of having the power of, for example, hundreds of workstations at the disposal of a technology department is an intriguing thought, the problem lies outside what IT professionals can properly control within the environment that those servers in particular are.

The benefits of anytime, anywhere accessibility can be exciting but there has to be a line drawn somewhere because of sensitive data issues. Many people consider abusing technology such as this, and as a result it is hard for IT professionals to trust the cloud vendors that are purveying their services to companies.

So can cloud computing be viable in a corporate setting? Only time can really tell what the administrators will be able to do to secure a cloud computing environment. The reality in the history of IT security is that it has always been a bit of an afterthought in regards to new technology. While these new networks are cheaper than in house equipment, there is a price to pay in giving away data that can flow into a foggy cloud.

Many chief technology officers say that the biggest detractor to cloud computing and what it can do for their business is that there is not enough ability to customize the system. As a result be concerned across many executives

continues to be that it will end up being more expensive to use cloud computing than to build their own capital infrastructure required.

Serious concerns are around the fact that bringing back the data in house may be a difficult proposition once it is gone now to the cloud because it has been taken hostage, so to speak, by a cloud vendor. Often times a major issue can result because companies are unable to bring up the data back into their networks. One of the reasons that this may happen is because of formatting issues, cost issue or even problems with the cloud vendor itself.

So privacy can be a big issue when it comes to security in cloud computing. Much of privacy can be attributed to the ability to control data. Unfortunately, the ability to afford privacy is that it costs money. Privacy is not free. Therefore cloud computing applications, such as web-based e-mail other Internet related applications can raise privacy concerns to a new level. Seeing as how over half of Internet users commonly utilize Web e-mail services, this is an example of the prevalence that is out there for data to already be out on the cloud.

Experts the average user, however does not realize prevalence of cloud technology. The modern corporation, does understand that cloud computing is probably a technology that they cannot avoid. But that does not need that there will be an early adoption by large corporations; there is simply too much risk in the eyes of any chief technology officer relating to security and privacy concerns

on the cloud.

The only solution for the time being if cloud vendors want have large scale customers at cloud computing is simple. They must be able to thoroughly package a security suite that eliminates IT administrators from having too many doubts about privacy and security concerns. Even this may not solve all of the issues relating security, but it would be an excellent start for forward thinking cloud vendors to consider.

Inherent to this issue, unfortunately, is the fact that it is unknown for the time being what kind of value corporate customers on a security suite of cloud computing applications. It is not fundamental for companies in the past to have to pay such protection; this is outside of the normal security software such as antivirus programs and as such will require adjustments to the market that is for them.

For many IT departments this issue of security considerations for cloud computing have unintended benefit: may be able to keep IT departments in business. The idea behind this that once a large amount of business type computing has moved from private server farms into the cloud there may not be much left of an IT department, save for developers.

That may be a bit of an exaggeration for the time being, and there is no doubt that there will always be information technology workers but there may be some validity to this argument. Companies like Google and Amazon are

creating new business worlds based on the cloud. This may create emergency situation in many IT department. However this is not something uncommon the IT world: a few years ago there was an outsourcing movement that developed and materialized into nothing.

But one has to look deeply into the future of information technology to see that it is possible that save security requirements IT departments will have been completely on the cloud based on economies of scale and competition. It makes a lot of sense complex layers of data off of the company's network for simplicity purposes.

Because of economies of scale there are many costs in all with IT that will continue shown in scale for most corporations. Some of these include power human resource costs hardware Moore's law and limited technological space.

So from an executive standpoint it makes complete sense to move much data infrastructure onto a cloud environment, and cloud vendors have open arms words most companies today. The reason for this is because they see the potential profitability of cloud computing because of its per user fee structure.

Still, this leaves security considerations left out in the open. There may be a time where the modern corporate organization in the future relies solely on IT departments to embrace security issues. Security issues in the future will be more complex than they are today. As a result having

infrastructure and server maintenance personnel on-site the most companies someday makes needs to be a large financial waste.

There are several reasons for this, many of them technologies relating to cloud computing such as virtualization and ubiquitous bandwidth capacity. So the issue of security in cloud computing is deeper than just the actual issue of user privacy alone. It has to do with IT organizations and where they see the future of their profession developing.

Still out in the open, because most vendors still do not have solid pricing structures as well as they do not have solid security structures for their cloud computing environments. Yet is expected that as large organizations begin to use as well as prosper upon cloud computing technology that these models will be further developed.

Some companies find security to be optimal issue in any cloud computing negotiation. The reason for this would be because of have the amount of competition in the market today. Companies are concerned that their competitors, for security purposes would be able to somehow gather data regarding their business this may be an unwarranted all, but it is something that companies the considering or.

Is obvious that cloud computing for organizations will work wire a lot of segmentation and that is where the in-house IT professional will be prevalent. As an example applications such as office for the to the software will need to be run on

a separate cloud environments then say, eight development environment for the development environment will need to be separated from the testing environment the testing environment will need to be separated from the production environment, and this is for security purposes.

The use of virtualization and its ability to offer a secure level of privacy data protection will be in for to the cloud computing vendor. Vendors must find a way to offer security within the virtualization environment on their servers.

As discussed previously, one of the potential problems with securing an IT department with the concept moving data over to the cloud is that many IT professionals who are not Web -- conscious may have issues with moving data outside their own four walls. It is the IT professional who grew up in or has been majorly exposed to Web development will Web technology that will be open in embracing the idea of moving information over to the cloud.

So while the near-term future of cloud computing will require serious considerations from IT security experts on what to do about cloud computing issues regarding data privacy and keeping that data under IT control, there is no doubt that the positive or cloud computing technology will in the end shine through because of the economies of scale that IT in the long run will require for businesses to remain competitive in their environments.

Many experts will have to agree upon standards, or a

common language, if you will on cloud computing security. During a recent IT security symposium focusing on cloud computing security issues a large contingent of IT security experts hope I that cloud computing will in the future increase the risk of leakage of data.

This type of symposium is where a common language can be developed between IT security professionals. This is because IT arena will be able to meet at a neutral location to discuss the serious shortcomings that come with using cloud computing in the corporate environment. Once there are solid standards relating a security environment of cloud computing, there will be most likely a large burst of activity on this IT sector in regards to business.



# A Complete Guide to Cloud Computing

# 12 Contracts and Agreements

It is clear that the for companies to successfully contract out some on IT infrastructure services that they will need construct complex service level agreements with their cloud computing vendors. Some of the key items that these contracts will need to include are relating to outages, server failures, reliability and data security.

## 12.1 Outages

It is inevitable in any IT environment that there will be outages occurring at some point. While a cloud vendor may not want to confront these issues with their potential clients, it is an issue that needs to be addressed for any level of service can be agreed upon. Companies are relying on cloud vendors provide them with a solid source of data capacity.

For this reason and this reason alone there has to be a set template or what will if/when there is an outage issue. No matter what, there is always going to be the potential for dangerous situations to occur. There will always be the potential for equipment failure, power outage, earthquake, civil unrest and other disaster scenario situations.

Cloud computing companies would be keen to be aware of each of these issues and what will happen if there is an outage. What will clients be able to do in the event of an outage and what kind of communication structure will be available to these clients in order for them to find out where their data is and if it is safe during an outage situation.

## **12.2 Server failures**

Ideally, server failures in a data center-type environment should occur never or at least very rarely. Unfortunately that is usually a scenario that IT professionals need to keep in mind so that they are aware of the associated risks that come from equipment failure.

One way to avoid the risk of server failure in the cloud computing environment has been to host several applications on several different virtualized machines. This reduces the chance that an application would lose all of its data, however that does not mean that all data will be spared from being lost if there were a server failure situation.

Amazon and its EC2 service what is known as the availability zones. Because there was a known weakness in the Amazon elastic cloud service, they will allow peace availability zones to help well the idea that users would lose their data by just uploading it to the cloud if there were to be a server failure situation.

These availability zones enabled users an option while putting data into the cloud. Instead of planting information

uploaded by clients wherever Amazon want to, it now allows its users to D. side which zone the information should be stored. These virtual systems have their own power, networking and cooling systems that the user can see via the web.

### **12.3 Elastic IP Address**

The concept of the elastic IP address has also become prevalent in light of risks associated with server failures in the cloud computing world. What an elastic IP address does is that it gives cloud computing customers a static IP address that is located in the cloud. This means that users are associated with the cloud via the same IP address no matter what instance/development they are attempting to perform, giving them stability while connecting to the cloud.

According to Amazon:

*“Unlike traditional static IP addresses, Elastic IP addresses can be dynamically remapped on the fly to point to any computing instance in a developer’s Amazon EC2 account. This means that rather than waiting on a data technician to reconfigure or replace a host, or waiting for DNS to propagate to all of their customers, developers can now engineer around problems with their instance or software by quickly remapping their Elastic IP address to a replacement instance.”*

So in effect elastic IP address concept is one standard that may be adopted by the entire cloud computing industry because of its ability to be flexible. There are not many

reasons to not adopt this type of standard. Instead of having to rely on several different IT technicians to administer server settings, the cloud environment is ready to go for developers at any time that they need it.

## **12.4 Amazon Machine Images (AMI)**

Another concept that Amazon is introduced, being one of the biggest proponents of cloud computing today, is something called Amazon machine images. What this in effect does is allow developers and administrators to be able to choose the specific machine kernel and random access memory to be run on their virtualized instance in the cloud.

Allowing for scalability, flexibility and redundancy in the event of server failure issues is an important feature that the cloud computing vendors need to provide. It appears that Amazon is the leader of the pack, and it may be because they have been offering their services already for some time. The concept of elastic IP addresses as well as machine images will indeed be something that others will follow Amazon's lead because they both assist customers with issues they may have with farming data out to a vendor to save costs.

With all this talk about server failure, over the long run cloud computing shows a better chance of success than individual lives corporate IT data centers. The biggest issue, as many IT professionals see it is that there is a psychological barrier between in-house and in the cloud. So

issue of server failure becomes more pressing in the cloud environment as there is more accountability once information has left an internal server environment for corporations.

## ***12.5 Peer-to-Peer***

One idea that has gathered traction is the concept of peer to peer protocol. While this may be familiar to most as a data sharing and downloading technology, it can also be useful in the cloud environment for providing redundancy in the event that there might be a server failure issue.

One example of peer-to-peer technology being successful in a cloud environment would be the company Skype technologies Inc. Skype has always embraced peer-to-peer technology to provide its users with stable telecommunication over the Internet. It has already been an issue for both Google and Amazon and their cloud applications having server failure issues.

Skype technologies, however, has never experienced a major outage of its services. This is an interesting fact in that it is not a corporate centered application. The reality is that by using peer-to-peer technology, cloud vendors are capable of so much more by simply using individual client technology and bandwidth to prop up networks.

At any one time the Skype software has approximately 9,000,000 people online using the system. All of those people with peer-to-peer technology are helping keep the software and its service reliable. While there have been

some minor outages from time to time with Skype, it is nothing in comparison to major outages that are possible in the cloud computing environment mixing cloud computing and peer-to-peer technology, would be beneficial to both corporations and individual users.

In the cloud computing storage stage, there is a small start-up called Wuala that is offering peer to peer data storage. In a typical cloud storage environment, users would be migrating their data onto a server farm environment. With Wuala, the service utilizes all of its customers' hard drive and bandwidth capacity to a small degree to help provide resources for its own service, offering its customers storage at a discount to other cloud computing vendors.

The Wuala service appears just like a file folder would on a personal computer, but it is hosted through a Web browser client. This is example of how efficient cloud computing can be, especially when resources can be dispersed to help reduce the risk of outage and/or failure.

There are other services that are being introduced that follow the peer-to-peer concept, saving users the hassle of worrying about data redundancy and outages. A couple of instances include Faroo, which takes an approach of search through peer to peer technology. India's Metaaso is the peer-to-peer version of YouTube.

While focusing on capital expenditures required for cloud computing infrastructure, it has to be noted that in order to become a cloud computing vendor companies have needed

to spend a lot of money. But this is not the case for companies that use peer-to-peer technology, because they are harnessing the power of all of their users as well. This not only provides an ability to have the infrastructure required to become a cloud vendor, it also provides a data protection inherent to peer-to-peer systems.

To build a server farm cost hundreds of millions of dollars. It is not easy to try to save money because large corporations must continuously budget for extreme usage and peak times for their server farms. Because of this large capital expense, smaller players have difficulty entering in cloud computing market. Even though the marketplaces relatively new, that does not mean that start-up companies are not considering making a foray into this type of business plan.

It has been said that peer to peer technology is a great way to capture underutilized computing cycles on individual personal computers. Small companies are following the Skype technologies model and working towards cloud computing sharing resources with individual users.

A few of the main features that peer-to-peer can compete with on server redundancy issues are scalability, reliability and cost. Peer-to-peer environments are incredibly scalable because as a network grows larger the individual thin clients can help support the network as a whole.

As for reliability, peer to peer offers an incredible network of machines that use available processing power to help push functionality within a network. In terms of cost, the money required for infrastructure does not have to be extraordinary



because much of the hardware is already available networked to the Internet.

# ***13 Cloud Computing – Hype or the Next Big Thing***

A lot of information has come out recently in regards to allow computing and how it will supposedly change the way users interact in computing environments. This is not to be discredited, but this has indeed been pushed as an idea in the past and came to naught. It may appear that in today's Web 2.0 environment that cloud computing set to hit the big time. But unfortunately it appears for the time being that it may only be an early adopter technology because of the associated risks it poses in the corporate environment.

## ***13.1 Hype***

Already there are numerous cloud computing conferences, blogs and consulting services that are helping to hype up the movement. While the positives of cloud computing cannot be challenged, it remains to be seen what open standards can be adopted to help the technology flourish.

When trying to decide whether cloud computing is hype or the next big thing, it is interesting to note that the technology the technology media is pretty much hyping

cloud computing to be the next big thing. That is part of their job, and there is no doubt that there are exciting horizons ahead for cloud computing.

The fact that there are so many applications for cloud computing leads many to believe that cloud computing is indeed the next big thing. Because the idea of cloud computing encompasses so many different products and services that people use on the Internet, it is easy to write about a subject such as cloud computing.

It is for that reason that the media rights so much about cloud computing and surrounding technologies. It is easy to find news stories relating to cloud computing and the problems that are associated with its emergence onto the technology scene. Also a factor is the fact that so many large, successful Internet and technology based companies are getting into this industry sector of technology.

## ***13.2 Technology Media***

Basically anything that is touching Internet technology on the Web has to do with cloud computing and so there are a lot of topics or technology writers to opine about. This is probably leading to there being excessive hype surrounding cloud computing. The reality is that it will not be the next big thing until the corporations are ready to adopt it, and, of upper does not appear that that will be happening anytime soon based on issues relating to the drawbacks surrounding using the cloud technology for companies benefit.

While this idea has been tossed around for years dating back to the utility computing movement, the average Internet user is not aware of what cloud computing really is. In fact many developers are not even aware of what cloud computing encompasses because their jobs simply does not revolve around that type of system.

The majority of developers of technology don't understand the concept of cloud computing. The reason for this is because developers, as a rule, are closely associated with corporate environments. Even though they may be working with something known as an internal cloud, which would be a server technology in house that is hosted and viewed through workstation thin clients such as Internet Explorer, the terminology and structure that cloud computing involves is generally unfamiliar to them unless they are known for keeping up with general technology media that is written.

For those who are familiar, it is an intriguing proposition. But, there are significant issues that need to be resolved and that most people do not have the solutions for. It is expected that some of the titans of industry will be able to solve these problems in the long run, but for the short run cloud computing will be relegated to those who are looking for in upper hand against their competitors and are not concerned about possible security threats or other associated risks involved in cloud computing.

### ***13.3 Cloud Computing and Maturity***

The reality is that cloud computing has not matured to a

stage where one is able to fully identify what will actually happen with the industry. Although many the heavyweights have gotten all because they know the future of business computing will involve the use of sourcing data services out to the cloud.

Many tech journalists are mostly concerned with the data integrity when talking about the potential cloud services. This may be as a result of speaking with IT professionals in businesses and understanding that this is a key issue for those people in IT organizations. Chief technical officers are indeed worry about data integrity and they passed this year or paranoia over to tech journalists.

Harking back to the dot com bubble days, journalists have been good at typing new technologies, causing businesses to adopt and reflect the market more so than probably was prudent. Their job is to write an idealized future scenario based on the road travelled by technology. So it is not them to blame for hyping it, as long as companies realize that this new technology still requires a lot of work before it can progress corporate scene.

So while the future does not necessarily need to be on cloud computing to be the future of technology, it appears that many pundits believe it will be. Time will only tell what will really happen. It is preferential for tech journalists to take a wait-and-see type of approach. One thing is for certain however, and that is the media will always report on the security problems and outages that cloud vendors face.

# *14 Financial Benefits and Pitfalls Around Cloud Computing*

The reward today of using cloud computing is putting pressure on CIOs to consider moving to the cloud because the cost benefit is immense: capital expenditures are expected to skyrocket for IT shops because of the fast pace of technical innovation in the market today. Therefore it cannot be ignored.

But CIOs have to appeal to their own security experts in the respect that they cannot do too much too quickly. The market for clouds services is still new, and there is a lot that the industry as a whole still needs to learn about this technology. Besides this point, it is clear that there have been technological movements in the past that have not fared so well and have resulted in costly mistakes for some companies.

## **14.1 Benefits**

Some of the financial benefits have already been touted: increased productivity across the board, the ability to be flexible where rigid hardware once was in its place, the ability to be more creative as a result of more collaboration

and aligning with a company's business strategies to deliver solutions that combine thought provoking concepts.

The affect, just from hardware investment savings alone, is huge. But it is the ability to conserve capital based on these other concepts that is very unique from a corporate standpoint. At some point, the reality is that the level of efficiency that we keep progressing upon will someday sputter out. This is where new technology and the early adoption of it comes into the spotlight and creates a burst of productivity.

## ***14.2 Enterprise Resource Planning***

Enterprise software solution providers are keenly aware of this situation, and it is evident to them that they will need to jump onto the so-called cloud “express train” if they hope to retain profitability. Many companies, such as Epicor Software Corporation, have partnered with Microsoft to assist them in making this transition.

This is a win-win scenario for both companies: Epicor’s main product is building software solutions for Global 1000 companies. By using Azure, the name for the Microsoft cloud product, they can more comfortably put themselves into a position of success because of the corporate agreement that they now possess with Microsoft.

The idea that Epicor’s enterprise resource planning software can be had “virtually anywhere” intrigues most potential customers because much of what ERP involves takes effort outside of the office environment. As such, ERP

software will be able to be accessed by thin clients not even imaginable by today's scale. Epicor is putting that idea into the heads of their clients, and it is probably why Microsoft has become interested in working with them.

But as an example the Epicor system could fall into the wrong hands. Barring some airtight security, there could be serious issues involved in the long run because of the purpose of enterprise resource management. Because enterprise resource management takes key information and insight from business resources, it is important to keep in mind from an IT professional standpoint that this type of information is mission critical to the success of the business in general.

So while the purpose of enterprise resource management, also known as ERM is to be able to save costs by keeping resources under type lock and key, the system itself can be inherent flaw by design because if thin clients can have little security than they can be taken by an unscrupulous user and used for hacking purposes.

It's not that companies like Microsoft have not thought of this issue. In fact, they spent a lot of time researching and trying to come up with ways that they can circumvent this type of process from occurring to enterprises across the board. The reality is that they need to set up a system that has resources to set security standards.

### **14.3 Open Standards**

And this is where open source standards come into play



because the open source community deals with proprietary systems that companies like Microsoft support and in effect does not offer any across-the-board standard. This is unfortunate because cloud computing for will require an enhanced platform for security standards.

These platforms for security standards will need to be used across many different companies and organizations. So why not develop a standardized platform? Some pundits would say that the reason why is because of corporate greed. Corporations have an incentive to keep their systems proprietary so that they can gain profit from them over a long period of time.

The reality is that the open source environment, however, as an incentive to help users in the long run and maintain secure systems. This in effect is a model which will most likely be adopted in cloud computing industry at some point.

Companies like Microsoft, that do not accept open source standards face an uphill battle against companies like Google that openly accept the idea of open source programming. The programming is an underlying foundation cloud computing movement. However even Google's own Chrome browser/operating system for thin clients is not particularly open source except for the fact that it is built off the Mozilla platform.

The Mozilla standard was developed as a business needs standard for web browsing. The idea is that separating structure from presentation gives Web design more to gain.

A reference to this idea would be helpful in the cloud computing environment for developing open source standards to dictate what clients can or cannot do on server farm environments.

With HTML code as a reference, is one standard that is open source: companies agree on adopting a common standard for what it felt technologies using the underlying code. Designers use that code to create secure and pleasant viewing websites. There is no reason why, for example, the cloud computing cannot adopt such open source standards for simple security purposes.

So what are the major pitfalls of cloud computing? What could really go wrong if corporations take their data and put it on the cloud? There are indeed uncertainties based on the technology, as there is with any new and burgeoning development in IT.

## ***14.4 Terms and Conditions***

Legal issues notwithstanding business leaders are becoming more open of buying IT service is an enticing idea to let enterprises become more flexible and have, in essence less stability in order to have more of a creative destruction type of approach to their IT services. What this creative destruction can cause problems and even legal faults which will be discussed later.

Once the average IT department understands the terms and conditions to be expected of cloud computing, they need to be concerned about licensing. This may include a

greeting to a cloud providers standard terms of service. This would be a fantastic time are IT departments to define the scope of negotiation for cloud computing and its reliability and security standard.

When looking at a sample portion of the Amazon Web Services terms of service it states:

*“Neither we nor any of our licensor shall be liable to you for any direct, indirect, incidental, special, consequential or exemplary damages, including but not limited to damage for loss of profits, goodwill, use, data or other losses (even if we have been advised of the possibility of such damages) in connection with this agreement”.*

While this appears to just be simple legal speak based on a licensing platform, there is something should be cautioned about when agreeing to a terms of service statement such as this one. Basically Amazon Web Services has neglected to include any liability for any failure of their services. This is not something that clients are going to be happy to see especially if something were to go wrong.

It should be noted here that a terms of service agreement such as the one that we have excerpted above is typical of a licensing agreement based on IT services/products. Most people don't realize that when they use software or a service on the Internet or even on the personal computer that they have it accepted a licensing agreement. Most people have to check off a term of agreement based off specific legal instructions that were written corporate

lawyers.

While it is easy to take the assumption that most IT departments understand this, it is also good to point out that IT professionals are not lawyers. And they are not expected to be lawyers but intellectual property issues are important in their profession and thoughts being involved in a new technology such as cloud computing can cause pitfalls when trying to implement an innovative new system such as this.

While most corporate executives would know that this is a rudimentary task to get corporate lawyers simple, often times I keep originals take the attitude that they know exactly what they are doing when it comes to licensing agreements.

The reality is that IT professionals do not practice contract law and therefore do not understand simple legal boilerplate measures are put into terms of services and complex licensing agreements.

It's not their fault, however and is part of the corporate hierarchy that companies should be able to take advantage of their legal departments' structure to correctly identify, interpret and negotiate the terms of service of an important element of company policy which would be to farm data into the cloud.

# A Complete Guide to Cloud Computing

# 15 *Cloud Computing for SMEs*

Cloud computing for the small to medium-sized business segment should be, in effect, a no-brainer for the leaders of these organizations. There are significant barriers of entry for small to medium businesses to participate in this new technology mainly because of knowledge factors. These factors can in fact be overcome.

In today's small business environment, winning new business gets to a point of heavy expansion and needs to hire a lot of people; one of the first things that it has to do is to think about what server that needs to purchase.

Unbeknownst to the leaders of small businesses, mainly because they simply do not have time to keep up on high technology trends like IT departments are able to, they are unaware that cloud computing services are available to them to.

Even though the media has hyped up cloud computing as the next wave of technology, this is mostly heard about in the IT professional world. The average business owner does not care will want to be concerned about technological issues.

The reality is that small business owner, as well as the media business owner only cares about doing business efficiently, safely and cheaply. This is the reason that only high technology start-ups will be early adopters into the cloud environment high-technology start-ups realize benefits and cost savings that can be a crew through using a cloud computing service, often times they are aware of the because of word of mouth or from reading be laws that are out there today.

Technology start-ups stay very ahead of the curve when it comes to understanding new ways technology and the emerging patterns on the scene. Many of them are looking for faster ways to develop applications on host them on database software. Another segment of them will require massive amounts of space.

### ***15.1 Case Study***

So what does all this mean for the typical website owner? A savvy Internet marketer like a website owner may realize that using cloud computing storage space, for example, they would be able to develop Web 2.0 applications for their particular service that is on the web. This can create a sense of social interaction for users of a particular website them coming back.

This is not a new concept; companies have been using social interaction technologies interested in products and services that they make. The Web 2.0 functionality brings a new paradigm to the e-store concept, however, in it is

cheaper for them to do business by using a per user basis type model with cloud computing.

So ideally, small and medium-size businesses should take the reins of cloud computing and use it for their own use, which may include an extension of their own infrastructure to create the perception that the company is larger than it really is their customers. This way it is easier to compete with large competitors easier to try to dominate the market in whatever product and service that they had to offer.

What are some of the nature benefits for a small to medium-sized business to use cloud computing? Cost is probably the biggest factor is involved. Because of the per user model as prevalent in the cloud computing industry, this is a scalable approach for small to medium sized implement to help captivate brand-new customers.

There are, of course, significant risks that are involved with taking the opportunity to embrace a new technology such as cloud computing. One of the risks would of course if all security. A serious security breach by a disgruntled employee or for that matter customer could cause the business to have to shut down if losses are great.

Another major issue would involve reliability of the cloud vendor that is involved with the small or medium sized business. If a cloud vendor does not perform up to a reliable standard, it will appear to be business that is trying to service customers is actually one at fault.

It is helpful to keep in mind that customers will not know the



infrastructure is being farmed out and they shouldn't. It is the job of company in question to keep control over what the cloud vendor is able to do.

This is not an easy proposition because these types of businesses are small in stature do not dictate the rules of the market, it is hard with individual cloud vendors which may affect even the larger than the businesses that a server. Because the businesses are smaller is harder to dictate licensing agreement and regulations on a cloud vendor.

It can be done, however, by explaining to cloud vendors that the potential for future business/services will become greater if they are able to offer a superior and reliable product. Cloud vendors would be smart to make sure that they are treating all of their customers with the same level of service so that as companies grow they can grow together.

Being able to thoroughly understand the benefits as well as the drawbacks of using cloud computing in the small business environment is something that needs to be fully understood before undergoing such a contract of data migration. It would be helpful for a small business to consult with an IT professional who specializes in small business services.

Being able to perform massive computing tasks as if a small business were one of the titans of industry something that must have business owners salivating at the prospect

many ideas that business owners have about running a business or starting new lines within their own business are open with the potential of cloud computing.

Right now most businesses if they wanted to do something with their PCs they would want to buy software and install it but with Web 2.0 and cloud computing resources companies are able to fully flexible applications and new infrastructure on the fly. This gives companies a lot of swinging through when it comes to competing against their larger competitors.

While this idea of levelling the playing field for small businesses against the competition has been spoken about numerous times, he needs to be mentioned that there is no doubt it will business environment is able to successfully combat the efforts of larger companies, the larger companies will indeed migrate their services as well over to the cloud.

This brings up an interesting question: what happens when everyone is on the cloud? If everyone is on the same level playing field, how to small and medium-size businesses properly compete?

While cloud computing may be a gainer, so to speak, for some time against larger businesses, it will not last forever. The reality is that no matter what technological advance happens, there is only a short amount of time before the reality is that providing a superior product/service is where businesses win.

So most businesses, and that includes large ones, IT is relegated to the somewhat of a tough character to deal with. IT is expensive, is not simple to implement and the highly complicated nature of its environment makes it very cost prohibitive to implement new ideas.

But it's not impossible implement new ideas. And for the larger companies, even though cost may be an object, it will not stop the larger organization from pursuing as much profit as possible. This is especially true if it can be done at the expense of the little guy.

So it is not easy for so a medium-size businesses to have to take on the large conglomerate corporations. The best way to take on a Corporation is to attack its weaknesses. For the time being that weakness would be a corporation's inability to understand and in fact cloud computing policies that would be beneficial streamlining business flexibility and agility.

The modern business would be smart to realize that by taking on cloud computing that they would be able to try him over large corporations, at least for some time before the corporations realize that profit is being taken from because of a new technological advance.

# 16 *Legal Implications*

Although licensing and terms and conditions segment of cloud computing has already been discussed, the concept involving legal implications of cloud computing need to be explored further. Lawyers will be hearing more and more about cloud computing and the intellectual property issues that they bring up in the coming years if not months.

Like it or not lawyers, especially of the intellectual property variety, will soon be dealing with issues much like they did at the dawn of the Internet age. In a sense this new cloud computing movement is the somewhat of an enigma in that its complexity could bring about pure anarchy in the way your data is organized.

For the majority of end-users there is a good reason to want to use the cloud because it makes using the Internet a lot simpler. It makes IT even cheaper than it is today. All of the complex work is taken care of by cloud computing vendors, much like Google takes care of all of our searching that we today.

## **16.1 *The Legal Implications of Google on the Cloud***

But for anyone who pays attention to the media today, there

are serious legal implications to what even Google does. Google has gotten themselves involved in many legal disputes regarding freedom of speech and freedom of information issues. The company openly states that they use customer data to properly target their ads towards people.

One excellent example of this one perfect example of the legal implications of targeted advertising is Google's Gmail product. The Gmail service while useful takes customers internal information based on their inbox and target ads towards them at the top of the screen.

While this may seem like an excellent service from Google's eyes, there are privacy advocates that are against this type of targeted advertising.

Freedom of speech lawyers to find issue with some of the things that Google does. The reason for this is because it is hard to determine exactly what Google knows about each individual that uses its services. Google has become so big what is that they in fact probably have information on just about anyone uses the Internet today.

Further exacerbating the problem is the fact that Google now is worldwide and it is for largest search engine used even in China. Google is probably slowly collecting information on every one; collecting a profile that person buys and sells on the Internet. While some people may not find this a problem from a legal standpoint that is open to interpretation.

If a company like Google is able to collect simple search information from people and use it to target them for advertising, imagine what a cloud computing service would be able to do that type of data mining experimentation. Thus it should be read with a cloud computing vendor that to use their services there are particular privacy agreements involve in the contract that is signed.

## **16.2 Territorial Issues**

Territorial issues also come into play when talking about the legal aspects of cloud computing. Many cloud computing vendors are hesitant to explain exactly where the data farms are located where sensitive information is stored. This could be because it is sensitive information is actually harbor any location that could be hazardous for that data.

So there is no doubt that people should be given a certain amount of disclosure as to where their data is residing. In Canada, for example, there are specific laws stating that data cannot reside on certain servers in certain countries. This is probably a common law in most countries as most countries that sensitive information they would prefer other territories/countries not possess.

With the advent of the Internet there was very much a utopian atmosphere at the time because it felt like the Internet globalize and unified the world. Unfortunately, even though the world has gotten smaller with electronic commerce and so on and so forth, that does not mean that geopolitical problems do not still exist.

Upon examination of the specific data that could actually be migrated to a cloud computing environment, is clear to see that there is extremely sensitive information that once aggregated into one central location it is possible that it could become very clear what that data in particular specifically means.

That is to say that if data is harboured on a separate environment in any traditional IT server structure, it is hard to interpret what that specific data may actually relate to or actually mean. But that is difficult to substantiate in a cloud computing environment because it is impossible to tell exactly who may be reading data off of cloud servers.

### **16.3 Policy**

In an era of identity theft, where people routinely get data stolen from them for the purpose of ripping off credit scores, one has to be careful of the legal implications of storing data in a. Is key to keep in mind that even though there are a multitude of positives that can come from using a cloud service there still can be issues relating to legal problems and it would be wise to consult with an intellectual property lawyer on these type of issues to save business costs in the future in case a problem arises.

Cloud computing could even become an area of debate in Washington DC. Policymakers will need to decide if their huge challenges facing them in the coming years with cloud computing becoming popular the major question is: who owns the data that consumer store on cloud computing

networks?

At issue is what rights government law enforcement agencies have towards personal information that exists on a particular cloud vendor's server environment if it is needed for a pressing judicial case as one example.

This brings Washington DC folks into the picture again because regulations need change to embrace the cloud computing movement so that personal data security issues can be properly addressed. Legislation will be needed in order to properly address problems such as this.

Many intellectual property lawyers don't even have any idea how they will practice their craft and where they will find their place in where the future of cloud computing will be. They don't have any clue how exactly this new technology is evolving and how they will practice their law around it.

The reality is that there are a growing number of people using cloud services, and this includes private data such as hosted e-mail online photo storage sites. Careful attention needs to be paid towards getting this information secured.

## ***16.4 Average Users and Legal Issues***

In a recent study by the Pew Internet and American life Project 49% of US residents who use cloud computing services would be very concerned if cloud computing vendors would share their files with law-enforcement agencies.



Almost half of all people today use Web e-mail services such as Gmail. Fully a quarter use personal photo online sites that host pictures. This indeed may be personally since I information that some users would feel comfortable having out in public.

Even though cloud computing services can be very convenient it is almost hidden that there are elements of privacy concerns to possibly pop up in the future.

Although there have not been any serious data infractions as of yet, is sure that some point if something bad were to happen to someone's private data where a loss of information was reported everyone would hear about it.

## **16.5 Contract Issues**

With a trend of contracting cloud computing services out to cloud vendors and the adoption of new business models so organizations and users can access to IT products and services, the old-style licensing model that software is granted rights on a single computer for a single user on one premise has faded away.

The right to obtain an access to certain limited functionalities to web-based interface is the new model for business for cloud computing vendors. In some instances there may be limitation rights for size of files, time of use or number of times accessed which brings in new contract issues for software, especially applications that are used as a service through a Web browser environment.

There are implications to this, however, because at this point contracts for the use of application for legal purposes become more complex. As we have seen in previous sections, a term of service would be more expansive for applications of this type. This would include matters such as payments, warranty, termination, liability and protection of privacy of personal data relating to that particular application.

## ***16.6 Protection of Privacy***

It is a major concern that data remain private especially in light of the sections previously about Google and its ability to gain information about people and use it for marketing purposes. While this may not seem like a serious the fact that Google is able to target people specifically or their own personal information that is available to them brings up serious data protection on issues.

Popular privacy worries include things such as credit card information, Social Security information and job data. Also brought to light would be factors in full medical history. Having confidential article information released to the public or somehow compromised through data mining and collection means is a serious problem.

These are legitimate concerns that are at heart of traditionalists in the IT security sector. It is until situation because we do need to surrender information to others in order to make transactions that are part of every day in life. A lot of times users take for granted the fact that we are

able to keep data secure, yet there are always those stories in the media of information being stolen.

One issue that many in the legal field have noted is that even the largest breaches of security in a corporate environment go unpunished. The only thing that large corporations receive in the form of punishment is damage to their own reputation. Unfortunately this can easily be retracted using marketing dollars that are always at the disposal of the modern corporation.

The problem with personal information is that a lot of it is stored in a lot of different places especially in light of cloud computing. This is because there are numerous attributes that are transient for example bank account balances.

Many cloud vendors will claim that breaches could be avoided in cloud computing buyer because they secured access by authenticating users over secure connections there is a possibility data being stolen. But that may not always be accurate.

The major concern is the loose encryption is available in today's modern thin clients although companies do use secure socket layer technologies, the major problem is the thin client itself and who may possibly have access to that device.

Some might say the best way to keep information safe is not collect it in the first place. With most IT professionals now well versed in data mining and data aggregation technologies there is no doubt that personal information is

being spread all over the place and open standards for security protocols are most likely the best way to while any sort of future problem, which may result in an attack on personal information.

## **16.7 Data Segregation & Recovery**

Although encryption will be a highly cloud computing technology, it is not clear is if there are still going to data separation and segregation cloud environment. Also at issue during segmentation there may be problems with recovery issue of the data becomes separated from its master key in a database environment.

One thing that potential clients should ask their du jour cloud provider before committing to a service contract is finding out what level of segregation data that are data on virtualized servers in the data farm.

The best thing for cloud provider to do is provide evidence all the back that data is properly segregated through a solid encryption program that is to certified by an IT security technical specialist. This enables the cloud vendor to prove to the potential client that they are motivated to provide data that is secure and it is properly related.

On the topic of keeping data secure and segregated from data that is miscellaneous and has nothing to do with corporate function, is that restoration efforts should have a specific disaster plan outlined in the service level agreement for the cloud vendor.

Many IT professionals will keep in mind that any offering that does not replicate data as well as application infrastructure is probably own herbal to any sort of failure due to force majeure. A key question to inquire with cloud vendors is to ensure that they have the ability to perform complete data restoration.

One thing to keep in mind is that investigation post failure will be difficult in the emerging cloud environment because the tools to perform this type of searching is simply scare and/or nonexistent at this point. All recovery specialist must have a backup plan for all data is stored, even plan on although using cloud computing services making sure that there is a neutral site that can keep alternative backups.

These are some of the key reasons why many IT professionals feel somewhat can turn about the future of cloud computing is investigative purposes in the fact that the correct utilities and tools backup and recovery failure restoration simply do not exist yet.

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