WP 1 – Review and analyze best EU and global practices in cloud computing

DEV 1.2 – Review on cloud computing service relate objectives

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# Introduction

# ‘Cloud computing’ in simplified terms can be understood as the storing, processing and use of data on remotely located computers accessed over the internet. This means that users can command almost unlimited computing power on demand, that they do not have to make major capital investments to fulfil their needs and that they can get to their data from anywhere with an internet connection. Using the cloud, even the smallest firms can reach out to ever larger markets while governments can make their services more attractive and efficient even while reining in spending. Where the World Wide Web makes information available everywhere and to anyone, cloud computing makes computing power available everywhere and to anyone. Like the web, cloud computing is a technological development that has been ongoing for some time and will continue to develop. Unlike the web, cloud computing is still at a comparatively early stage, giving Europe a chance to act to ensure being at the forefront of its further development and to benefit on both demand and supply side through wide-spread cloud use and cloud provision.

# In today’s business world with the amount of economic downturn and loss happening every day, the need for reliable, yet affordable technology is needed more than ever; cloud computing fills that void. Cloud computing offers its customers reliable service at flexible prices that do not break the bank. However, as good and innovative as cloud computing may be, it does not necessarily mean that cloud computing is good for all businesses. By researching the cloud computing services available, this paper explores the benefits, as well as the drawbacks of cloud computing within the business realm.

# Cloud Computing in Business

# Nowadays, companies continue to grow larger and larger, not only in the number of employees, but in the number of departments and type of employees. In cases such as these, cloud computing is a resource that is readily available to help companies meet their needs and accomplish their goals. Especially in small businesses, cloud computing is an excellent technological tool that can benefit the business. All businesses need to respond to competition by making better use of Internet services and offering more incentives than their competitors.

# Cloud computing can help business shift their focus to developing good business applications that will bring true business value. It can serve as a vital improvement to the business by acting as a potential disruptive innovation for its employees. However, these businesses should be mindful of the uses of cloud computing, as well as which services provide suitable public or private clouds (Staten, 2008). Since businesses are constantly trying to outwit their competition, cloud computing technology has become a popular idea and service. Countless companies make use of cloud computing, and in various ways.

# Cloud technology does not need to be created by the company that uses the cloud; rather it is provided by a cloud company infrastructure. For example, every company in Benchmark‟s portfolio uses Amazon‟s cloud infrastructure in one way or another (Ha, 2009). Even though, cloud computing is an innovative way to increase business value and productivity in the workplace, the use of this technology should be only for the people or workers who have access to the Internet right away. In some case, offline workers cannot use this technology because it is solely offered online (Miller, 2009). Therefore, cloud computing, in order for it to be used successfully, must only be used by companies that meet specific criteria with specific needs and resources.

# This paper will discuss the use of cloud computing and how cloud computing technology focuses on delivering true value to the business.

# About Cloud

# Cloud computing is still a hot topic today. However, even with all of the talk about cloud computing, there seems to be some debate as to a set definition of cloud computing. It is basically a technology that is used to access different services on the Internet “the cloud.” For the purpose of this paper, Haag and Cumming‟s definition will be used. According to Haag and Cumming (2010), “cloud computing is a technology model is which any and all resources-application software, processing power, data storage, backup facilities, development tools… literally everything-are delivered as a set of services via the Internet”(p. 205).

# Users of this technology can access the provided services on the Internet without having any previous operational knowledge. It is divided into a number of segments that include the cloud infrastructure, cloud platforms, and cloud applications. This type of technology involves a number of researchers and engineers from different backgrounds, such as grid computing contains software engineers and database experts (Wang &Laszewski, 2008). When it comes to competition, of course, each business wants to be better than the next. Its goal is to increase their profits with minimal output. To do this, many turn to cloud computing, but the use of cloud computing is not just spreading between different businesses; it is also about who provides the best service to its customers.

# Cloud computing has a number of different providers that a business could choose from. These providers are Amazon, Google, IBM, Yahoo, eBay and Microsoft. However, each one of these providers offers different functions within their cloud computing service. For instance, Google and IBM have already built different data centers that students can tap into over the Internet to program and research remotely (Lohr, 2007). Most of these companies have built services that use cloud computing to predict the market, tailor pricing and optimize their procurement and manufacturing. Moreover, these companies have come up with different Internet consumer services like social networking, email and Internet that use cloud computing.

# Cloud computing is considered to be better than other computing, meaning it offers better services and features than other computing options. This can be seen in that some cloud computing interfaces do not require users to change their working habits and environments (Wang &Laszewski, 2008), which is just one feature that makes cloud computing different than others, such as grid computing. In grid computing, users have to learn all the commands to access the service. It is essential in cloud computing to use virtualization, but in grid computing it is only necessary in the beginning. Also, a major different between these two types of computing is the application development.

# Cloud computing varies from grid computing slightly, where development applications are actually in the cloud, while in the grid these applications are only local. Moreover, the use of grid computing is more complex, whereas cloud computing is simpler (Weinhardt, Anandasivam, Blau, &Stößer, 2009). Cloud computing has different types of developments. Three important models or developments will be explained to give a better understanding about what cloud computing is. One development is called software-as-a-service (SaaS), this model allows users to pay for the software per one use.

# Another development called hardware-as-aservice (HaaS), which means that computing processing capacity is purchased on the web. For example, Amazon allows their customers to purchase data storage online from a service called elastic compute cloud. Lastly, another development is infrastructure-as a-service (IaaS), which allows cloud computing users to pay for the technology on a pay per use basis. The technology includes firewalls and anti-viruses software (Haag & Cumming, 2010).

# Cloud Computing Advantages and Disadvantages

# Today, cloud computing tends to be different than other computing. People use cloud computing in countless ways. Some people see cloud computing as virtualized computer resources. On the other hand, other people see it as a dynamic development or a deployment of software fragments. As previously mentioned, this kind of computing is not only different from other computing, but it also supports interactive, user-facing applications, such as web applications. Some of these web-based applications are accessed via browsers to not only to access these applications, but also to get the taste of desktop programs.

#  The use of cloud computing is an easy thing for developers. As a result of this, developers can retrieve application fragments such as a very simple web service or the third party software libraries because cloud computing implies component-based application constructions (Weinhardt et al., 2009). Also as mentioned before, cloud computing is a new technology, however like all technology it comes with both benefits and drawbacks. Cloud computing can be seen as a beneficial tool for businesses for several reasons.

# To begin, businesses can have lower cost computers for users. This means that the user does not have to have a high powered computer to run cloud computing web-based applications as these applications run in the cloud, not in the desktop or PC. Again, because the applications are run from the cloud instead of running them on a computer, cloud computing can improve the performance of a desktop PC. It is not unusual for many companies to have very high IT infrastructure costs and it is with the use of cloud computing that it actually lowers the costs of these infrastructures. As a result companies do not have to invest in a large number of powerful servers; the IT department of companies can then use the computing power of the cloud to enhance or change the internal computing resources.

# Another benefit is that cloud computing drives to lower software costs. Software can be an expensive resource for organizations. Organizations do not need to buy separate software packages for every single computer in the organization. Software can be accessed from the cloud by the business‟ employees. This type of technology provides a higher capacity of memory storage, so users do not have worry about their PC‟s memory storage (Miller, 2009).

# Moreover, cloud computing technology is actually able to improve compatibility between operating systems (OS). The user‟s OS can be connected to the cloud and still share documents with other users who have a different type of OS. Lastly, cloud computing provides the ability for multiple users to collaborate on projects or documents in the cloud. This point has been reiterated and reinforce recently as a major selling point to businesses. TV commercials and print advertisements have attempted to gather support for cloud computing by selling the idea that employees can work remotely, yet still efficiently through the use of the cloud.

# Cloud computing provides the ability to access documents from a distance. This may come as a relief for the forgetful employee that left his/her document in work or for companies that require employees to travel by giving him/her access to these documents from the cloud. The only requirements are a computer and an Internet connection. If these requirements are available for the user, documents can be easily accessed from anywhere (Miller, 2009). Yet still, while there are many benefits to using cloud computing, like all things there are some disadvantages as well. First of all, the use of this technology requires a constant Internet connection. In order for users to connect remotely to documents or applications stored in the cloud, users need to first access the Internet. Moreover, the Internet connection needs to be a strong speed connection. For example, if the user is downloading a larger document from a web-based application, it requires a large bandwidth for the connection.

# Also, if a high-speed connection is not used, the cloud can be slow in some cases due to the speed of the connection. The cloud seems to have limited features in applications as well. This can be seen when doing presentations in Google‟s doc. in the cloud; it is not the same with doing these presentations in Microsoft PowerPoint. Some features might be lacking when it is used in the cloud. One of the important disadvantages that users should be aware of is that it can be a little difficult for users to just simply store their documents in the cloud. Furthermore, data stored in the cloud can be unsafe. If the cloud was to go down and the user does not have a backup of her/his document, he/she will simply lose the document. It is also hard to trust cloud computing to store confidential document, in that it is possible for the cloud systems be hacked and accessed by unauthorized people (Miller, 2009).

# The Use of Cloud Computing to Improve Business Value

# The concept of cloud computing in business may sound ideal and easy to implement, but like all new technology being introduced into a business that already has a system and method in place it has both positive and negative aspects. As previously mentioned, cloud computing has both benefits and drawbacks, however it is vital to examine if these benefits and drawbacks are beneficial or detrimental to businesses when deciding whether or not to implement cloud computing.

# Although cloud computing has been recognized as a way to improve business, not all businesses are the same. So, is cloud computing for all businesses or is it more beneficial for a certain type of business with certain infrastructure already in place? One service provider that has been paving the way for businesses is Amazon. To narrow the scope of this research paper, Amazon‟s cloud computing services will be used to give a better idea of the uses of cloud computing in business, as well as how it can improve business. Amazon‟s cloud computing services serve as a model for this paper to describe cloud computing services due to the fact that its cloud computing services are one of the best available. Amazon has different branches of its company in seven different countries.

# Also, it has more than 79 million active customer accounts around the world, along with around one and a half million active seller accounts. Moreover, it has around 400,000 registered Amazon web service developers along with 17, 000 employees around the world (Vaira, 2008b). Amazon‟s platform includes the web services. Furthermore, Amazon provides its customers or sellers with web services that they can use to have easy access to documents, share files and applications, as well as store documents in the cloud (Vaira, 2008b).Taking a closer look at some of the services that Amazon offers will help determine what the business benefits of cloud computing are and who benefits the most from these services. Amazon offers its customers Elastic Compute Cloud web services. This web service has several advantages for customers, including elasticity, flexibility, decreased costs, and reliability.

# Another one of the services that Amazon offers is S3. This service is mainly created to securely store business‟s information in the cloud. Many companies like to store their information in the cloud as a way to reduce the expenses. By doing this, companies can save money instead of buying various powerful servers for storage. Rather these companies can just pay for this service and use Amazon‟s storage to store their information and allocate their funds to other areas within the business. The point of any business is to increase profit, while decreasing cost. Amazon‟s cloud computing has the ability to decrease costs in several ways. Especially, as businesses begin to downsize as a result of economic hardship, cloud computing can serve as a tool to not only decrease costs, but simultaneously increase profit, build better business relations, and remain current on technological advances.

# To begin, Amazon‟s Elastic Compute Cloud web services can reduce the costs of cooling and power, new servers, and server administration and management (Greggo, 2009). Thus, with these reductions a business is able to then reduce the amount of space, equipment, and energy needed to run the same business only cheaper and more effectively. Moreover, it enables businesses the ability to provide standardized and lower cost services (Etro, 2009). As a result of these reduced expenses, businesses will be able to free up operational budgets for new investments for direct business benefits.

# Also, Elastic Compute Cloud services can not only save companies money on the amount of hardware they must invest in, but also in the number of employees that they must hire (Varia, 2008a). This point is extremely beneficial for new businesses trying to get started. Also, for companies looking to reduce personnel because of limited resources or cutbacks, cloud computing can come to the rescue. The use of cloud computing will allow businesses to cut the cost of numerous employees for a task that can be completed by a few employees through the use of cloud computing (Galarneau, 2009).

# Furthermore, as a result of the reduced amount of hardware needed, business can cut the number of operations personnel once needed to manage hardware. However, while management may see this point as a benefit, for those working in IT departments this issue would be seen as a negative. What‟s more, is that by using Amazon‟s services, the hardware requirements can be increased or decreased within minutes, making the service elastic for its customers. While cloud computing can limit the number of employees needed on a given project, it can also bring together the key players in business. Amazon‟s cloud computing services can help teams, customers and suppliers meet, share ideas and basically do business more effectively and without delay (King, 2008). Given that team members, customers and suppliers can be given access to the cloud, business can be conducted like never before.

#  The use of cloud computing in any given company can help give them the edge over their competition, which ultimately increases business value. This shared access also essentially shortens the time it takes for customers or suppliers to access the market (Klems, Nimis& Tai, 2009). When the market is virtual and constantly accessible, both business profits and relationships can grow. In addition to shortening the time it takes for buyers and sellers to get to the market, Amazon architectures also shorten the amount of time that it takes to process “compute-intensive or data intensive jobs.” Amazon cloud architectures offer parallelization, which can reduce processing time. For example, “If one compute-intensive or data-intensive job that can be run in parallel takes 500 hours to process on one machine, with Cloud Architectures, it would be possible to spawn and launch 500 instances and process the same job in 1 hour” (Varia, 2008a, p. 2). Therefore, it can be seen that Amazon‟s cloud computing services can not only reduce costs in terms of hardware, but also save money by saving time in turn allowing for the business to grow.

# Still though, business growth can also be a problem. Even though business growth is what businesses essentially strive for, if a business outgrows its infrastructure then they may begin to slip backwards. Through the use of Amazon architectures, businesses not only have room to grow, but also scale back if need be. Pay-per-use services allow for businesses to only pay for what they need. This service will save system administrators from worrying about hardware procuring or making better use of excess and idle capacity (Varia, 2008a). Now, system administrators can have the applications either request more capacity or relinquish unused capacity.

# Moreover, Amazon‟s system does not require a specific amount of capital to be invested, providing for inexpensive services. Amazon allows for customers to pay for the services used, instead of paying for a service, only to find that the business did not used the services paid for or greatly exceeded the amount of service purchased. Specifically, Amazon‟s Elastic Block Store only charges $0.10 per gigabyte of storage and $0.10 per million IO transactions (Kondo, Javadi, Malecot, Cappello& Anderson, 2009). This demonstrates the flexibility of Amazon‟s services for users in that it allows them to choose the specification of each individual instance of computing power purchased (Varia, 2008b). Although the use of Amazon‟s cloud computing services can be seen as highly beneficial, not all businesses are ready to jump on board.

# Many businesses have doubts about whether cloud computing services, like Amazon, are able to service large businesses in a way that is cost efficient and reliable (Seeley, 2008). Large businesses have voiced concerns over the use of cloud computing. Some of the concerns include initial start up costs and data center constraints. These large business concerns are not unfounded; however their reasoning may be under informed. The initial start up cost for large businesses may be expensive, as switching between any services can not only incur new costs, but most importantly can be time consuming (Staten, 2008); and in business, time is money.

# However, the long-term costs of switching services may be more profitable for large businesses willing to make the shift. Using the costs of Google Apps and Microsoft Office Professionals as an example of the cost of switching services, it can be seen that Google Apps only costs $50 per user per year in contrast to Microsoft Office Professionals which retails at $499.00 (King, 2008).

# Likewise, Amazon boasts reliable services because it makes use of Amazon data centers and network infrastructure (Vaira, 2008b). Large businesses fear that data centers may not be able to keep up with their extensive needs. Also, the possibility of outages forces these same large businesses to rethink the use of cloud computing services. Data center downtime would result in profit loss. Still though, outages can happen both within a business‟ own IT department, as well as with Amazon services.

# However, it seems more likely that outages would happen within a business‟ own IT department, rather than with Amazon‟s services (Seeley, 2008). This is not to say that Amazon‟s service has never had an outage. In 2008, Amazon‟s S3 service was down for six hours (King, 2008). With less server outages, system administrators can focus their attention on driving innovation to improve business growth allowing for increased business value. So, it can be seen that cloud computing services, like Amazon‟s, can be used by all business types. Still though, they may be more ideal for smaller businesses or especially ideal for businesses just starting.

# The Economics of Cloud Computing

# There are many reasons for organizations to move from traditional IT infrastructure to Cloud Computing. One of the most cited benefits is the economics of the Cloud. Yet while many people point out the cost savings that Cloud Computing brings to an organization, we believe attention should be drawn to four distinct mechanisms through which these cost savings are generated:

# By lowering the opportunity cost of running technology

# By allowing for a shift from capital expenditure to operating expenditure

# By lowering the total cost of ownership (TCO) of technology

# By giving organizations the ability to add business value by renewed focus on core activities

# The study found that 88 percent of cloud users pointed to cost savings and 56 percent of respondents agreed that cloud services have helped them boost profits. Additionally, 60 percent of respondents said cloud computing has reduced the need for their IT team to maintain infrastructure, giving them more time to focus on strategy and innovation. And indeed, 62 percent of the companies that have saved money are reinvesting those savings back into the business to increase headcount, boost wages and drive product innovation. "The study shows just what an important impact cloud computing is having on U.K. and U.S. businesses," Engates says. "It's particularly interesting that, despite the ongoing economic backdrop, half of businesses on both sides of "the pond" are actually increasing profits and growing their business through the use of the cloud. This includes investing in headcount and wages as well as driving further innovation."

# Turning to Cloud for Storage and Collaboration Apps

# The services or applications organizations are moving to the cloud are largely dependent on company size and industry, according to CDW. For instance, storage is the primary service for 40 percent of small businesses and 35 percent of mid-sized businesses, whereas large businesses and the federal government are first and foremost going to the cloud for conferencing and collaboration applications (40 percent and 39 percent, respectively). Organizations are also turning to the cloud for messaging, office and productivity suites, business process apps and compute power. However, reducing IT operating costs is only one of several cloud benefits, according to cloud users surveyed by CDW. In fact, organizations implementing or maintaining cloud computing point to increased efficiency (55 percent), improved employee mobility (49 percent), increased ability to innovate (32 percent) and freeing current IT staff for other projects (31 percent) as the top benefits. Reduced IT operating costs come in fifth on the list of benefits (25 percent).

# Calculating Cloud ROI

# When you set out to calculate your cloud ROI, Paul Croteau, an enterprise solution engineer at Rackspace, says you'll need to consider factors that are relevant to your enterprise application portfolio and specific computing needs.

# First, Croteau says, your ROI analysis should take into account broad considerations like cost per unit of computing power, the tradeoff of the amount of labor necessary to redesign applications that need to operate in a cloud environment and intangibles like time.

# "Moving to the cloud also adds new factors into the ROI equation that require thinking beyond the realm of items like capital acquisition, licensing of software and depreciation," Croteau says. "For example, users only pay for what they use with a cloud platform, and you can see exactly what the power is costing you through the transparency of a cloud provider's interface. Another prime cost benefit of the cloud's economy of scale is the ability to scale up and down quickly, across a number of investments."

# "Cloud computing can create a significant return on investment, affording energy, licensing and administrative costs, and it frees up capital and personnel to innovate on new ideas quickly," Croteau adds. "Moving to the cloud is a transformational investment, in every sense of the word—but it's a move that many of today's organizations find compelling."

### Building a Cloud Roadmap

CDW offers the following recommendations for building your cloud roadmap:

* Tap a cross-section of your stakeholders for a thoughtful analysis of benefits and costs, and then select a cloud strategy consistent with your IT service fulfillment model.
* Launch first with services that don't pose unacceptable risks to your organization, aren't business critical and where complexity of implementation is low (storage, unified communications and office productivity apps, for example).
* Leverage your user's familiarity with consumer cloud offerings to maximize the success of cloud adoption.
* Independent software vendors will bring new features to market faster with cloud applications, so follow those changes closely.
* Start planning today; understand your internal "cost to serve" per application, which will help determine ROI for public cloud solutions.
* When working with cloud providers, look for contracts that establish and enforce service levels and security standards.
* Work with a software licensing expert to clarify and resolve issues affecting applications your organization wants to move to the cloud.
	1. **The Problem with the 80-20 Rule**

The 80-20 rule is often used within organizations to illustrate the large effects that small variables can have. It was first suggested by business management thinker Joseph Juran and originally called the Pareto principle after Italian economist Vilfredo Pareto. Rather than an absolute measure, it tends to be a generalization that is intended to make a point about distribution curves.

The most well known use of the rule is the sales 80-20 rule which says that 80% of revenue for a business is derived from 20% of customers. Information Technology has its own series of 80-20 rules. As we detailed in a previous CloudU report Gartner estimates that IT maintenance accounts for around 80% of total IT expenditure.

However we contend that the 80-20 rule occurs elsewhere within IT and relates to time, just as must as it relates to monetary costs. When we look at organizations running their own data center infrastructure, and extend Gartner’s findings, we hypothesize that only 20% of the time and effort that goes into running applications, where all business value is concentrated, is actually concerned with running those applications themselves. The diagram below illustrates the extent that routine and non-core tasks, like patching operating systems and performing backups, impact upon the time of IT departments.



# Cloud Computing is a force that helps flip this ratio and gives IT departments the ability to spend 80% of their time on core business processes, like business application design. It’s for this reason, the ability to go from 20% of time and money dedicated to core business processes to 80%, that the economics of Cloud Computing is so compelling. Nowhere is the current model’s inefficiency more evident than in the opportunity costs that organizations pay to manage their own computing needs.

* 1. **Opportunity Cost**

Opportunity cost, a concept first developed by British philosopher John Stuart Mill, is a basic economic premise that is concerned with the costs related to the choices NOT made by someone. Opportunity cost is the cost related to the next-best choice available to someone who has picked among several mutually exclusive choices. It is a key concept in economics opportunity costs are not restricted to monetary or financial costs: the real cost of output forgone, lost time, pleasure or any other benefit that provides utility should also be considered opportunity costs. Opportunity cost is an important concept when discussing the economics of Cloud Computing because it allows one to assess the true cost of any potential action. When choosing a particular direction for IT spend, for example, there may be no direct cost attached to maintaining the status quo - data centers have already been built, software purchased. However by including opportunity costs in any calculation, an organization allows for a truer comparison between the various choices to be made.

With this explanation of opportunity cost, we can now apply the concept to a decision to either retain on-premise IT or move to the Cloud. As we’ve already seen, roughly 80% of IT time and expenditure is wasted on processes that don’t create any value for the organization (beyond maintaining the status quo). The opportunity cost of not choosing the Cloud is therefore the benefit that can accrue to the organization through optimal utilization of that 80%.

To put it simplistically, a move to the Cloud can make the difference between an organization being 20% efficient, and one being 80% efficient. While opportunity cost, and the value to be gained by reducing that cost, is a compelling benefit of moving to Cloud Computing, many critical readers will want to see more concrete examples of the economics at work. To this end it is important to understand the gains to be made from a move away from capital expenditure, and over to operating expenditure.

* 1. **Financial Considerations**

OpEx is beneficial for the organization, as it gives it the flexibility to terminate costs at will. With a capital purchase, the server or software being acquired is fully committed to. Regardless of whether it is being utilized, the ongoing costs (by way of depreciation or financing costs) still need to be borne. Contrast this with OpEx where, in the event that the item is no longer required, payments can cease rapidly. It is for this reason that many companies prefer leasing vehicles in place of purchasing them outright. While it is true that organizations pay a premium per unit for the flexibility to be able to suspend service, as we will see elsewhere in the report, the total cost of ownership of owned assets is much higher as demonstrated in the chart below.



# Conclusion

# Cloud computing touches a wide range of policy fields. Ongoing policy initiatives such as the data protection reform and the Common European Sales law that will lower barriers to the uptake of cloud computing in the EU should be adopted quickly. In parallel, the Commission will deliver on the key actions identified in this Communication in 2013, notably in respect of the actions on standardization and certification for cloud computing, the development of safe and fair contract terms and conditions and the launch of the European Cloud Partnership.

#  We believe that there are significant economic benefits to be gained from a move to Cloud Computing. These benefits accrue to a business in two distinct ways – directly through reduced costs and indirectly by allowing for increased focus on core business functions.

# There are multiple forces at work leading to the growth of Cloud Computing. The economics are but one of these forces and, as such, we urge organizations considering the Cloud to look at broader benefits and impacts beyond pure economics.