

Strategies for Deploying Business Applications on the Cloud

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This paper starts with a summary of “Cloud computing” including Cloud service modes, deployment models, and Cloud environments. It then discusses the Cloud and its impact on business including opportunities and trends for the deployment of business applications on the Cloud. Examples of such applications are then discussed. This is followed by an evaluation of the benefits, risks, and costs of doing business in the Cloud. Finally, the paper discusses appropriate strategies for deploying business applications on the Cloud. The discussion is augmented, when appropriate and feasible, with mathematical models for calculating costs and assessing risks of some of these strategies.

CLOUD COMPUTING

The Cloud is a way to enable convenient, on-demand access to a shared pool of virtual computing resources, including networks, servers, storage, applications and services. The Cloud includes business services or applications positioned and maintained over the Internet often on a pay-as-you-go basis. A company which offers computing capabilities, as well as, storage and software for development of applications on the Internet, may be called a Cloud operation. The different capabilities, termed services, are referred to as “layers”. The various layers that are commonly in use are: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS).

- IaaS: Infrastructure-as-a-Service: This layer is used by customers to rent server capability, storage, and network infrastructure. Several major Cloud companies provide IaaS such as Yahoo, IBM, Amazon, and Microsoft (Goodburn and Hill, 2012; Alali and Yeh, 2012).
- PaaS: Platform-as-a-Service: Sometimes referred to as middleware, is the Cloud layer where software development can take place. PaaS Cloud companies provide a variety of software solutions for the development of applications; these include, but not limited, virtual servers and operating systems (Goodburn and Hill, 2012; Alali and Yeh, 2012).
- SaaS: Software-as-a-Service: Refers to all applications that are located on a remote server and can be accessed via the Internet (Goodburn and Hill, 2012; Alali and Yeh, 2012).

Cloud Deployment Models

Public Clouds provide access to computing resources for the general public over the Internet; however, the resources are owned and operated by the Cloud service provider. The public Cloud providers allow customers to control resources usually over a web service interface. Customers rent access to resources as needed on a pay-as-you-go basis. Public Clouds offer access to large pools of scalable resources on a temporary basis without the need for capital investment in data center infrastructure. This is the most cost effective model, for delivering Information Technology (IT) services,

for a business because they only acquire the computing resources they need and all the services are delivered with consistent availability, manageability, and security. However, this model provides less control and monitoring for the business. Public Cloud tends to cost the least and be less complex than the other Cloud models.

Private Clouds give users immediate access to computing resources hosted within an organization's infrastructure and the resources are only for that organization's use. Users control and scale resources from the private Cloud and from a web service interface, much like a public Cloud. The private Cloud is deployed within the organization's existing data center with the organization's own firewall. This means the private Cloud is subject to the organization's physical, electronic, and security measures which means there is a higher degree of security over sensitive data. This model provides the business the ability to enforce their standards with respect to data storage and security. Private clouds tend to be the most complex and costly among the various models.

A community Cloud contains features of the public and private Cloud models. The community Cloud is shared by several organizations, supporting a specific community. In the community Cloud model, rules are established and agreed upon by the various vendors. In order to be successful there must be cooperation between suppliers, providers, and users. This model is most suitable for businesses that have common set of needs and customers. The businesses can combine and share their computing resources. This leads to eliminating duplication of same resources thus reducing the cost of computing (Goodburn and Hill, 2012; Alali and Yeh, 2012).

THE CLOUD AND BUSINESS

The Cloud is becoming increasingly important to corporate strategy and overall business models. Many businesses already use Cloud computing. If they use email, that's a form of Cloud computing. If the company has a Facebook page, that's also Cloud computing. If they share videos on YouTube, that's Cloud computing as well. There is a lot of information and discussion about the Cloud and its impact on IT. There is less information on the impact that the Cloud is beginning to have on business. The virtualization of technology means virtualization of business applications, services, and processes. Overall this can result in complete virtualization of an organization. This change has had a large impact on business models and core drivers of competitive differentiation.

The Cloud allows larger organizations to move away from managing their own IT resources to focusing their attention on other important resources, financial and human; on their production, service, and marketing. Cloud computing also opens the door for smaller organizations to compete on almost equal footing with larger organizations since they no longer need to build extensive IT infrastructure. The Cloud is also impacting value chains, allowing companies to react more effectively to customer demand. Also, Cloud networks are growing, linking companies into single, virtual organizations.

Cloud computing requires, as with any transformational shift, that technical and operational hurdles need to be considered and addressed. Issues such as data storage and security, privacy and other technical and managerial issues must be carefully examined, and the right balance between cost, benefit, and risks associated with deployment of business applications must be achieved. As organizations seek to expand and look for new growth avenues, they should definitely consider the opportunities that Cloud computing offers (Goodburn and Hill, 2012).

Cloud computing provides businesses an easier way to deploy IT solutions or to combine the various residing technologies on the Cloud to respond to changing market business environment. Cloud environments are replete with applications built to meet specific needs, and many of these applications can be integrated to meet new requirements of businesses.

The Cloud is also a home to many applications that companies can "try before they buy," letting them be more aggressive and experimental in trying IT applications for solving their business problems (Goodburn and Hill, 2012).

OPPORTUNITIES THE CLOUD PRESENTS TO BUSINESS

By deploying applications on the Cloud businesses can increase speed to market of their products or services. This is due to reducing wait time on processing of information, a common value chain issue. With less wait time, companies can reduce product development life cycle times and change key processes, especially in the areas like planning, production, and marketing.

Cloud computing platforms make it possible for organizations to collaborate and share ideas and experiences with others in the Cloud community. This way, businesses can benefit from each other by sharing ideas about certain IT solutions to business problems, experiences in terms of performance and capabilities, resources both hardware and software, and benefits in the Cloud.

The Cloud can reduce IT costs and often changes how IT services are funded. IT expenses often become operational expenses (subscription base, pay as you go) and are no longer capital expenses. This move from capital expenditures to operational expenditures can have an impact on procurement and purchasing of the IT department.

Also, The Cloud has been an effective tool for gaining greater efficiency in applications ranging from email to photo storage to Web hosting. Many users of the Cloud computing services have already realized the benefits from this enhanced efficiency (Goodburn and Hill, 2012).

TRENDS AND SURVEYS

Many businesses are not shying away from the Cloud. A survey conducted in 2011 by Fran Foo showed that 50% of local companies plan to implement the Cloud computing platform. The industries surveyed included construction, manufacturing, retail, health, utilities and transport.

Also, out of the 255 technology decision makers who participated in the survey, half said their organization had plans to deploy their data and applications on the Cloud. Of this 22% preferred a private Cloud, 15% a public Cloud, and the remaining 13% said their companies would develop private Clouds with back-office systems that consisted of virtualization software. The last 50% did not have any plans to start into Cloud computing (Foo, 2011).

Information technology decision makers representing a cross section of organizations including education, government, and finance sectors also took part in the January 2011 study. The results showed that almost 74% of respondents said they did not believe virtualization improved the security of mobile devices connected to the enterprise network; 47% said they would not use virtualization in a mobile environment, while 31% said they would consider it in the future. Only 8% had a virtualized mobile environment (Foo, 2011).

INFORMATION TECHNOLOGY APPLICATIONS

Beyond the Cloud platforms and environments, the applications are the things that companies use to help them with different areas of their business. Applications can do everything from managing corporate finances, to assisting in the hiring and firing of employees, to processing customer orders. Cloud applications can be beneficial for essentially everyone in the business organization. Below is a summary of many IT applications in the Cloud.

Acumatica offers Cloud ERP software that gives companies a browser access to applications and documents. This is an example of SaaS or as a license purchase that can be hosted in the Cloud. Acumatica' application allows customers to streamline their distribution business including sales, inventory, shipping, invoicing, customer support and more. With no per-user fees and no software to install, companies can involve the entire organization including individuals in different offices and warehouses. Customized workflows allow users to maintain existing business processes or modify them based on availability of real-time reports and dashboards (Hickey, 2012).

Citrix ShareFile allows companies to create a custom-branded, password-protected space where they can exchange business files with clients securely. They can send large files by email, conduct a secure file transfer, and set up a collaboration space for project files (Hickey, 2012).

Cloud Cruiser delivers financial management solutions for Cloud service providers and enterprises migrating to the Cloud. For service providers, Cloud Cruiser helps automate multi-tenant Cloud billing. For companies they provide cost transparency, proactive cost controls, and chargeback across hybrid IT computing environments. Cloud Cruiser helps remove Cloud waste with its software that detects where cash is being used in the Cloud (Hickey, 2012).

Intacct offers a Cloud financial management system that includes built-in report libraries, best practices and industry expertise, and adaptable applications that can be customized for business processes. Features include; customizable workflows, fields, forms, documents, reports, and dashboards. This allows companies to eliminate the need for businesses to support their own financial management software, hardware, backup and disaster recovery (Hickey, 2012).

Intuit also offers accounting and finance solutions. Intuit is best known for Quick-Books. They moved away from their software-based roots and started offering Cloud based applications. Their SaaS offerings, connect customers to online products, such as TurboTax Online or QuickBooks Online. They also have PaaS applications that connect companies to each other, enabling them to share information and collaborate to solve problems (Hickey, 2012).

Microsoft created the Office 365 Cloud productivity suite. Companies can access Office virtually anywhere, across devices, so everyone in the business has the freedom and flexibility. They offer tools that make communicating with team members and customers easier. This also allows companies to reduce IT overhead and stop managing servers. Office 365 offers simplified administration, anti-malware and anti-spam protection, and a 99.9% uptime (Hickey, 2012).

NetSuite delivers accounting/Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Professional Services Automation (PSA) and Ecommerce in a single, integrated software solution. This allows companies to speed up business process, like order management and procurement. Upgrades are automated which reduces IT costs, and companies and employees can access the applications from any web browser or mobile device (Hickey, 2012).

Open Stack is a Cloud operating system that controls large pools of computer, storage, and networking resources that gives administrators control. This application, like many others is easy to use and offers advanced security features for highly regulated environments (Hickey, 2012).

Salesforce.com started with Cloud CRM and has since expanded. They offer many applications that can help businesses grow. Sales Cloud is a CRM application, Service Cloud is a customer service application, and Marketing Cloud is a Marketing application. Sales Cloud Log calls, allows companies to respond to leads and work with opportunities. Employees can collaborate with their team members from anywhere. With Service Cloud, companies can manage all of their customer service cases in one location, accessible to employees and users. Marketing Cloud is a Tool for listening, publishing and advertising on social media. This application allows companies to listen to their customers and advertise to reach new audiences (Hickey, 2012).

SOASTA offers a Cloud-based application that companies can use to test Cloud and web applications. The SOASTA Platform is an integrated testing platform created to test web and mobile apps. The platform uses the Cloud to affordably configure, deploy, and manage performance tests of any size. Its CloudTest uses Cloud resources for load-and performance-testing and simulates traffic hitting a site or app to see how it holds up (Hickey, 2012).

Taleo offers a Cloud-based, talent-management platform. Its features help companies with talent acquisition, performance and compensation management. The Cloud service collects relevant talent information throughout the employee's entire lifecycle, allowing HR personnel to control talent information to make improved performance and business decisions (Hickey, 2012).

Wyse offers Cloud Client Computing. It offers Cloud PC solutions with management, desktop virtualization and Cloud software to support desktops, laptops and mobile devices. Wyse has a Mobile Cloud Business Unit that offers the Wyse PocketCloud. The mobile Cloud app allows users to access

their desktop on OS or Android devices. It delivers the security, reliability, and user experience with low energy usage and total cost of ownership (Hickey, 2012).

Zoho.com offers a wide-ranging set of business, productivity, and collaboration applications. Customers use Zoho Applications to run their business processes, manage their information and be more productive without expensive or outdated hardware or software. To date, Zoho.com has launched online applications ranging from CRM to Mail, Office Suite, Project Management, Invoicing, Web conferencing and more (Hickey, 2012).

With the availability of such a wide array of offering of Cloud computing applications, it is necessary that a business entertaining the placement of some or all of its IT needs on the Cloud, to choose wisely among these competing companies. In the following sections of this paper we will recommend strategies for choosing where to place a given service.

BENEFITS AND RISKS

The idea of Cloud computing in business may sound great and easy to implement. But like all new technology that is being introduced into a business, which already has a system and method in place, it has many benefits as well as risks. It is important to analyze the benefits and risks when deciding whether, or not, to implement Cloud computing. Even though Cloud computing can be seen as a way to improve a business, not all businesses are the same. Therefore, cost/benefit analysis based on the Total Cost of Ownership is essential for the successful deployment of applications on the Cloud.

Benefits

Cloud computing can provide a number of benefits. According to Alali and Yeh, one of the main drivers of corporate interest in Cloud computing is the reduction in capital investments (Alali and Yeh, 2012). The Cloud provides a variety of ready solutions. Furthermore, the Cloud allows the customer to combine solutions, when needed, in response to changing conditions. Also, due to the way Cloud services are set-up, companies can “try before they buy” which can result in better business decisions. The following are strategies that a business can employ to try services before they subscribe to them.

Strategies for “Try before You Buy”

One strategy is to find all the Cloud services providers who support the “try before you buy” policy. Tabulate their policies and compare and contrast these policies among providers. As a result, this analysis might lead to a clear picture as to which provider (or providers) the business want to try. Metrics should be established to measure the performance of these providers with respect to the applications that are tried. The business, at the end of the try period, will have a solid measure(s) of which provider to engage for the service of their applications.

Another strategy is to deploy business applications simultaneously on more than one “try before you buy” Cloud provider; compare and contrast the measurement results and decide on which provider to contract for hosting the data and applications.

Metrics may include, but not limited to, Total Cost of Ownership calculations, cost of individual transaction, time to execute a transaction, cost of securing data, cost of unavailability of data, cost of unavailability of applications, cost of recovering data, and cost of recovering applications. It might be advisable in certain circumstances to combine some or all of these measures in a function emphasizing the relative values of these metrics. Some mathematical models are introduced in this section and the following sections to solidify this discussion.

The Total Cost of Ownership (**TCO**) is a well-established model for estimating the cost of owning, operating, and maintaining an application or a database.

Let **TCO (i)** be the Total Cost of Ownership of an application (or database) *i* on the Cloud. This cost can be negotiated with the Cloud service provider. **TCO (i)** may be compared to the Total Cost of Ownership of the same application or database on the enterprise data center. As a result, the enterprise will know the most effective way of operating the application or the database. Furthermore, the enterprise

may aggregate the **TCO (i) for all i** to produce a Total Cost of Ownership of its Information Technology needs on the Cloud. This cost is represented by the formula:

$$\text{TCO} = \sum \text{TCO (i) for all i} \quad (1)$$

If this TCO \geq the cost of operating the enterprise data center, then it is more beneficial to continue to operate the data center. Otherwise, the Cloud is the way.

Strategies for Using the Cloud to Share Ideas across the Enterprise

The Cloud also provides almost instantaneous information, reducing or eliminating information wait time, which is a problem in many value chains. With reduced waiting times, companies can reduce product development cycle times.

In public Clouds, platforms make it possible for companies to take advantage of sharing ideas, and development of new ideas with other members of the Cloud community. This way, everyone benefits from advances made by others in the Cloud community.

One strategy a business might follow to benefit from sharing information, about the Cloud and its providers, with other businesses is to join interest groups that deal with the Cloud. Another strategy is for the business to start an interest group for a specific deployment that has not been addressed by current interest groups. Either way, the business will benefit by sharing, in the experience of other users, and discussing the specific problems they face for a possible solution.

A third strategy is to blog about problems the business might have, and thusly, engage the Cloud community in promulgating possible solutions. Selecting a particular strategy over the others depends on the resources, human and know how, that are available to such a company.

Strategies for Cost Sharing

Lastly, the Cloud can be a very cost effective option for some organizations. The pay-per-use model offered by Cloud computing providers makes it very affordable for smaller organizations (large organizations too). Some organizations might share a Cloud with their vendors and suppliers, which reduce costs for both.

Even though the Cloud could be a source of cost savings to a business for deploying its IT applications and data, the cost still might be prohibitive. Cost sharing might be the way out of this dilemma. Cost sharing might take one of several forms. Cost sharing among vendors, cost sharing among suppliers, cost sharing among collaborators, and even cost sharing among competitors.

The cost sharing model may take a variety of forms depending on who owns the application and/or the data. One form is pay-per-use, another is to share the cost of the application and data, and yet another is bartering where one firm provides for the cost of application and say another provides for the cost of collecting and maintain the data.

Real-Life Examples of Cloud Benefits

Many organizations have taken advantage of Cloud operating environments, changing the way their technology is structured, used and administered. In the article, *The Cloud transforms business*, written by Goodburn and Hill (Goodburn and Hill, 2012), real-life examples of how businesses and organizations can benefit from the Cloud are given:

- A large American city decided to shift 34,000 employees from its operated email system to Google's Cloud-based email system, resulting in a cut in the city's operating expenses.
- The U.S. Federal Government launched a Cloud computing website where agencies can shop for Cloud services.
- Two retailers have piloted Cloud-based applications to connect to their suppliers. The retailers have recognized significant (50 percent) inventory reductions, as well as, a 30-percent reduction in out-of-stock.

- A large technology company decided for a Cloud supply chain platform to connect to its suppliers and was able to achieve its goals in a relatively short period of time. In addition, the Cloud platform helped reduce the overhead by 50 percent, and improved replenishment turn around by more than 50 percent (Goodburn and Hill, 2012).

Risks

One of the biggest risks or concerns with the Cloud is storage of sensitive data. The company usually places many controls over the physical and logical data that is stored inside its data center. However, when the data is moved to the Cloud the company loses these controls. The Cloud provider maintains their own hiring practices, human resources processes, and access control procedures. When data is offsite, data can become a target or susceptible to attack. Also, since data is traveling from the organization to the Cloud, it makes it easier to be intercepted. Technology is always improving so there are better ways to encrypt data, but hacking skills of individuals is also improving (Prakash, 2011).

Strategies for Dealing with Data Storage Risk

After sources of uncertainty have been identified and assessed, all techniques to manage the uncertainty fall into one or more of the following categories:

- **Avoidance:** This implies not performing the activity associated with the uncertainty.
- **Reduction:** This involves employing methods that reduces the uncertainty. In the case of deploying applications on the cloud, uncertainty reduction may be achieved by deploying these applications incrementally. Outsourcing could be considered a form of uncertainty reduction if the developer can demonstrate a higher technical capability than the originator of the application.
- **Transfer:** This involves buying insurance where the damages from uncertainty could be compensated for by the insurance provider.
- **Retention:** This involves accepting the uncertainty and budgeting for it.

The following are some precautions that could be exercised by a Cloud adopter.

- A Cloud client should determine if the data is suitable to be put on the Cloud. Performing cost/benefit analysis will definitely help in the process of classifying which data should be considered as a candidate for the Cloud.
- A Cloud client should find a Cloud provider that does security assessments to determine whether the application or the data is ready for the Cloud.
- A Cloud client may start with non-sensitive and less valuable data on the Cloud. This is an important first step until appropriate measures are considered and implemented to reduce the uncertainty that the Cloud introduce into applications and their data.
- A Cloud client may evaluate service provider agreements to determine how the Cloud provider secures data. This evaluation is detrimental in choosing a Cloud provider since it reduces the uncertainty for the client.
- A Cloud client should also insist on transparency of the Cloud provider so that they understand what's happening underneath the virtual Cloud infrastructure. This also goes a great way in reducing the uncertainty about the client's data on the Cloud (HP, 2010).
- The Cloud service providers may (and do) keep operations over multiple sites which are located in different countries. These countries have different laws governing data and computation and may for some reason confiscate data, data storage sites, and computing operations at any time and without notice. Therefore, the customer may be subjected to risks that were not taken into calculations. To deal with such a situation, the customer may include in the service contract its right to extract its data (and save on external storage devices) from the service provider sites at any time and for any reason it deems necessary.

Some or all of the above precautions may be instituted as policies and/or procedures for farming data and applications to the Cloud. A careful draft of and adherence to these policies and procedures will go a long way to reducing or eliminating some of these uncertainties (Farah, 2013).

Another risk or concern is data availability. Cloud computing is dependent on the Internet. If the Internet connection is lost, or one of the Cloud service provider's components malfunctions, access to the Cloud could be interrupted. This could occur in the middle of a task or transaction, resulting in the action being delayed or lost entirely if time sensitive (Prakash, 2011).

Strategies for Improving up Time and Availability

One strategy to deal with up time and availability is for the business to acquire redundancy of service, may be at the same provider or at a competing provider. Such redundancy of service may be available at a high cost for the business. A reduction of such cost might be possible if the redundant service is at the same provider. The business needs to make such decisions based on cost/benefit analysis where some applications might not need such a protection while others that are essential for the operation of the business need this type of protection. It is like buying an insurance policy where the cost of the policy must be balanced with the value of the insured asset.

The following is a mathematical model for assessing the cost of unavailability of applications versus the cost insuring such applications.

Let **CA (i)** be the cost of unavailability of application i. Let **CIA (i)** be the cost of insurance of application i. The net cost **NT (i)** for insuring application i is:

$$\mathbf{NT (i) = CIA (i) - CA (i)} \quad (2)$$

If NT (i) ≥ 0, then you are paying more to insure the application than it is worth its unavailability. In other words, you will be better off waiting for application i to become available when the provider fixes the problem. **If NT (i) < 0**, then you are better off buying the insurance coverage to insure the continuous operability of application i. In the aggregate, the above model becomes:

Net cost for unavailability of all applications is:

$$\mathbf{NT = \sum [CIA (i) - CA (i)] \text{ for all } i} \quad (3)$$

If NT ≥ 0, then the enterprise is paying more to insure the applications than the aggregate cost of their unavailability. In other words, it pays off for the enterprise to wait for any and all applications to become available after periods of unavailability. **If NT < 0**, then you are better off buying the insurance coverage to insure the continuous operability of all applications.

Regulatory compliance is also a risk or concern. Companies and their auditors are still responsible for assessing the security and control of service providers; more in section 7.

Lastly, data loss is also a risk with the Cloud. Data on the Cloud is almost always stored in an encrypted form to guarantee its security. However, when data is corrupted it is much more difficult to recover the original data its encrypted form (Prakash, 2011).

Strategies to Overcome Corrupted Data Recovery

To overcome delays in corrupted data recovery in terms of timeliness and accuracy, the business may build redundancy in their Cloud operation. This redundancy is better implemented at a different Cloud services provider just in case one provider has problems with their storage and security. A major issue is cost; and in particular who is responsible for the recovery cost, the Cloud operator or the business. This issue is better stipulated and resolved in the service contract between the Cloud operator and the business. A mathematical model for the cost of data recovery and insurance against data corruption is as follows.

Let **CD (i)** be the cost of loss, or corruption, of database i. Let **CID (i)** be the cost of insuring database i against loss or corruption of the same database. The net cost **NT (i)** of loss or corruption of database i is:

$$NT(i) = CD(i) - CID(i) \quad (4)$$

If $NT(i) < 0$, then the cost of insuring database i is greater than the value of loss or corruption of database i . In other words, the enterprise is better off waiting for the rebuilding, rather than paying to insure, the database. If $NT(i) \geq 0$ then you are better off buying the insurance coverage to insure the continuous operability of application i .

In the aggregate, the net cost (NT) of insuring the databases of the enterprise against data loss and corruption on the Cloud is:

$$NT = \sum [CD(i) - CID(i)] \text{ for all } i \quad (5)$$

If $NT < 0$, then the enterprise is better off not insuring the databases, and rebuilding the databases as they fail. However, if $NT \geq 0$, then some form of insurance against loss of databases is beneficial.

AUDIT RISKS AND REGULATORY CONCERNS

Outsourcing data and applications to the Cloud results in major difficulties for auditors whose job is to assess the controls of a company over its functions (Nicolaou, 2011). Auditors may not be allowed to audit applications and data on the Cloud even though it is necessary to discharge their duties. This is definitely the case of data and applications residing on a public Cloud. Auditing on a public Cloud might disrupt the service and compromise the security of other companies' data and applications that are residing on the same public Cloud infrastructure (Ryan 2011). In addition, the legal jurisdiction of the data is a major issue facing auditors. When data is placed on the Cloud, the Cloud service company decides where the data will physically reside. This could be in a foreign country where the laws add another layer of restrictions on the auditors' access, confidentiality, and security of the data.

Even before Cloud computing, the AICPA had rules about auditing vendors and service providers that clients had outsourced functions to. SAS 70 is a standard that allows vendors or service providers to obtain an independent audit, and issue one report that can be shared with all the companies that use them for service. Recently, effective June 15, 2011, a new Statement on Standards for Attestation Engagements (SSAE) 15 was issued. This standard replaces SAS 70, to keep pace with global international accounting standards. SSAE 16 standard is assisting service auditors in providing a broader range of options for reporting (Nicolaou, 2011).

The Cloud also has important federal tax implications. The actual location of a company's information and the servers is important. The exact flow of a transaction or, information, need to closely be kept track of to determine the government entities that have taxing authority over the information and/or the transaction. Along with federal tax, there are also state tax implications. For the state and local taxes, it is up to the Cloud service providers to understand their sales and use tax collection responsibilities. If the service provider fails to do this, these issues could subject the businesses to significant sales/use tax liabilities (Goodburn and Hill, 2012).

Strategies for Facilitating Audit on the Cloud

One strategy to facilitate auditing on the Cloud is to provide for such a responsibility in the service contract between the provider and the business. Penalties or cost of non-compliance with federal and state rules could be delineated in the contract. In addition, the business may insist on examining the service provider audit capabilities. Or, the business might insist on signing with service providers who are certified, by outside IT auditing firms, as meeting federal and state rules.

COST OF DOING BUSINESS IN THE CLOUD

Most companies will agree that the Cloud offers many tangible benefits. Many companies are struggling to find ways to cut costs. Cloud computing can be a great cost saving alternative. Cloud

operators like Google, Microsoft, IBM and many others provide today's companies with a large range of services as a major cost saving alternative to the traditional data center and IT department. However, moving to the Cloud can also cause unforeseen added costs.

Cost of Moving Data

Cloud providers might charge an upload or download fee. Even though the workload for the data move might be reduced in the future, the labor costs will go up at first. Companies usually have to scale up their staff size to help with the added workload from the move. Also, the amount of data companies have is increasing, as well as, the period of time they are required to keep records. Companies cost will increase when data increases and they will continue to pay as long as they are storing data. This doesn't mean that the Cloud will always be more expensive than storing data internally. Companies need to consider their internal storage and capacity needs and figure out if they can store data more effectively in the Cloud or internally.

Strategies for Dealing with the Cost of Moving Data to the Cloud

One strategy to deal with the expense of moving data from the business internal IT operation to the Cloud is to include it as a part of the cost of placing the applications on the Cloud. Such a strategy could be implemented in the contract between the operator of the service and the business. In this case, the Cloud service provider is responsible for securely moving the data. The service provider is better equipped to undertake such a responsibility since they deal with the storage and security of data for multiple clients and hence have the essential technology.

Another strategy is for the business to assume such a responsibility for moving the data to reduce the cost of the service contract. This strategy is desirable when either the amount of data is limited or nonexistent, or the data is of a marginal value to the business and can be duplicated in a short period of time.

Integrating Apps from Multiple Vendors

Another unforeseen cost is the cost of integrating apps from multiple vendors. If a company wants to use Cloud computing instead of a traditional software or platform, they must make sure that all its vendors who used the traditional software must also have access to the Cloud. Sometimes, this is not the case. For example, Pacific Coast Building Products wanted to start using Cloud computing so they evaluated several vendors. But the Rancho Cordova, California based provider of goods and services to the construction industry has limited its Cloud usage so far because the economics are not quite there yet according to the CIO.

Two reasons that the integration of apps is so difficult are 1) The difficulty of integrating software from different vendors in the Cloud, and 2) the fact that a single company would incur added costs if it tried to handle the integration on its own.

Without integration, the features and capabilities that are available are in many instances useless. These challenges exist with both small and large applications. With an ERP application, like SAP, putting it in the Cloud means companies would have to give up features or spend a lot of money on integration, with other vendors.

Strategies for Dealing with the Cost of Integration

One strategy is for the business to subsidize say its suppliers for using the Cloud to access the necessary software. This subsidy could be in amount over and above the cost that the subsidiary incurs for using their regular software. In other words, splitting the difference in cost with the subsidiary. Another strategy is to give the business to another supplier which uses the Cloud.

Testing Software

Testing software can also be costly. Companies should always test the software before migrating to the Cloud. Many companies run into unforeseen expenses that they did not expect, in order to test and

debug applications. The cost of such testing can be expensive and time consuming. Sometimes the company needs to modify existing test to accommodate the requirements of the Cloud service providers. Furthermore, the test results may not be as accurate because of the performance of the provider's hardware, software, and Internet connectivity.

Strategies for Reducing the Cost of Testing on the Cloud

One strategy to reduce the cost of testing on the Cloud is to acquire testing methodologies that other businesses have utilized. When the applications are similar, or the same, such previously used methodologies can be used with little or no modifications. The cost of such strategy can be considerably less than developing tests from scratch. When the business is engaged with interest groups and/or blogging, it can easily find out details of these methodologies and their cost.

Rent and Utilities

There are many costs to hosting a system internally, but these costs are not always paid out of the Information Technology budget. Cloud service providers often charge monthly rent and utilities, which is not something that companies would pay if they were hosting the system internally. Monthly subscription costs can add up, making your annual cost of hosting in the Cloud almost as costly as hosting the system internally (Violino, 2011).

Strategies to Deal with Reducing the Cost of Rents and Utilities on the Cloud

A strategy for assessing the true impact of the cost of rent and utilities charged by the Cloud provider is to estimate such cost the business incurs at its current operation. In other words, the business should come up with a reasonable estimates of the physical size that the IT operation occupies in office. A ratio of the IT office space to the total office space of the business is then calculated and the ratio multiplied by the rent of the business office place. The result is the current cost of the rent that will be compared to the cost of the rent charged by the Cloud provider. This calculation can take the following form.

Let **S** represent the total space (measured in square feet) of the enterprise facilities including the space occupied by its IT operation. Let **S (IT)** be the space the IT operation occupies (measured in square feet). Let **R** be the total rent (in dollars) that the enterprise pays for all its facilities including the IT operation facilities. The portion of rent of the IT operation facilities **R (IT)** is:

$$\mathbf{R (IT) = R * [S (IT)/S]} \quad (6)$$

In a similar fashion, the IT utilities portion could be estimated. For more accurate estimates of utilities used by the IT function, electrical, gas, and water meters might be installed if such accuracy is desired. These cost are then accumulated and compared to the utilities charged by the Cloud provider. Let **U (IT)** be the utilities attributed to the internal IT operation.

At this stage the business has some concrete estimates to base its analysis with respect to the cost of rent and utilities. Total cost of Rent and Utilities of the internal IT is then:

$$\mathbf{RU = R (IT) + U (IT)} \quad (7)$$

If the cost charged by the Cloud provider is less than or equal to **RU**, then the cost of rent and utilities is not a major decision variable to the business. Otherwise, and depending on the magnitude of the difference, the business might consider the cost of rent and utilities of the Cloud provider to be a major decision variable that might necessitate a further search for another Cloud provider or keeping the current IT operation as it stands.

SUMMARY AND CONCLUSION

The Cloud is increasingly becoming important to corporate strategy and overall business models. Cloud services' market is expected to grow and Cloud computing, as a platform for business IT needs, is on an increasing trend. Beyond the Cloud platforms and environments, the applications are the things that companies use to help them with different areas of their business. Applications can do everything from managing corporate finances, to assisting in the hiring and firing of employees, to processing a customer order. Cloud applications can be beneficial for essentially everyone in the business organization. As the Cloud has gained popularity, security quickly became a major concern. Both the customers and accountants and auditors reacted to security concerns. Auditors and accountants now play a major role in assessing the security and control of Cloud service providers.

To take advantage of opportunities and survive in fast growing markets, companies need to build an operational structure that is cost effective and scalable. Of course, it is important to first evaluate the benefits and risks and decide if the Cloud is the appropriate platform for the business need. As with any change to the IT strategy, determining whether Cloud computing is right for a business requires an extensive look to evaluate whether Cloud computing will support the business and organizational strategies. An organization considering the Cloud as a computing platform should assess its viability with respect to security, level of service, availability, and capability among other factors. When an organization has sufficient controls over its data and applications, the Cloud could provide a viable IT solution to an organization with a reasonable cost and technical knowhow. That is not the solution to every organization. Therefore, it is essential that a cost/benefit study is conducted before any commitment is made to migrate to the Cloud.

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