

# **THE BENEFITS OF USING CLOUDING COMPUTING TECHNOLOGIES FOR FILE MANAGEMENT**

Submitted  
to  
Claire Farley, Teaching Assistant  
University of Ottawa  
75 Laurier Ave E  
Ottawa, Ontario

by  
Zarif Shahriar, 8177206  
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The report examines the benefits of cloud computing technologies in file management. Security and accessibility issues associated with local storage have caused an eruption of cloud based services to appear. The report describes the advantages of using cloud based file management compared to local storage. There will also be a discussion about the costs and steps associated in switching to a cloud based computing system.

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## ABSTRACT

As the internet gets larger and computer technologies grow, the data being used increases as well. Within a decade the speed of data transferring over the internet has substantially increased. As consumers moved from dial up connection to high speed fiber optics the power of the internet has become apparent, and some companies caught on.

Companies such as Salesforce made the first push into using the internet as a mean of hosting services and utilities. Amazon continued by creating its own cloud based product that would allow consumers to purchase server space over the internet to host files or programs of their choice. This became known as cloud computing and soon revolutionized what the internet could do.

With cloud computing local storage was no longer necessary as users would be able to safely store files in the “cloud”, a term used to describe space in the internet. This meant a user could always access their files as long as they had internet connection. File management no longer needed complex and cumbersome hard drives and storage utilities. As cloud technology improved over the years the costs also decreased, making mass consumer usage possible.

Cloud servers also came with enhanced security features that allowed files and programs to be secure, regardless of where it was being accessed from. These features prompted many organizations to create their own cloud servers and from it the fundamental models of cloud computing were developed. More companies meant more competition and the cost metrics for cloud computing began to create affordable options for organizations to switch into.

Cloud computing offered much more than local storage in terms of file management and security options, prompting many industries to immerge solely in the form of online services. These are often called Software as a Service solution. Although there also other industries that can benefit from these additional improvements over local storage. With local storage requiring maintenance and upgrades, on average opting for a cloud service provider will be a better financial decision towards company resources.

Because of the added security and file management benefits, software engineers and computer scientists can take advantage of the cloud. Since software development often occurs in large teams, file management becomes very important. With the cloud, team members can access each other’s updated code without having to copy it onto a USB. Computer scientists also benefit from the cloud as it allows programs created with sensitive algorithms to be stored in an encrypted cloud server, offering protection against cyber-attacks.

With the advantages of cloud servers in terms of security, file management and cost metrics, cloud computing is a better solution for software engineers and computer scientist over local storage.

# 1. INTRODUCTION

The way of transferring files and data has changed much since the dawn of the PC. There was a time when floppy discs were enough to store data and hard drives were a luxury. However, times have changed and the data being used has changed as well. Today most files and documents are accessible through various websites with online storage. This storage allows for users to upload files to the website and others to download them. This is possible because of cloud computing technologies.

The purpose of this report is to examine the benefits of cloud computing technologies and how it can alleviate many file management and security issues. File management and data transferring are two important concepts in the fields of software engineering and computer science. This report will introduce many advantages associated with cloud computing to software engineers and computer scientists. It will allow them to make a more informed decision on their file management and security protocols going forward.

The report will consist of four sections. The first section will explain background information on cloud computing including: the history of cloud technology, understanding what cloud computing is, as well as the fundamental concepts and models associated with the cloud. The second section will examine the findings of the research such as: cloud architectures for file management, cloud security for users and files and the costs associated with using the cloud. The third section will discuss the recommendation based on the findings. The final section is the conclusion which will summarize the findings on cloud computing and its advantages in file management and security issues.

# 2. BACKGROUND INFORMATION

## *History of Cloud Technology*

The history of cloud technology began with the internet. The internet allowed users to send and receive data and by the mid 1990's it also allowed users to access emails and use websites such as Google to search all over the internet. The popularity of these services drove a large push into the internet era, allowing companies like MySpace and Yahoo to gain a major consumer base. In the late 1990's a company named Salesforce began to host services offered by many companies on their website. This allowed users to access these services from anywhere with internet, making it the first cloud based service.

Hayes (2008) describes that as more companies created cloud bases the technology became easier to access. Commercial use began as early as 2006 when Amazon released its cloud product *Elastic Compute Cloud* which allowed users to store programs and data over the internet instead of on a hard drive (Hayes, 2008, p. 9). Since then the world has seen massive cloud based technologies such as Google Drive, DropBox, iCloud and others. These services allow companies and users to take advantage of the internet and because of this have grown exponentially.

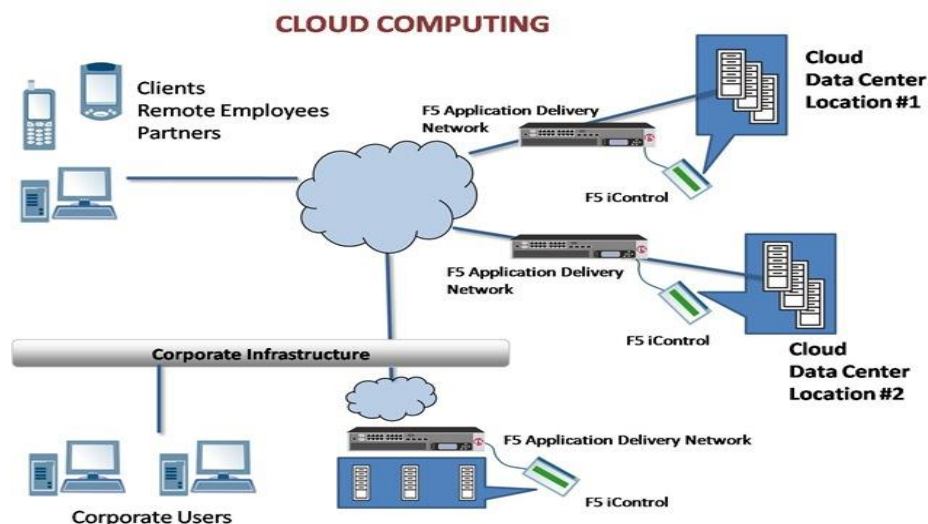
## ***Understanding Cloud Computing***

A “cloud” refers to an information technology (IT) that is designed for the purpose of implementing a scalable storage that can be measured and accessed. It was originally used as a metaphor for the internet but has since developed to something else. Erl (2013) describes that although the cloud is a type of network like the internet, it does not provide the same access. Where the internet is openly accessed by anyone with an internet connection, the cloud can only be accessed by those who own it or have permission to use it. By making this differentiation we can see how cloud computing becomes possible. (Erl, 2013, p. 34)

Cloud computing is a term used to describe running computer programs or accessing files over the internet instead of a computer’s hard drive or local storage (Griffith, 2016, p. 1). The way this happens is through a network or server, often called the cloud. The cloud acts as a storage, or a safe for all the files and items that it can store. In case of a hard drive failure or a trip across the world the files are always accessible as long as there is an internet connection.

By using the internet protocols the cloud server is able to send files to a computer or user whenever it is requested. It is also able take a file and store it, given the server has enough space. The cloud itself is actually hosted on multiple computers in a datacenter somewhere in the world that allows it to store massive amount of data. This means that often times the files that are being sent in one part of the world is being received in another. This can lead to advantages and disadvantages depending on the country where the datacenter is as the files are under the legal laws of its host.

Ruperalla (2016) explained that in the cloud there are systems in place that allow multiple user to access a file, but each user can access it in a different way based on their authorization (p.105). The figure below demonstrates how a single cloud can be shared by different users who have different uses and authorization for whatever data the cloud server holds.



Cloud Computing

Figure 1. The picture shows how multiple users can access a cloud server (shown as the cloud) based on their role. *Source: Shukla, 2014: Cloud Computing.*

Figure 1 shows how the cloud works by highlighting the different users that can access it. The diagram shows how the Data Centers manage or send data to the cloud through “Application Delivery Networks”. It also shows how the different infrastructures then utilize it. In the case of corporate use, companies can create smaller versions of the cloud for different branches or teams. For personal use such as computers and cellphones the cloud can be directly accessed if necessary. This explains how users can access files without having them locally on a hard drive by using cloud computing.

### ***Fundamental Concepts and Models***

Using cloud computing means allocating network resources to a server. In order to achieve maximum efficiency and usability the cloud must be created using concepts and models that outline how it stores its data and how much it can store at once (Korzeniowski, 2009). These are called the fundamental concepts of a cloud server model. There are four common uses of a cloud: Software as a Service (SaaS), Platform as a Service (PaaS), Infrastructure as a Service (IaaS) and Desktop as a Service (DaaS). The table below describes each model function and what it can be used for.

Table 1: Description of Clouds Models

<b>Service based Architecture</b>	<b>Advantages</b>	<b>Features</b>	<b>Examples (Service Providers)</b>
Software as a service (SaaS)	Offers application as a service on Internet	Easy to collaborate or access data, Pay per use.	Google Apps, Microsoft 365, Salesforce.com,
Platform as a Service (PaaS)	Used by developers for developing new applications	Allows for launching new application, requires minimal expenses	Google App Engine, Microsoft Azure, Salesforce.com
Infrastructure as a Service (IaaS)	Providers Provide the features on demand, used for storage or other utilities	Small portion of cloud is provided free.	Amazon Elastic Compute Cloud, Rackspace, Dropbox, iCloud, Google Drive
Desktop as a service (DaaS)	Virtual Desktop Infrastructure where third party can host desktop services	Data storage, security and backup managed by service provider	Citrix

Table 1. The table describes each of the four models for cloud storage and gives examples for each one. *Source:* Kumar, 2012: World of Cloud Computing and Security.

### **3. DISCUSSION OF FINDINGS**

#### ***Cloud Architectures for File Management***

In order to take advantage of cloud storage features there must be an architecture in place for the files. This means that depending on what is being stored, the cloud should be optimized and secured. This is where cloud infrastructure is important. According to Kumar (2012) Cloud computing relies on 4 different types of infrastructures for file management. The first type is the most general, a public cloud. A public cloud allows users to access and share files from anywhere with anyone. These are typically suitable for private use for sharing files between friends or family or keeping a backup for data.

The second type is a private cloud. These clouds do not allow open ended file transfers from the cloud server. The structure of the server is authenticated. This means that users must have certain credentials to access the cloud and further authorization to access more secure files. This type of cloud is often used for internal teams within organizations to secure employee data. In the fields of software engineering and computer scientists, private clouds are almost always necessary in order to work on large scale projects and share code with team members.

The third type is a hybrid cloud. These are servers that incorporate both aspects of the above features, allowing for certain files to be shared openly while others remain completely secure. Often times storage platforms such as Google drive or Dropbox implement these features to allow user to share a single file from the cloud without compromising the other files.

The final type of cloud system is called a secure cloud. These clouds allow for maximum security of a system and server by limiting access by means of encryption of data and monitoring user traffic. (Kumar, 2012, p. 54-57)

#### ***Cloud Security for Users and Files***

With the cloud architecture in place, there is still more security features available for files and users that use cloud computing. Chee and Franklin (2010) describe that cloud security has the advantage of being able to stop traffic at the provider's network by preventing access to malicious data (often times we see this in schools or organizations when certain websites or online resources are blocked) before it enters the enterprise network (Chee & Franklin, 2010, p. 376). This feature of filter can also be placed on data stored on the server. This will allow the cloud to erase data that has not been used in a certain time, or by other criteria's defined by the cloud architecture. The cloud can also backup any data stored for future use.

Another advantage and security feature of cloud servers is that it can be updated much easier than a local hard drive. Since the entire server is over the internet the updates to the security is simpler to implement then it is on hard ware like hard drive and computers (Erl, 2013, p. 117). This allows cloud computing to remain ahead of the latest malicious viruses by frequent updates.

Having data on a secure cloud server will also encrypt all the files in the case of cyber-attacks. Although cloud servers have more security features compared to local storage, cyber-



crime is still a real threat. With the growing industry of online storage, cloud computing will still remain a target for cyber criminals.

**Cost Metrics and Pricing Models**

In order to determine the price model for a cloud server there are some factors that are considered. Ruperalla (2016) describes these factors in detail. The first aspect to consider is the use of the server. Depending on the users of the server (large corporations with sensitive and high amounts of data vs private user using it for school or sharing photos) it is possible to determine how large and complex the server must be. As mentioned in the *Cloud Security for Users and Files* section, there are many ways to secure the cloud, some will cost more than others, with the highest security costing the most.

Once the user base and security systems have been decided on the next cost to be considered is the maintenance. Since the cloud is run on a server there will be costs associated with maintaining the server equipment (i.e. Rental of office space to hold server, heating and cooling for servers, update costs etc.).

The final cost to consider is the cost of renting out a server. If creating a server is not required, it is often a good idea to buy or rent a server. Servers would often be in IaaS or SaaS platform. With a definite plan, Ruperalla (2016) mentions that getting a server up and running for an organization could take anywhere between a week to a month (depending on creating a server or renting one out) (Ruperalla, 2016, p. 68-72).

The following graph shows the difference in running a cloud service such as Microsoft Office 365 versus using an on premise or local software licensing of Microsoft Exchange. Note that office 365 also offers more programs and utility then Exchange does on its own.

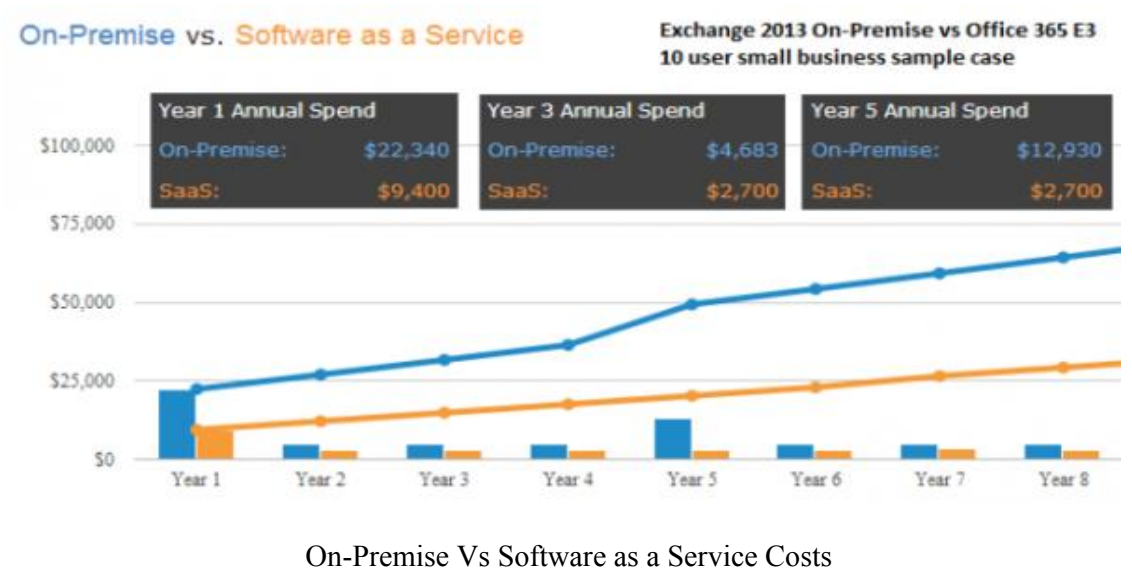


Figure 2. The graph compares the cost of local storage (blue) to a SaaS counterpart (orange). *Source:* Wlodarz, 2013: Comparing cloud vs on-premise? Six hidden costs people always forget about.

In figure 2 the local storage solution of Microsoft Exchange requires an organization to pay large amounts for corporate licensing, IT installations as well as maintenance (updating service, handling problems etc.) over the first 5 years. By the fifth year there is yet again a large cost associated with licensing the newest software since software older than 5 years is very outdated. This results in higher costs for an organization. In the SaaS solution there is also an installation cost in year 1 that is less than half of its local storage counterpart. SaaS however does not require maintenance and IT staff since the service provider already provides this. There are no additional costs over the years (other than a slight increase in subscription price to account for inflation) as the subscription covers all future updates. It is clear from these results that most organizations will indeed benefit from switching to SaaS or IaaS as a platform for file management and other services.

#### 4. RECCOMENDATIONS

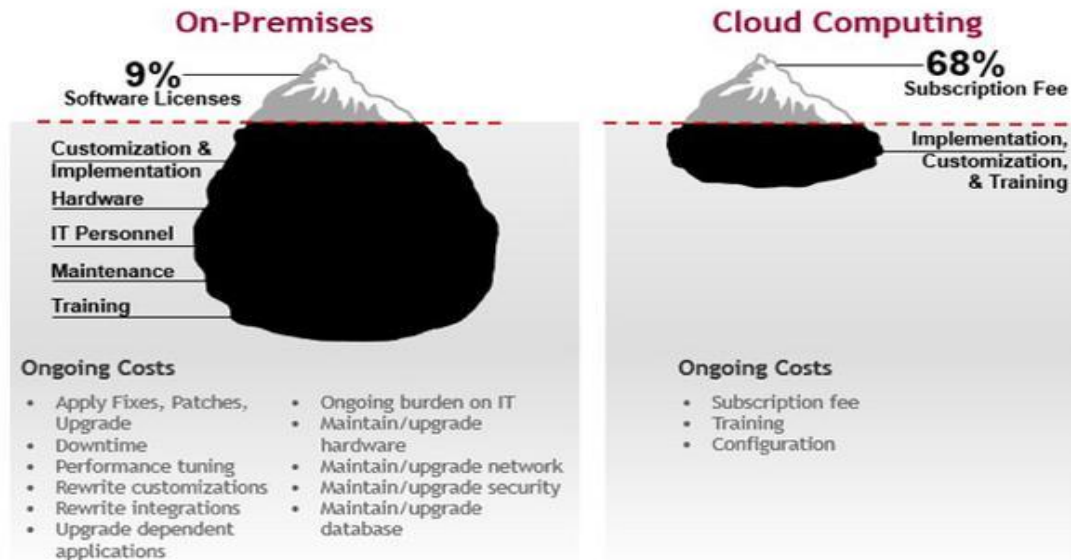
In organizations that deal with software and computer sciences, cloud technology can improve work flow and file management significantly. This is because having a cloud server to store files allows other team members to quickly catch up on any changes to a code repository (for writing software programs). Changes made by any other team member can be accessed and tested without the need of USB's or other file transfer hardware. Cloud computing has also made possible the use of version control for software and computer scientists. Since the cloud is able to backup files, if a software developer makes changes to a program that suddenly causes major problem, it can always be reversed.

For computer scientists' security is an important concept in order to prevent data theft of algorithms involved in many major infrastructures (bank codes, security verification, encryption etc.). By utilizing a cloud server's comprehensive security features, the algorithm and work of these programs can be kept secure and away from cyber thefts.

The many options and features that cloud servers present over traditional local storage offer many reasons to upgrade. Organizations can pick and choose a provider and host services they offer directly without having to manufacture hard copy versions of a program. Business practices such as these will allow a company to cut costs and still offer the same services from before. Depending on the goals and objects of a company, cost metrics for cloud services can vary.

Often times the high subscription costs of cloud servers create a stigma towards its benefits. However, the costs and work that goes towards common on-premise and local storages often far outweigh the subscription costs associated with a SaaS or IaaS solution. A single payment for licensing often seems more appealing than a monthly subscription and because of this many software organizations have not yet made the change.

The figure 3 below summarizes this stigma and shows how indeed cloud based technologies are more affordable to use as discussed in *Cost Metrics and Pricing Models*.



### On-Premise Vs Cloud Computing Ongoing Costs

Figure 3. The picture shows the tip of the iceberg that most consumers see when looking at local vs cloud computing costs. *Source:* Smith, 2016: Web GIS Is Not Optional (Unlike Your IT Department).

## 5. CONCLUSION

As the Internet expands and computer technologies continues to improve, having the appropriate methods and software to secure and manage data is very important. By utilizing a cloud server, software developers and computer scientists can benefit from fast file sharing and secure file management. Cloud computing can expand the market of many software organizations by allowing SaaS or IaaS as intermediaries to host and maintain software programs developed.

By switching from a local storage, cloud computing can offer on average a more affordable and efficient use of company resources. Taking money and time away from maintaining a system and allowing a provider to handle it instead will allow software engineers and computer scientists faster and more efficient work flow.

Therefore, the benefits associated with cloud computing in terms of file management, software distribution, cost metrics and security make cloud computing a better solution for many software engineers and computer scientists.

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