



School of Sustainable Development & Technology

Master Thesis in IT Management

Cloud Computing: a new approach for Hallstahammar's IT
companies



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Abstract

Title:	Cloud Computing: a new approach for Hallstahammar IT companies
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Keywords:	Cloud Computing, Hallstahammar, IT Innovation, IaaS, SaaS, PaaS, Cost Leadership, Business Network
Thesis Purpose:	Examine the possibility of small IT companies being benefited from a Cloud Computing transition. Through one case study of a software development company and interviews from five Hallstahammar's IT companies, we showed how Cloud Computing can enable organizations to decrease IT investments and related costs. Besides we critically analyzed some drawbacks of this latest concept.
Methodology:	Primary and secondary data has been collected based on a qualitative method and a structured approach. The collected material of the secondary data was mainly based on latest journals. The interviewing parts have been recorded and summarized.
Theoretical Perspective:	We have used theories of various aspects of business related to Cloud Computing; e.g. innovation and Cloud Computing, business model and Cloud Computing in order to acquire a complete knowledge base for analyzing our empirical data.
Empirical Foundation:	A case study of TotalAssist, interview data of LifeCenter AB and interviews of four IT companies of Hallstahammar, are our empirical foundation of the reserach.
Conclusion:	IT companies of Hallstahammar may adopt the Cloud Computing paradigm. Besides, yet this new concept has its risks. Security remains a concern among many CIO's. In addition, we recommend means that a company can pursue while implementing a Cloud Computing transition.

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Basic Vocabulary

CC	Cloud Computing
CEO	Chief Executive Officer
CIO	Chief Information Officer
CMS	Content Management System
CRM	Customer Relationship Management
IDC	International Data Corporation
IT	Information Technology
IS	Information System
IaaS	Infrastructure-as-a-Service
PaaS	Platform-as-a-Service
RIA	Rich Internet Applications
SaaS	Software-as-a-Service
SEK	Swedish Krones (Swedish Currency)
SSL	Security Sockets Layer Protocol
VLAN	Virtual Local Area Network
XML	Extensible Markup Language

Chapter 1 - Introduction

In this chapter we introduce our report to the readers by describing a brief background of the subject matter. The discussion of the problem statement follows, which will define more specifically about the aim of our thesis. To facilitate the reading as well as an in-depth understanding of this research, we have formed the research question (section 1.4) The Delimitation part informs the reader particularly of what is being focused as well as what has been ignored. The chapter ends with the thesis outline section.

1.1. Background

1.1.1. Cloud Computing

“CIOs are eager—extremely eager—to see if the potential of the cloud can be transformed into tangible business value...” (Evans, 2010)

“Cloud Computing is nothing more than the collection of computing software and services that can be accessed via the Internet rather than residing on a desktop or internal servers” (Stroh et al, 2009)

Cloud computing is one of the new paradigms of information and communication technologies, which provides opportunities of delivering computing services in new ways. Yet, many firms continue to take a cautious approach, using cloud computing mostly to provision their less strategic applications; even so, they are already launching benefits in the form of variable cost, faster speed to production, and ubiquitous availability to end users.

First of all, CC is not a technology but a concept. It has many different definitions; among them most general definition is that “it is a cluster of distributed computer -mainly large data centre or server farms- which provides on demand resources and services over a network medium -mainly the internet-” (Grossman, 2009). The word cloud is usually a buzz word pointing to the remote environment of the source of resources and services. (Sultan, N. 2010 & Grossman R, 2009)

To be simpler, the meaning of Cloud Computing is about sharing resources, minimizing organizational expenditure and collaboration between networks or organizations. The cloud computing enables the IT service providers with a new way of doing business. In addition

other non-IT companies can get benefit by facilitating the cloud computing service. (Accenture, 2009)

In Cloud Computing, organizational tasks are done by accessing the required applications through Internet simply by using a web browser. The applications reside in the cloud - somewhere in the internet- where user might not know the particular location. The computational work is done by the cloud computing service provider and user gets the result. In cloud computing concept, organizations deal only with the software and do not need to think about the hardware at all; unless they become data centre service providers. Among popular cloud computing service examples are SalesForce.com, Google Apps, Amazon web services and even Facebook, which is generally categorized as a public cloud. (Kambil, A., 2009) We will discuss further about the definition of public and private clouds in the chapter following. Figure 1 visualizes the basic difference between cloud computing services with other internet services.

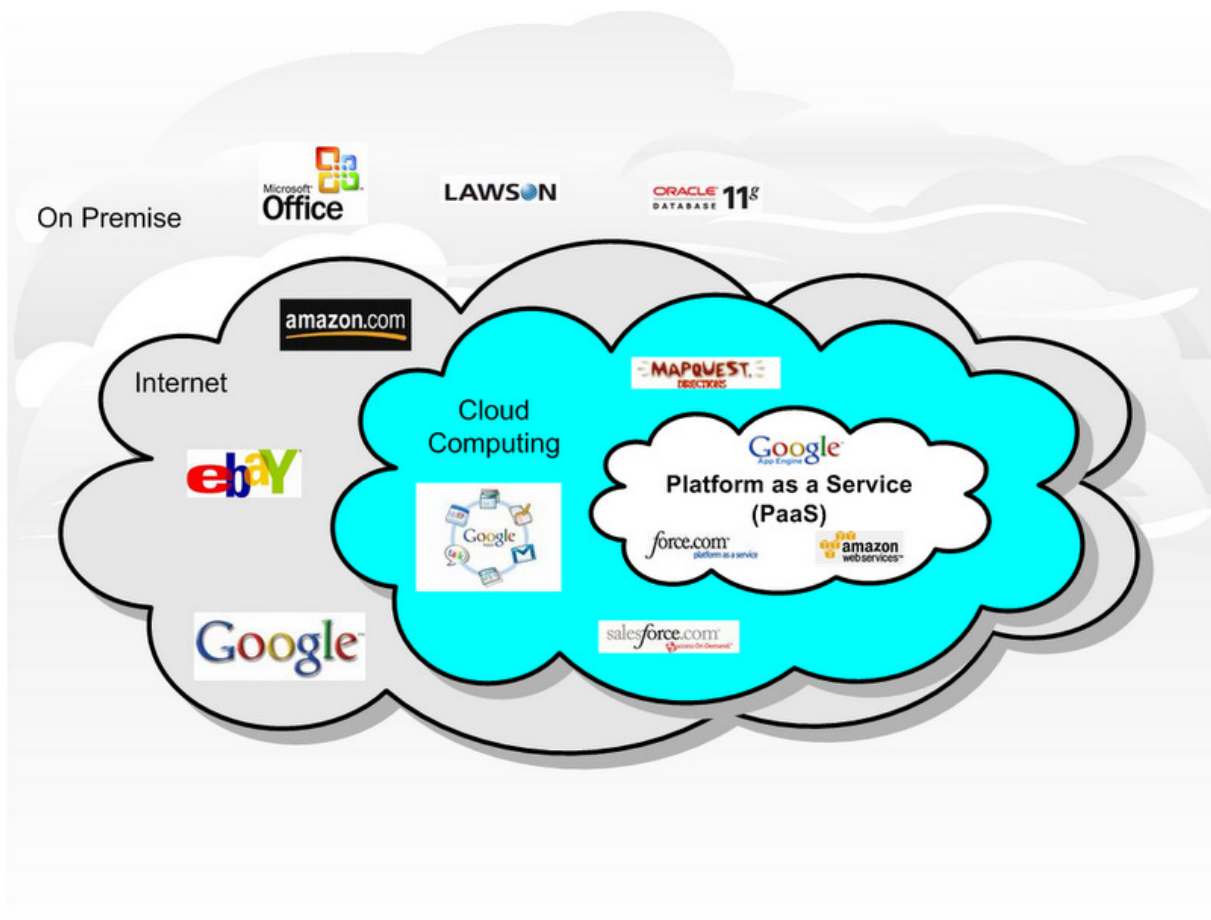


Figure 1: Cloud Computing (Source: <http://atyourlibrary.com/cloud-computing.htm>)

According to the figure, 'On Premise' environment, users use local computer or client-server based applications when they work from office, home or mobile. We can observe that cloud computing is inside the internet. In better words, Cloud Computing uses internet as its network medium. For example Google Apps and Salesforce.com through web environment provide applications for users to run a small firm or even a whole organization. Users store information in those sites and access this data to manage the business.

There do exist many advantages of using cloud computing than its disadvantages. Lower-cost computers for users, improved performance of computers, lower IT infrastructure cost, fewer maintenance issues, IT service innovation, and lower software cost, represent few of the main ones. Also instant software updates, unlimited storage capacity, increased data safety, improved compatibility between operating systems, easier group collaboration, universal access to documents, latest version availability are some of the assets of using cloud computing. Among of the few drawbacks are: requirement of a constant internet access, most applications do not work well with low-speed connections, features might be limited and stored data might not be secured. (Miller, 2009)

What makes Cloud Computing particularly interesting from a research perspective is mainly due to all the attention this architecture has gained in business; needless to mention the wide recognition it has received by research departments. Information Week Forum, Computer's World Forecast, International Data Corporation are some of the organizations that have conducted some of latest researches about companies facing this new challenge.

1.1.2. Western Mälardalen and Hallstahammar

Western Mälardalen region in Sweden is situated in the west side of Mälaren Lake consisting of four small municipalities: Arboga, Hallstahammar, Kungsör and Köping. (Le Duc. M., 2010 & Västra Mälardalen, 2010)

The municipality of Hallstahammar is situated beside the Mälaren Lake in Västmanland County. According to the municipality's website¹ the total population of Hallstahammar is around 15,000 habitants. 700 firms are situated in the area. In our research we are focusing to the IT companies of Hallstahammar municipality. (Hallstahammar Kommun, 2007)

¹ www.hallstahammar.se – Hallstahammar Municipality website, Accessed March 02, 2010

Meanwhile the reason of our research focus can be justified due to being part of the Western Mälardalen Economic Association Project (väst Mälardalen Ekonomisk Förening projekt).

More particularly, Hallstahammar municipality has 30 IT based companies working in the area of telecommunications computer programming, consultancy and information service activities; like data processing, hosting services. Among these firms, there are 21 sole proprietorship, 8 limited companies, and one trading and limited partnership. At these 30 IT companies -except from the owners- there are also 30 more people employed. (Retriever Database, 2010)

1.2. Problem Statement

In Hallstahammar municipality among the 30 IT companies, these are mainly service and software development firms. Those companies are small in size and earn low revenues. For the regional growth of the examined area it is that these companies could also grow by reducing their costs and making more revenues through innovative services to their customers.

1.3. Organizational Growth

“Growth is something for which most companies, large or small, strive. Small firms want to get big and big firms want to get bigger.” (Crosby, 1988) Most of the organizations want to grow for prosperity and not just only to survive. Hence to grow more, surplus is needed. There are many components to measure the growth or the surplus; profit, net profit, revenue, sales figures, number of employees, physical expansions and so on; these are the most common indicators of growth. It is not always true that this growth depends from organizations’ size; however superior performance of small firms can lead to proportionately high growth. There are many alternative ways to achieve growth such as joint ventures or alliances, licensing of own new technology, approaching a new market or a new product development etc. (Dan et al, 1985 & Crosby, 1988)

<i>Net Sales (thousands of SEK)</i>	<i>No. of companies</i>	<i>Percentage %</i>
0-1 k	10	33,3
1- 499 k	7	23,3
500- 999 k	2	6,6
1, 000- 9,999 k	3	10
10, 000- 49, 999 k	1	3,3
Without turnover in the database	7	23,3
Total No. of companies	30	100%

Table 1: Net sales of IT companies of Hallstahammar Municipality (Source: Retriver Database, 2010)

Table 1 shows the net sales of the 30 IT companies in 2008 fiscal year. From the table it is clearly observable that one third of the companies have turnover less than 100,000 SEK, only 7 companies within 100,000 SEK to 500.000 SEK and just 3 companies have more than 1 million SEK turnover. Hence, 62% of the companies have less than 1 million SEK turnover.

1.4. Research Questions

Should IT companies in Hallstahammar adopt Cloud Computing with the intention of minimizing costs and hence grow more in the Western Mälardalen region?

- Which are the prospective business advantages that these companies can be influenced by?
- What are the chances for innovation, enhancing the business model, and extending the business network?
- Which are the main risk implications of moving the existing technology (IT infrastructure and IS) on to the cloud?

1.5. The Research Purpose

The primary goal of our research is to explore and learn various aspects of IT companies in Hallstahammar Municipality and their awareness on Cloud Computing. Besides, the possibility of those firms being benefited from a cloud transition is also investigated. Furthermore one small case of a company in Västerås is included; it has already implemented software innovation through CC. By analyzing the primary and secondary data, we suggest different ways that companies can decrease IT investment and cost by using the existing cloud services and utilize IT innovation through the CC facilities. Achieving organizational growth is the next step forward.

1.6. Target Groups

The results of the research can be beneficial for the CIOs and IT managers of various IT service providers before considering adopting CC services and especially in Hallstahammar Municipality. This project work will also be helpful for other researchers that are interested in investigating more on CC in business organizations.

1.7. Delimitations

In the thesis we will mainly argue about the benefits of using CC for an organization and developing applications for customers in the “cloud environment”. Furthermore we will also consider some drawbacks and risks. One ambiguous factor for instance -that many scholars are arguing about- is the risk management issues of implementing a cloud computing service. In this paper we will be unable to give exact information on which services fit better into particular industries. Though in the conclusion section we propose recommendations to the examined companies in order to be effective from a cloud transition and reduce their costs. These recommendations can be generalized to other similar IT companies. Hence, it is the company’s responsibility of choosing the best services according to their needs.

Chapter 2 - Methodology

In this chapter we will mainly introduce the ways in which we are going to work concerning the critical literature review, the gathered empirical data and the following analysis of the above elements. Further information will be given regarding the methods we have chosen as well as appropriate justification of choosing those methods.

2.1. Chosen Method

2.1.1. Combined method and Structured Approach

There are some ways to conduct a research, regarding the amount of the material used, and the selected criteria of approaching an issue. More particularly, Bryman and Bell (2003, p78) presented the way of inductive and deductive approach while doing a research. Deductive means that theory is something that guides and influences the collection and analysis of data. In fact that imposes that queries are answered based upon an existing theoretical base concept. Whereas inductive is the approach where the theory can be revised and recognized after the collection of all the data that is related to the research topic. However focusing on our issue topic and we can state that there is no specific way to follow; but a combined method of inductive and deductive approach. The reason is that we cannot rely too much on past experiences of companies implementing CC as it is a new concept. In addition it is not feasible to rely too much on the theoretical base conceptual framework and come up with logics and new revised theories. Thus we are going to keep track of both the theoretical and experimentation approach and align them to the nature of our project.

In addition we examined two more ways of conducting a research; structured approach and grounded theory. According to Fisher (2007, p123) the former method is when we impose a structure in our research, based on preliminary theory, such as concepts or hypothesis. Then we can use this structure in order to guide us in the collection process of our material. We can only choose related material to our structure, and not any type of information that is just familiar to our topic. In our case-topic we are going to follow a structured approach while studying the potential literature and choosing the appropriate ones. Primarily, we intend to create a conceptual framework to structure our thesis data, but we leave some chances to revise it while we are working with our research and the critical literature review. Hence, we do not aim to be reluctant to change.

2.2. Qualitative and Quantitative Method

Initially, we were thinking of implementing a quantitative method to gather all the research data. Likert scale and open-close questions could be a part of the prospective interviews conducted at the IT companies of Hallstahammar Municipality. Rating factors and connecting the research unmodified data with the theory could be impressive but a time demanding procedure. In addition as we are examining the awareness on CC and opinions of the IT managers, examining this kind of information through a qualitative method is appropriate. Therefore, we have chosen a qualitative method for our research topic. Besides, we are focusing on the quality of data chosen, whether it will be from interviews or from the appropriate literature. In the following sessions we are describing further the data collection process.

2.3. Data Collection Process

2.3.1. Secondary Data

Primarily, secondary data can be selected from academic and business literature, journals, articles and results from other researches such as surveys or statistical researches. These researches might have taken place for another research topic; in contrast we are going to analyze further these results and relate them with our collected literature. Meanwhile another aspect that will be used is a triangle of analysis (see Figure 2). It would be the empirical data which is explained further in the sections following.

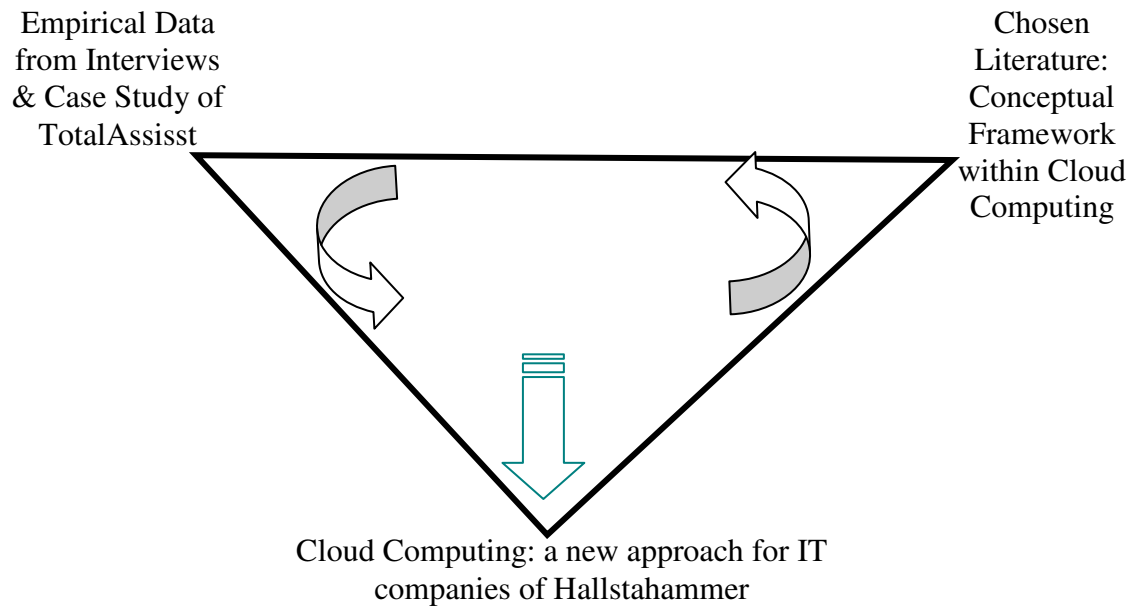


Figure 2: Triangle of Analysis

2.3.2. Chosen Literature

Initially, by the time we chose our thesis topic and from the early feedback that we took from our reviewers and supervisors we realized that we had to cope with an up-to-date topic and contemporary issue in the companies' IT environment. The really challenging subject topic and research question forced us to select from latest sources and mainly sources being published in the 2007-2010 period. In addition, textbooks and academic monographs were in fact a minor option for our thesis. Thus, we turned into getting our sources from journals. According to Fisher (2007, p81) academic papers and trade or professional journals are actually the two main categories of journals. The first category of academic papers consists of articles that have been reviewed by academic community before being accepted to publications. Meanwhile, trade papers are mainly shorter than the academic, but they are extremely useful for recognizing trends, fashions and current concerns inside business. Hence for all these reasons, as we wanted to be closer to more contemporary opinions and aspects, we have mainly focused our literature research in those types of sources. What's more, as Fisher advices (2007, p81) that journals are sometimes more crucial than books, will most likely be our main source for this research dissertation. Probably this is because of the most up-to-date researches and debates that can be found in journals.

Furthermore, World Wide Web was also a beneficial source of material. Being by far the most convenient mean of accessing material, it brought to us a huge amount of information such as

companies that have implemented CC or explanatory videos discussing about concepts of this ubiquitous matter.

2.3.3. Electronic Databases

In order to collect all the appropriate data, including the ideal literature, we made use of the Mälardalen University Library Database which led us to the following electronic databases: Emerald, Ebrary, DiVA and Business Insights. Among the keywords that we have applied, here we mention some of them: Cloud Computing, Cloud Computing implementation, Low cost of CC, Security issues, Cloud transition, risk factors of CC and so on. Additionally a very helpful partner for us was Retriever Business which was used to find and gather contact information for companies in Hallstahammar Municipality.

2.4. Primary (Empirical) Data

In our research dissertation primary data is mainly the unstructured information taken from the interviews/questionnaires, and the case studies. The way of congregating the interview data and how to accomplish the interviews is explained further in the next paragraph. In order to conduct an interview, we had initial contact attempts through e-mail and telephone communication. The conversation was as short and simple as possible. We had no intention to interrupt tight workloads and stressed schedules of the employees answering our calls or our e-mail messages. After introducing ourselves, we briefly explained our research topic and our intentions for arranging an interview for further discussion and feedback. Politeness and courtesy were some of our exemplary behaviour. Arrangement of time and place, such as the method of interviewing was customized according to the needs of every employee and each company.

2.4.1. Interviews

According to Fisher (2004, p159) there are three types of interviews. Among the open interview, the pre-coded, and the semi-structured ones, we have chosen to conduct the latter ones. In the Semi-structured interviews, the interviewer has a schedule to remind the primary topics that need to be covered. The interviewee has much latitude to answer to the questions in manners that seems sensible to him. We have prepared an approximate number of 12 thematic questions, in a logical thematic order. Furthermore, we have aligned the questions

with the elements of the conceptual framework. Among the first ones, there are sorts of introductory questions, such as learning the type of company, the area of work, the number of employees or the position of the respondent in the hierarchy of the organization. The questions will mainly be opened ones with the aim of delivering more controversial ideas and personal opinions. From the 12 queries we are planning to customize a number of 3-4 questions based on every company's area of working. For example, one of our respondents was from a technical construction company which delivers construction plans for precast buildings and provides customized plug-ins (small customized applications for Auto-CAD). Thus we had to customize and adapt some questions to his particular segment of working area. Moreover, we are planning to give the respondent a more flexible way to answer our questions, in such a manner that we can cover more detailed aspects in our research. Simple business questions with non-technical language can be an illustration of how the questions will be posed.

The respondents are asked to think of potential problems faced in the IT-infrastructure area or the software development process. The way of how they react is asked, and the respondent is encouraged to explain the incident in enough details. Afterwards a solution based on Cloud Computing is proposed. Then we can get critical feedback from the respondent (the respondent can critically comment) and we can explain further the potential solution that Cloud Computing offers. In addition, depending from the answers and feedback that we receive, we can lead the discussion in the appropriate questions. Lastly, we are not planning to use any offensive questions, or querying to retrieve crucial private data from the organization's side. A sample script of the questions that we have used is placed in the Appendix chapter of our thesis.

2.4.2. Type of Interviews

Nowadays, except from the face-to-face, telephone and e-mail interviews, we have also the video-conference interviews. Through personal communication and contact it is feasible not only to obtain much more information, but also to use visual materials (pictures, figures, diagrams, etc.) so as to encourage a substantial response. A face-to-face interview does not bore the respondent and guarantees full and accurate data. From the other side of the coin, telephone interview is the first alternative when a straightforward interview meeting seems implausible. However there are some advantages like that we could obtain access to people who would never find the time to give an interview (Fisher, p169), or other factors such as a

far away location, or building that we could never get access in due to security reasons. Additionally, video conferencing as a contemporary way of interview can be achieved by many applications such as Skype, Msn, iVisit, Polycom, Arkadin¹ and so on. We selected Skype as it is more reliable and approved for its high quality and public trust especially in Sweden. What's more regarding the production of the transcripts, it can be accomplished by digital tape recording and by certain application through Skype. We chose Vodburner, a free of cost based Skype utility, which offered us to voice or even video recording our empirical data.

2.4.3. Sample of Companies

Through our thesis topic and the research question we are examining the possibility of IT companies in Hallstahammar Municipality to adopt and implement CC architecture successfully in order to cut down costs. As we have already mentioned there are almost 30 IT companies in this area. However we decided to interviewed at least 6 of them in order to have a representative sample for our research analysis. Except from that, the reason that we chose to examine only small and medium IT companies of Hallstahammar -and not particularly IT departments from a variety of companies- is that IT companies are more eager to change. They have a main focus on IT infrastructure and IS applications so thus they have more reasons to follow a change and a potential adaptation of CC. According to their main area of work and after interviewing them we have segmented the 6 companies in 3 categories. - Designing/Construction IT companies, Software development firms and Non-profits organizations- see Figure 3. Moreover, as it is stated already, our thesis is a part of Western Malardalen Economic Association Project (väst Mälardalen Ekonomisk Förening projekt). Thus we had one more rationale to follow the IT companies of Hallstahammar; although we could have chosen other cities of Västmaland. In the figure following we have include all the companies interviewed with all the available ways mentioned above, such as Skype, face-to-face meetings and email interviews.

¹ Msn, iVisit, Polycom, Arkadin: Various computer utilities that offer the ability of a video conference (live-meeting)



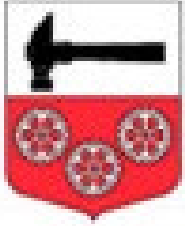



Construction/Designing IT Companies	Software Development Companies	Non-Profits organizations
 <p>Hanson&Verthed AB</p>	 <p>Aros Circle AB (TotaAssist)</p>	 <p>Hallstahammar Kommun</p>
 <p>IDÉbild</p>	 <p>PComPartner</p>	 <p>LifeCenter AB</p>

Figure 3: Interviewed Companies

2.4.4. Difficulties – Obstacles

Most of the employees that we approached were consistent and helpful. They contributed effectively in order to gain valuable information. However we encountered few obstacles. For instance, some companies' representatives were not willing to have an interview conducted in English, or they did not have enough time to participate in a short discussion. Needless to mention that from an initial number of 15 companies, the amount of 4 companies respond negatively.

In addition while we were searching for contact information through databases such as Retriever, we found out a few incorrect data. For example, one company was situated in Hallstahammar according to the database record; however after communicating with them we were informed that was situated in Göteborg. Besides, we figured out that some telephone numbers were not updated properly. Minor things like these just made our work a bit trickier but hence enthusiastic.

2.4.5. Anonymity

Due to the research character of our thesis topic, we are not going to follow any type of anonymity in the interviews sections. In addition we want to include the names of the respondents in order to be credible or being a source for further research. For this reason we have previously stated and taken relevant permission from all the respondents concerning our aims. However if someone from our interviewing sample was wishing not to share his name, this was also acceptable.

2.4.6. Case Study

In order to develop a more critical approach towards CC implementation we have chosen one company that has recently utilized a Cloud transition of their systems both in Infrastructure (IaaS) and Software (SaaS) model of CC. Sensitive data has been collected for this reason, and a smooth description of the transition has been released. Imminent risks and potential successes are also included in the TotalAssist case study.

2.5. Analysis of collected Data

One big issue when conducting qualitative research is to shape how non-codified of information can be organized and analyzed. According to Fisher (2004, p180) there are some strategies that can lead a structured approach to a successful result. First of all, in order to understand what we have collected it was mandatory to write it down, and put together all the sentences in an organized way. However these processes need to take place continuously; therefore, a repeated cycle of sorting and sifting was mandatory. Some devices, that we made use of, were some memos to ourselves in order to write down flashes of insights. Secondly, one more strategy was to follow a clear explanation of how the data was analyzed and transformed in order to persuade the reader about the validity of the results. In addition in the analysis section, meaningful correlations of the concepts (secondary data) were done with the opinions/aspects (primary data) taken from the interviews and the case study. Moreover we have also included some recommendations in the conclusion section. In the illustrative mind map following (Figure 4) we are explaining further the triangle of analysis enhanced by our methodology outline approach such as the Gantt timeline frame.

2.6. Methodology Outline

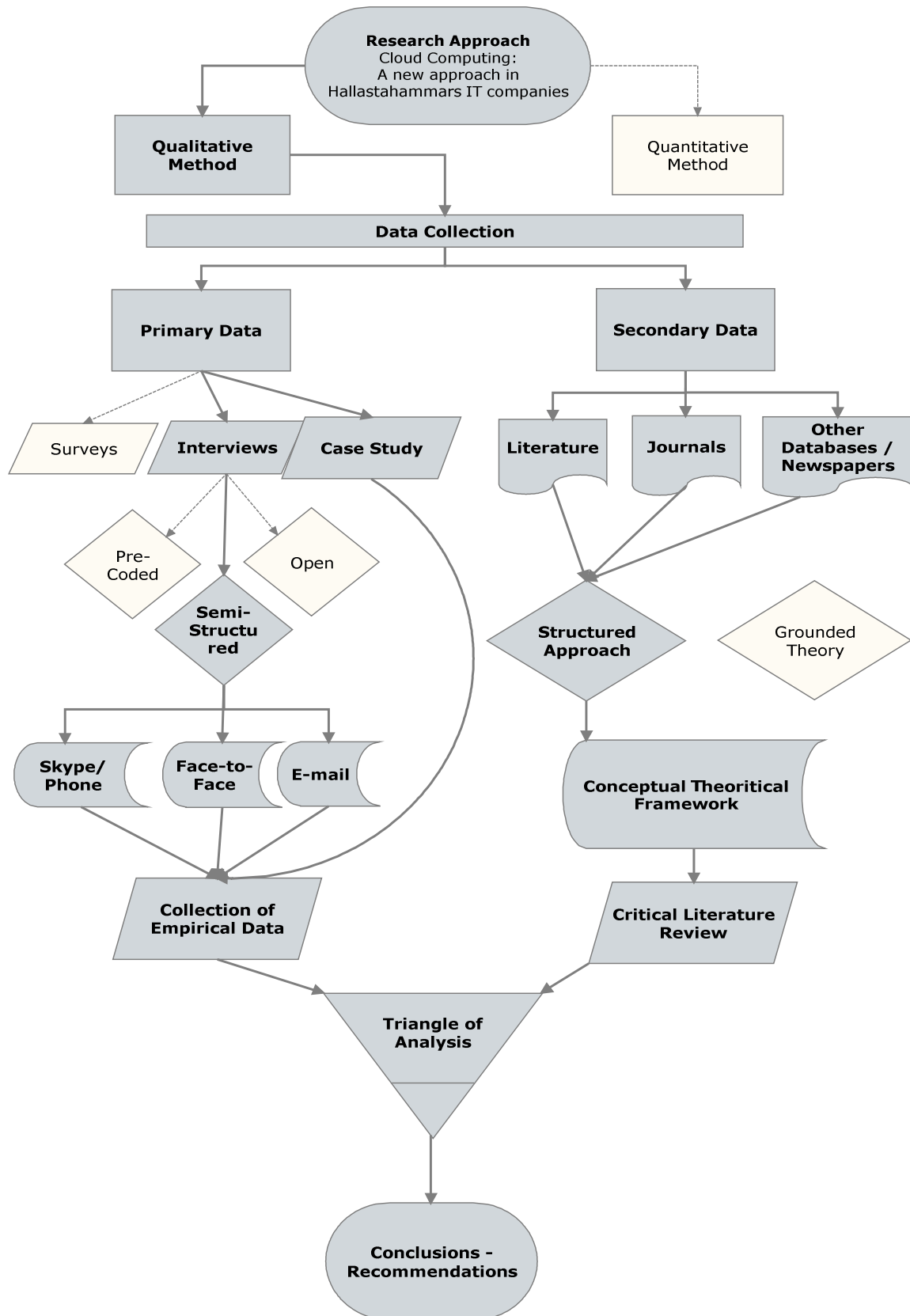


Figure 4: Methodology Outline – Flow of Thesis process

2.7. Timeline Frame

Number	Task	Duration	2010			
			March	April	May	June
1	Choosing a topic and designing the project - Cloud Computing: a new approach for Hallastahammar IT companies	10	↔			
2	Writing a critical literature review	14	↔			
3	Creating Conceptual Framework of Cloud Computing	32		↔		
4	Collecting and analysing Research Material (Primary & Secondary Data)	22		↔		
5	Interpreting the Research material	21		↔		
6	Framing arguments, conclusion & recommendations - Writing up	19			↔	

Figure 5: Gantt chart – Steps for writing our dissertation

Chapter 3 - Conceptual Framework

In this chapter we will have a well structured discussion about a variety of different business concepts that can be correlated with the implementation of Cloud Computing in IT companies in Hallastahammar., In order to visualize the way that we touch and unfold the concepts, we used a mind map diagram in the beginning of the chapter.

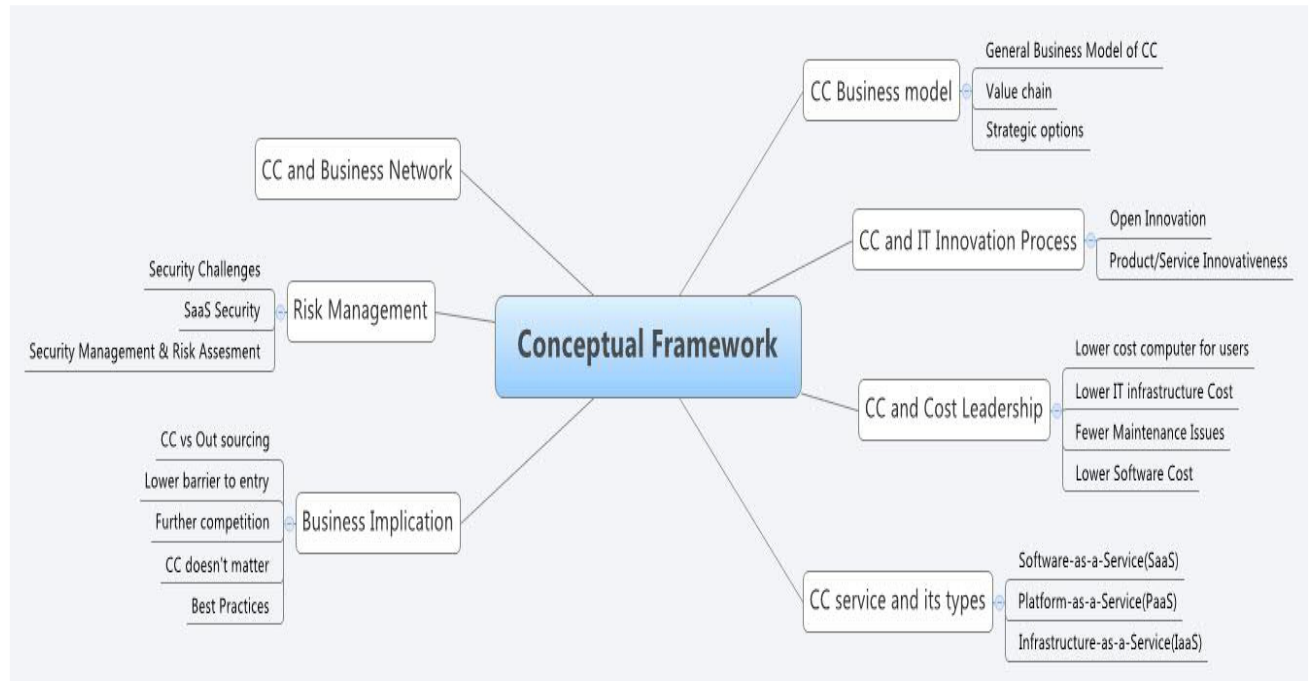


Figure 6: Mind map diagram of Conceptual Framework

In this mind map diagram we have showed the summary of the conceptual framework of various business concepts. We correlated these concepts with the Cloud Computing services.

3.1. Cloud computing Services and its types

There are three different types of services that cloud computing can offer:

1. **Infrastructure as a Service (IaaS):** Many companies have their huge data centre in their offices. The IaaS providers come to offer where companies use the same kind of processing, storage facility and network which was initially provided by their own data centre. The main facilities of IaaS are: company can spend computational power as they use and it will be an on demand; this power will be escalating depending on the demand; the medium of communication will be internet. e.g., Amazon Elastic Compute Cloud (EC2) provides this kind of services to its customers. (Sultan, 2010)

2. **Platform as a Service (PaaS):** To develop customized software, different vendors provide applications like Google AppEngine, Microsoft Azure, programming API and scripting languages for those customers that are ready to develop their own system in the “cloud environment”. Open source application development environment like PHP, MySQL, Joomla, Drupal are more popular as on premise tools as PaaS. (Sultan, 2010)
3. **Software as a Service (SaaS):** Companies provide applications through the internet as a service where users do not need to install and maintain the software locally; users are free from complicated software and hardware maintenances. Many reputed companies are already offering services which are very common in business organizations such as task and planning management, calendars, schedules, event management, contact management, customer relationship management, word processing, spreadsheets, presentations and storing and file sharing. This is attained in a very low cost which is called pay-as-you-go, meaning pay as much as the company uses these applications. (Sultan, 2010)

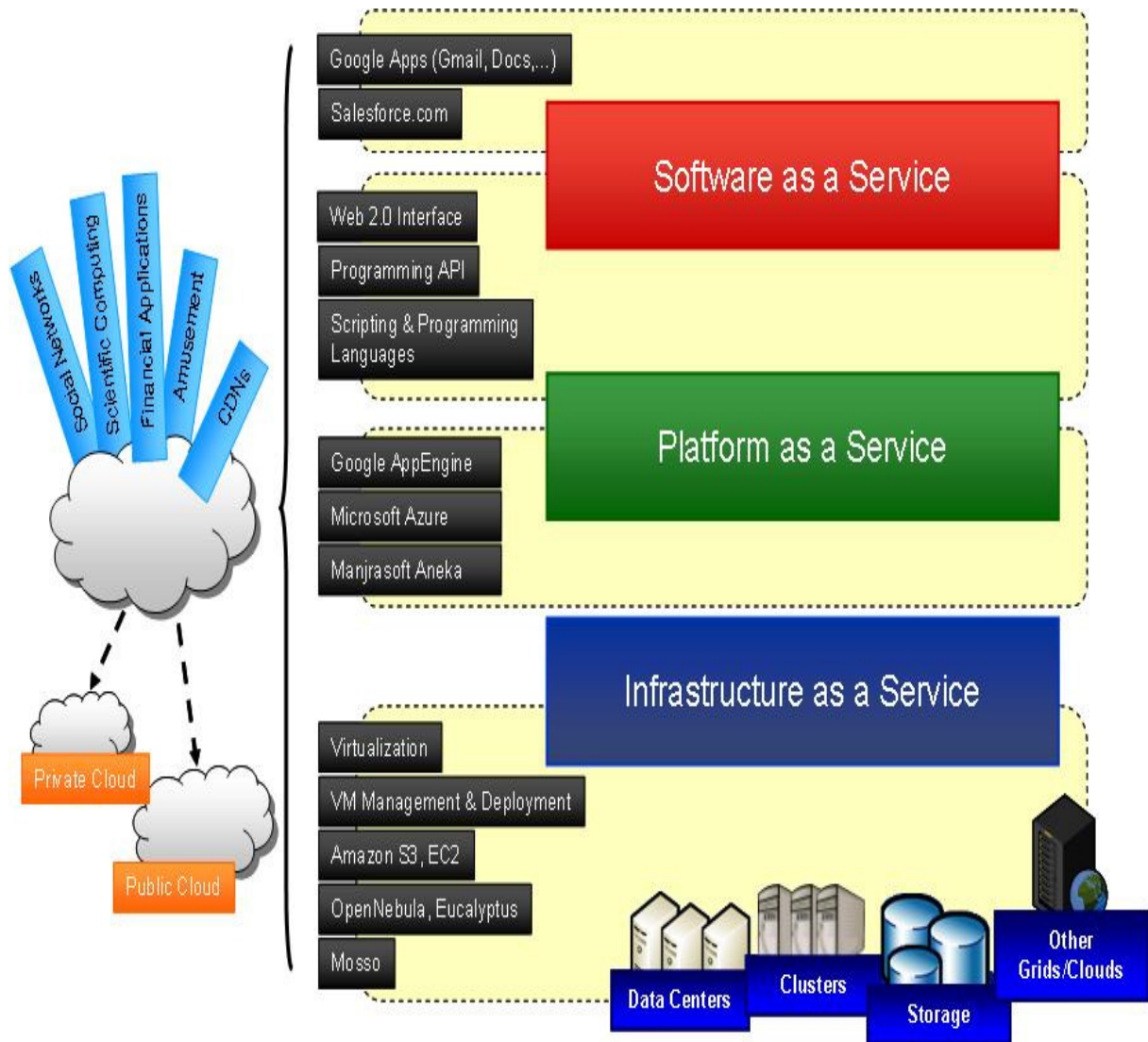


Figure 7: Types and services that cloud can offer (Source: The Structure of the new IT Frontier: Cloud Computing- Part 1, 2009)

The CC environment is expressed mainly in two types. The one is public and the other is the private cloud. In public cloud, data and application are hosted by third party companies and controlled by them. The user can only access his data through providers' applications; these providers are public which means that any company can join and take the services from them. So far SaaS are more popular as public cloud services. (Introduction to CC Architecture, 2009)

Private cloud is more exclusively making use of companies or networks, where a company can use IaaS, PaaS and also customized SaaS for their business. In the private cloud the company has mostly all the controls and available functional options over their cloud. (Introduction to CC Architecture, 2009)

The main components of the cloud computing services are to make dynamic IT delivery services through the internet medium. The following figure (3.1.2) demonstrates the main architectural framework of CC.

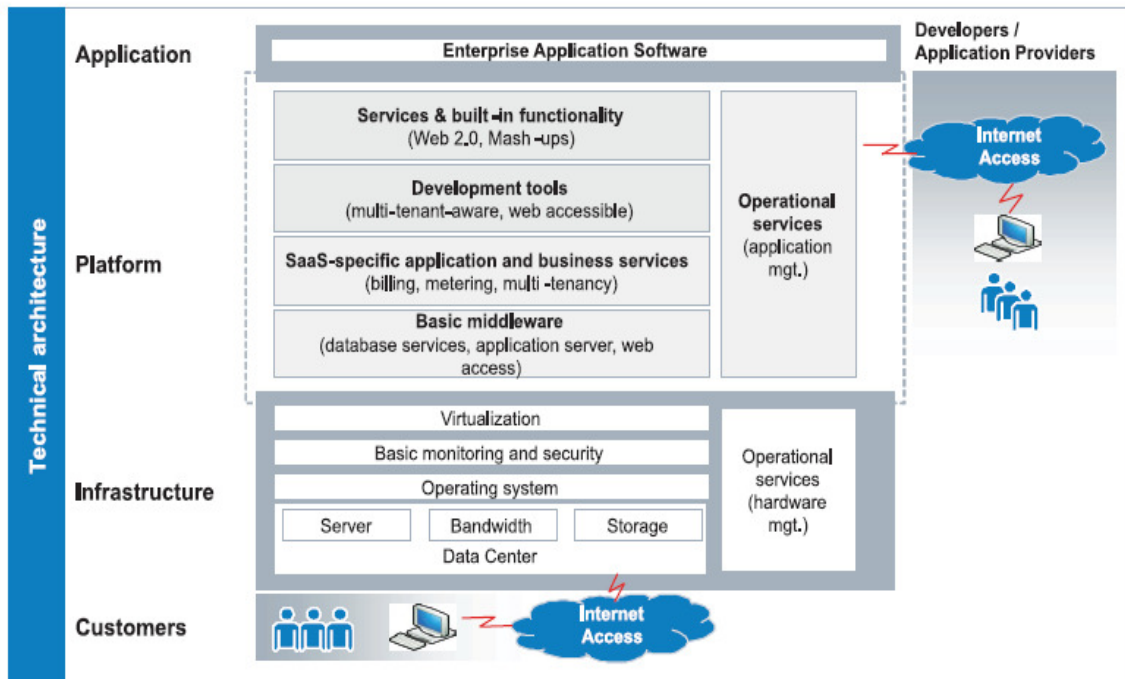


Figure 8: Architectural framework of Cloud computing (Source: Jackel. M., Luhn. A., 2009)

As application, platform and infrastructure as services have already discussed, from the above figure we could clearly comprehend that customer only need to have a personal computer and an internet connection. On the other hand, developers -application providers- can be located anywhere to create the services for their clients. The customer is not anymore needed to buy software applications, platform and infrastructure, as they can get same result and total benefit as before, plus with more enhanced advantages like cost reduction and mobility.

3.2. Cloud Computing and Cost Leadership

According to Michael Porter, the generic strategies for companies to reach a competitive advantage can mainly be accomplished through cost leadership and differentiation. Companies can have competitive advantage over their competitors if their overall expenditure and other operational costs are less during production. (Hedman, Kalling, 2002)

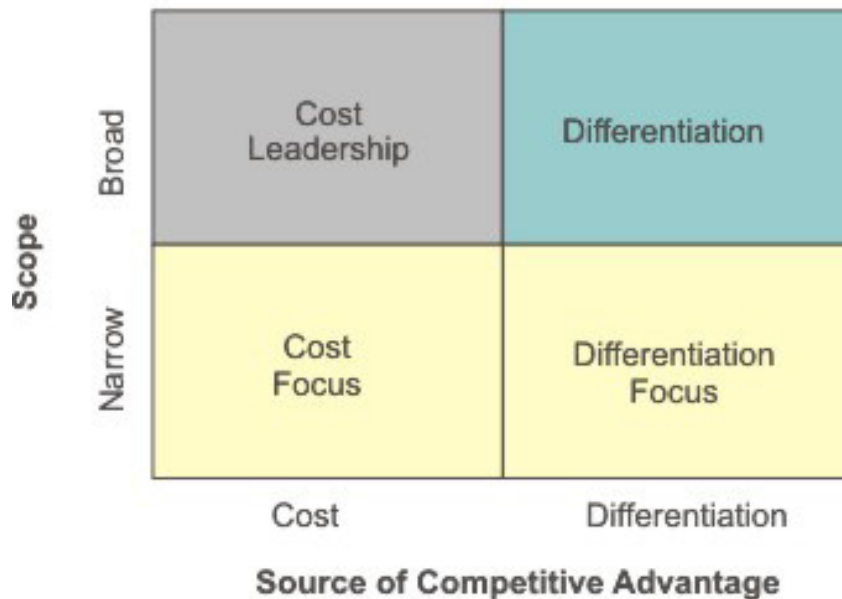


Figure 9: The generic strategies by Porter (source: Hedman, Kalling 2002)

IT infrastructure setup, maintenance and make them function (operating costs) define one of the largest costs for many firms nowadays. Using CC, companies can reduce their infrastructure and operating cost of IT department within organization. (Sharif, A., 2010)

3.2.1. Lower-cost Computers for Users

Companies are not needed to provide their employees with highest speed computers in order to use the daily operational task to “run” the company; as all the computation power is offered from the cloud. The supported computers can have a be a medium speed, enabling to run web browser with the least disk space capacity. Even with no CD or DVD drive demanded, as user does not have to install applications in the computer’s hard disk; it has primarily installed in the cloud. (Miller M., 2009)

3.2.2. Lower IT Infrastructure cost

Large organizations' IT departments can also minimize their cost by adopting CC. Mainly they invest more in acquiring powerful servers and professional IT staff. Instead they can hire these resources from IaaS vendors, e.g. Amazon Elastic Compute Cloud (EC2) services is one of the reputed among all. Company has to pay only for small instance of \$0.085 per hour (see Appendix) for using EC2 service. (Miller M., 2009 & Amazon EC2 pricing, 2010)

3.2.3. Fewer Maintenance Issues

Cloud computing diminishes greatly the hardware and software maintenance costs of organizations of all sizes. As most of the power of servers and hardware is in vendor's side thus organization does not have to maintain those; hence no need to keep enormous number of specialized and high skilled IT personnel. (Miller M., 2009)

3.2.4. Lower Software Costs

Companies can reduce a great amount of expenditures by not purchasing the software package for every PC in the office; as an alternative by utilizing the CC service they can have all the facility of PC based software in very low cost. For example, instead of Microsoft Office they can use Google Docs and proprietary CRM from Salesforce.com CRM; or instead of applying Microsoft Exchange server they can employ Google Apps for more collaboration and more mobility. (Miller M., 2009)

3.2.5. An example of cutting down the costs using Cloud computing

The University of Westminster (UOW), UK embraced CC for their internal 22,000 students by a mailing system using Google Apps. Google mail provides 7.3 GB of disk space for each student's mails; furthermore the students can keep their original email domain and addresses e.g.: david@wmin.ac.uk . Other facilities of Google Apps provide word processing, spreadsheet, presentation and calendaring; all of them can be shared, so students can distribute and collaborate with each other when they accomplish teamwork. UOW saved around £1,000,000 in terms of installations, ongoing maintenances, upgrades, staff costs, licenses, servers, hard disks etc in the academic year of 2008/09. In addition, cost of using Google Apps is literally zero for educational institutes. (Sultan, N. 2010)

Although the IT companies in Hallstahammar are not educational institutes, they are mainly business firms; still the cost of applying this kind of cloud services is not too high if we compare with traditional IT investment and operational costs. It is painless for the small firms to take an innovative decision and implement such architecture; while large organizations go through a lengthy process of decision making as they have to consider many factors and issues inside and outside the organization. Thus IT companies in Hallstahammar can easily adopt this new trend of CC services and minimize their IT cost; meanwhile they can have their own innovation project using CC to provide low cost services to their clients (Sharif, A., 2010)

3.3. Cloud Computing and IT innovation Process

According to Bessant et al (2007, pp 404) “*innovation is a generic process, running from ideas through to their implementation.*” New kinds of services and products and their development and delivery processes have been increased by the improvements of technology for storing and sharing information. CC is one of the latest concepts of distributing those tools, which are helpful for business, in a flexible way. (Bessant et al, 2007)

As more and more applications are migrating from client-server to the cloud, opportunities of whole new software and business innovation are created. One group of innovators can develop innovative business applications in the cloud and so other groups are able to use the data from the cloud to provide new insights and valuable experience. For example *Mark Elliot Zuckerberg*, co-founder of Facebook, one of the most popular social networking site, is an innovator while many other innovators generate applications which are used by Facebook users; e.g., Birthday calendar, family tree etc. (Kambil, A., 2009 & Rittinghouse, J., Ransome, J., 2010)

3.3.1. Open Innovation and Cloud Computing:

“*Open innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas; and internal and external paths to markets, as the firms look to advance their technology*” cited by Henry Chesbrough, professor of UC Berkeley and writer of *Open Innovation: The new imperative for creating and profiting from the technology book*.

The idea of open innovation has become very important in practise; theory from the last few years has been gained as for its shorter innovation cycles and less industrial research. Meanwhile lower development cost (R&D) and optimization of resources have been utilized. (Gassmann, O. & Enkel, E. 2004)

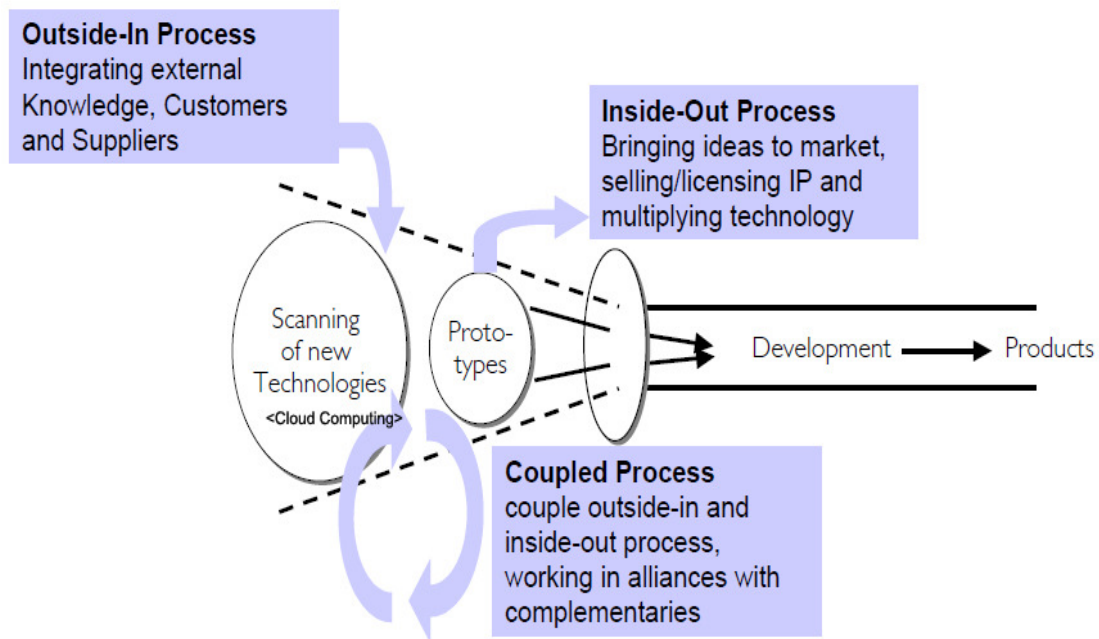


Figure 10: Open Innovation and Cloud Computing (Source: Gassmann et al (2004))

The three open innovations process archetypes and CC: (as shown in Fig 3.3.1)

1. *Outside-in process*: company can enrich their innovativeness through the integration of suppliers, customers and external knowledge of technology and business. It is company's core innovation approach. CC is one of the newest concept from which company can get ideas of new businesses or services in order to serve their clients.

2. The “*inside-out process is mainly about earning profits by brining ideas to market, selling the intellectual property and multiplying the technology by transferring ideas to the outside environment.*” In this approach, companies open up their boundaries by leveraging their knowledge and gain advantage by letting the ideas flowing outside. Cloud Computing can play a vital role in this process while companies can provide IaaS and PaaS to developers as they can produce software for their clients. Therefore companies can earn revenues from hiring out the infrastructure and platform to the developers. Platforms like Force.com,

Windows Azure or Google App Engine provide the developers with enhanced programmable user interface, real-time work flow, and real time mobile development environment. This kind of platforms enables the development cycles being reduced from years to months and from weeks to days; thus in the competitive application development sector, companies can be ahead of their antagonists using CC. (Gassmann et al., 2004 & Accenture, 2009)

3. *The Coupled Process*: It is one of the key processes by combining the outside-in process and inside-out process for companies by working in alliances of complementary partners. Salesforce.com is one of the pioneers in providing cloud computing services worldwide. The main product of this company is CRM system. On the other hand Google Apps are also successful and popular for its collaboration system like Gmail, Calendar, Gtalk and Google Docs. Consequently Salesforce.com and Google Apps collaborate and provide all salesforce.com customers and Google Apps functionalities in their CRM. (Gassmann et al., 2004 & Salesforce for Google Apps, 2010)

3.3.2. Product/Service Innovativeness in Cloud Computing

In any industry, a new product brings two kinds of perspective; one from the customer and another is related to the company. Innovative attitude, adoption risk and behaviour change are customer's perspective; familiarity and fitness of technological and market environment are company's perspective. And that is no different for the software industry. As cloud computing provides mainly the services as many other software do, we can relate this product innovativeness to service innovativeness. (Athey T. ,1998 & Danneels et al ,2001)

Northzone, one of the leading investor groups of Sweden mentions “*entrepreneurs should come up with a new way of selling existing product...*” (Wanted: There is: 1.5 Billion¹, 2010). The concept of CC can be one of the new way of selling exiting software and hardware services in an altered way. The software development companies can sell the same services to its customers but the channel of delivering those services can be replaced through the cloud as it is more cost-effective, more user-friendly and less time is needed for the development process. The RIAs² (mainly called Web 2.0) like Ajax³, Adobe Flash/Flex¹ or OpenLaszlo²

¹ <http://northzone.com/for-entrepreneurs>

² **RIA**: Rich Internet Application

³ **Ajax**: (Asynchronous JavaScript and XML) is a method of building interactive applications for the Web.

can be a development platform, which can provide a desktop-like experience in the web browser. These tools offer unique opportunities to the development companies to deliver highly innovative software application for their existing and new customers; although familiarity of the technological environment can be low for some companies. (Accenture, 2009)

Verma, S., (2010, p43) describes many benefits of companies in product innovativeness: among them one is that a new product tends to attract new partners, new venture capitalists and gain more profits, which are actually some of the main factors for measuring organizational growth. IT Companies in Hallstahammar can develop new products or services through CC and that might enable them to grow in the market place. No matter how many firms come up with very innovative products or services, though they fail to become successful in the market due to their poor selling technique and inaccurate business model.

3.4. Business Model for companies using Cloud Computing

Northzone recently announced to invest 1.5 billion SEK to the IT entrepreneurs that have energy, passion, good business concept and most importantly a unique business model. (Wanted: There is: 1.5 Billion, 2010)

According to Alexander Osterwalder (2009, p85) the definition of business model is about a model that describes “the rationale how an organization creates, delivers and captures value.” It is nothing but only a representation of how companies gain or intend to gain profit. According to Tim O’Reilly -CEO of O’Reilly- “there is not a single universal business model but there are lot of opportunities and options to create the own and single one model according to the entrepreneurial needs.

¹ **Adobe Flex** is a software development kit released by Adobe Systems for the development and deployment of cross-platform rich Internet applications based on the Adobe Flash platform.

² **OpenLaszlo**: is an open source platform for the development and delivery of rich Internet applications. It is released under the Open Source Initiative-certified Common Public License

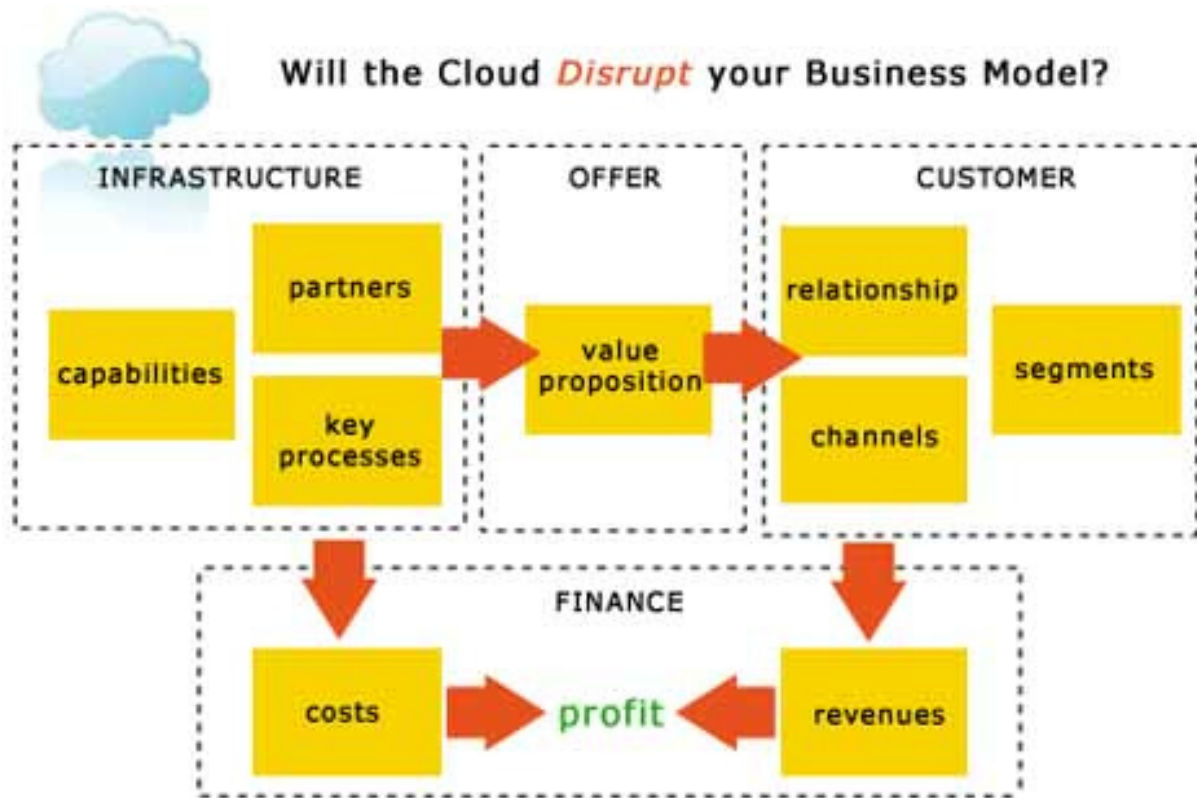


Figure 11: General Business model (Source: Lesem Steve, 2010)

Every organization or company must have an appropriate business model aligned to their needs and the exact value proposition they want deliver to their customer. The basic properties of every business models are more or less same, as illustrated in the Figure 11. This general business model is appropriate for firms that use CC for their IT infrastructure. The author tried to answer this question, “Will the Cloud disrupt your business model?” and argued that as the infrastructure of the business is changed only if it attains positive results for the company as the cost of infrastructure is going to be condensed. (Lesem Steve, 2010)

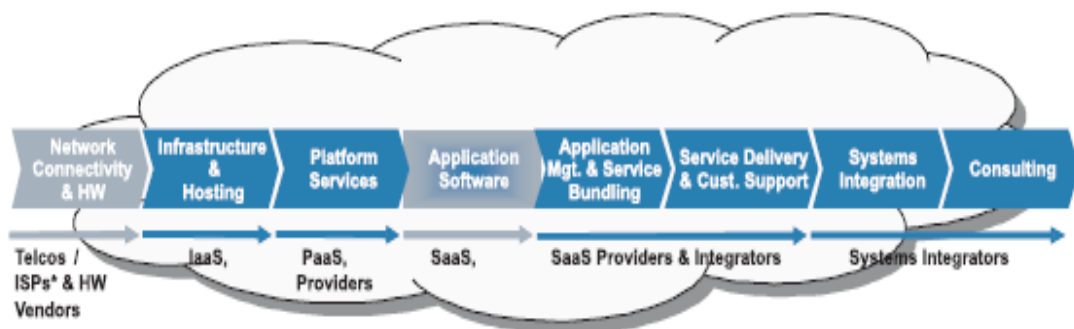


Figure 12: Linear Cloud Computing Value Chain (Source: Jackel. M., Luhn. A., 2009)

For the companies whose businesses are related with IT consultation, design, implementation and operation of IT solutions, IT infrastructure till the maintenance of applications, the value chain has changed due to the new CC concept. The linear Cloud Computing value chain is shown in the Figure 12. This shows how the CC service providers can offer value proposition to its customer starting from the providing internet, IaaS, PaaS, and SaaS until consultancy. (Jackel M., Luhn A., 2009)

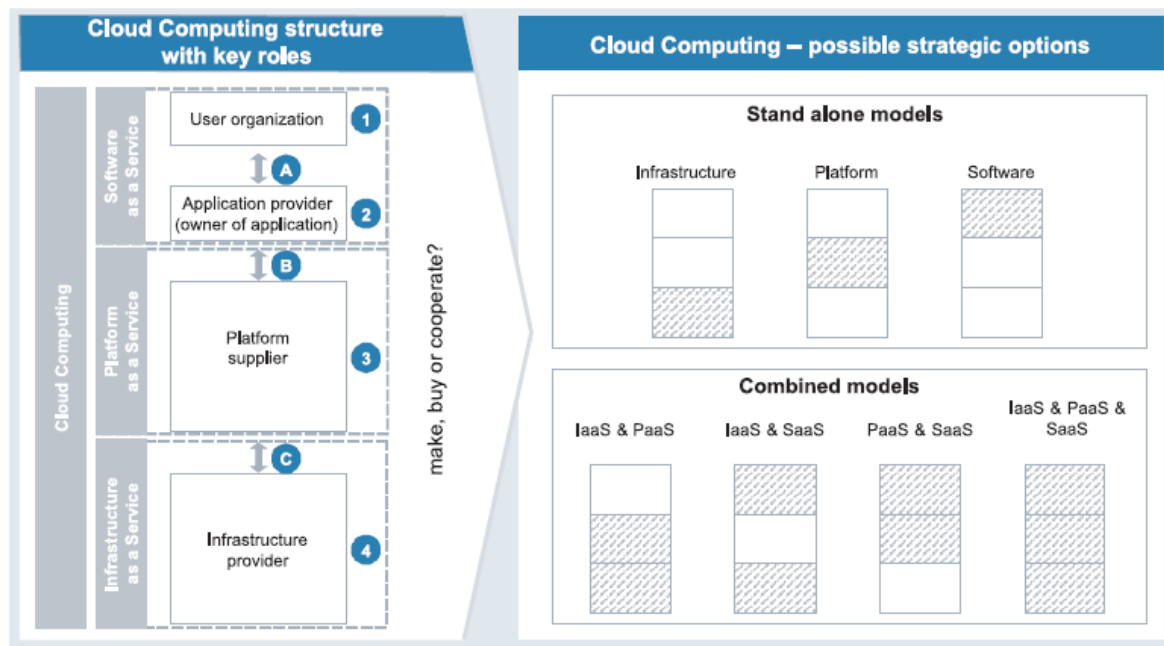


Figure 13: Cloud Computing Business model (Source: Jackel. M., Luhn. A., 2009,)

The basis of developing the CC business model is actually which elements (IaaS, PaaS, or SaaS) of Cloud Computing the company uses for its business purposes. A firm can use a mixture of all or two of the elements to provide value to its customers; this is a combined model as it is observed in Figure 13. This demonstrates the possible business models of Cloud Computing. Accordingly, the companies that use stand alone models attain only one element of cloud computing for their business. (Jackel M., Luhn A., 2009) For example Google usually provides SaaS and PaaS to its customers through Google Apps and Google App Engine respectively. On the other hand Salesforce.com provides PaaS and SaaS through its Force.com and CRM in that order. (Miller M., 2009)

3.5. Business Network and Cloud Computing

The main rationale of a business network is to help business owners and their teams to continually improve their business in terms of profit, sharing information, guidance and so on. The business network is work effective where partners are selected carefully; factors such as trust and commitment among the members are trend to be strong, (Moeller Klaus., 2010)

In a *Business Network* “Different partners have different infrastructures”, the interoperability among these heterogeneous systems is the base for the network enterprise “*to work seamlessly and effectively*”, in the best cost-effective solution (Qing Li et al, p127). Many networks of organizations and business networks share their IT infrastructure through CC mainly through cloud storage (IaaS). Hence they do not need huge investments to acquire storage devices. Besides they can remotely upload and download crucial information to storage devices; and if necessary they can add privileges to other network users to access this data. (Mitchel Robert, 2009)

Due to the creative Cloud Computing concept, the business network of Hallstahammar IT companies -if they have not already, they can formulate one- can provide various computing services by making a private cloud to its members or even for other companies in Hallstahammar in order to gain better economies of scale¹.

3.6. Risk Management of Cloud Computing

It seems that the majority of IT leaders and executives are warming up for start using Cloud Computing in the next few years. As it is already mentioned, CC offers elasticity, utility based billing, multiple storage locations and the ability to pull data directly from data centers. (Collett, 2010) In fact CC was ranked 2nd as the technology most tested in 2009 (1st was Virtualization²) according to a survey of more than 300 IT executives (Computer World’s 2010 Forecast). However this does not mean that CC can bring the success and cost-effectiveness so bounteously and easily. In addition while examining our concepts and facing

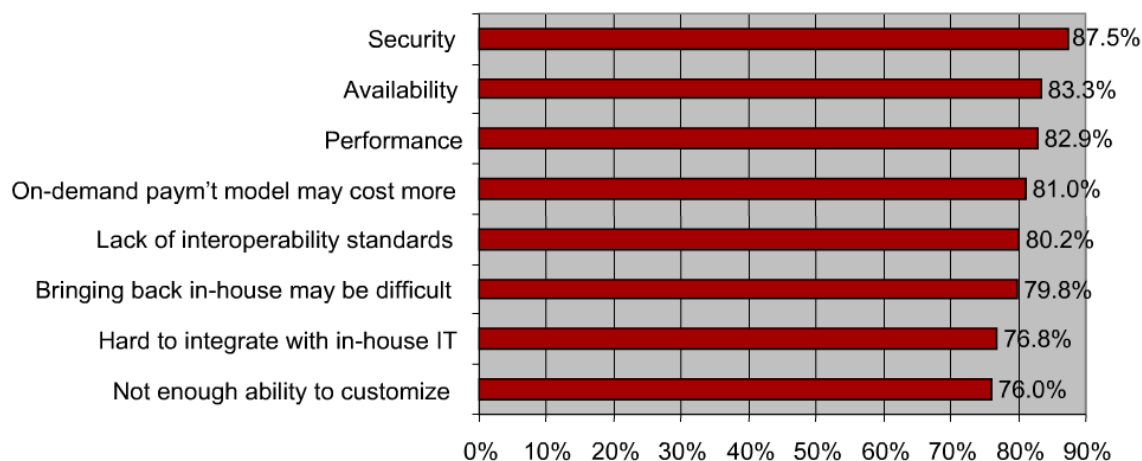
¹ **Economies of scale:** are the cost advantages that a business obtains due to expansion.

² **Virtualization:** It is a method of running multiple independent virtual operating systems on a single physical computer. It is mainly a technological way of reducing the majority of hardware acquisition and maintenance costs, which can result in significant lower cost for the corporation.

different opinions from journalists and authors, we encountered a two-side debate situation. Among them there are the ones that are eager to go on cloud, and the others that believe that Cloud Computing have to mature more as a practical concept and then starting following it. However, there are some others that do believe that it is mainly an overhyped and under delivering technology. Before analyzing further this pole debate and companies' CIOs got persuaded of moving into the Cloud, there are some security issues that have to be critically taken into consideration.

According to a recent survey conducted between 263 IT executives/CIOs (IDC, 2009), they were asked to estimate the main challenges and concerns that could arouse in a prospective use of IT cloud services in their companies. According to Figure 14 following, Security ranked first as the greatest issue of implementing Cloud Computing.

Q: Rate the challenges/issues of the 'cloud'/on-demand model



(Scale: 1 = Not at all concerned 5 = Very concerned)

Source: IDC Enterprise Panel, 3Q09, n = 263, September 2009

Figure 14: Results of IDC ¹survey ranking security challenges.

At this point of our thesis, we are going to mention contemporary security concerns regarding CC environments and the proper methodology for ensuring application and data security policy. In addition, the movement of systems from on-premises to public cloud environment

¹ IDC: International Data Corporation

and also some ways of retaining the integrity of data are also explained. We are briefly focusing on why and how these resources should be protected mainly in Software-as-a-service (SaaS), Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service environments accordingly. Besides, we will state on security best practises either for service providers or enterprises that are thinking of using CC.

3.6.1. Cloud Computing Security Challenges

Despite that Cloud Computing can help companies achieve more by terminating the physical bonds between an IT infrastructure and its users, some raised security threats must be eliminated in order companies to exploit more efficiently this new computer paradigm. Especially for the SaaS provider this is completely true. Furthermore, while companies using the Cloud, they lose control over assets in some respects; the security model must be redefined and reassessed.(Rittinghouse & Ransome, 2010) Enterprise security is only as good as the least reliable partner, or even to the best vendor to this extend. Can companies trust their data to any or to particular service providers? -like i.e.: Google, IBM & Amazon-. Queries like these really need to be answered by CIOs. Is vendor reputation that matter when choosing a potential cloud vendor?

Primarily companies lose control over physical security in the Cloud Computing model. While using a public cloud, one company's computer resources are being shared with other companies' infrastructure. What's more, companies do not even know where – in which particular world location- these resources are running, and they cannot even control them. From this perspective, companies' data is already put at risk of seizure, simply because the data is being shared in the same environment with others. (Rittinghouse & Ransome, 2010)

For this reason, vendors offer a range of security mechanisms that rely on customer management, such as VLAN¹ isolation, firewalls, storage access control, and public key authentication². (Mc.Daniel & Smith, 2010) From the other side as it is not only the technical security aspect, governments should develop appropriate laws and policies, in order to defend companies' rights and privacy of data. Besides, security managers will have to pay attention to systems that contain critical data such as corporate financial information or source code

¹ VLAN: Virtual Local Area Network

² An authentication method that uses encryption key pairs to verify the identity of a user or a client.

during the transition to CC environment. (Rittinghouse & Ransome, 2010) Also they will need to facilitate more with their company's legal personnel in order to provide ideal contract terms to protect this kind of sensitive data and acceptable service-level agreements. But are these mechanisms enough?

In addition, information used must be encrypted while passing through the cloud. CIOs are mainly wondering who is controlling the encryption and decryption keys. Are the customers/providers or the cloud vendors holding these keys? According to McDaniel (2010, p.77) most of the companies want their data encrypted both ways across the internet using SSL¹ protocol. Moreover; the majority of them wants the data to be also encrypted even when it "rests" inside the vendor pool data center. Finally it is better for the companies to hold and control the encryption/decryption keys just as the data was stored in the company's own servers. In addition, data integrity means that data is equally maintained during any operation, even if it is being transferred, stored, or retrieved. In other words, it is an assurance that the data is consistent and correct, and thus it can only change due to authorized transactions. However, a conventional standard does not exist right now in order to ensure data integrity. So companies must invest in new standards of maintaining data integrity. As McDaniel (2010, p.79) is mentioning, the broad acceptance of Cloud Computing depends on the foundation of future systems' security.

3.6.2. Software-as-a-Service Security

As we can see from the evolution of Cloud Services, according to Figure 15, CC models will integrate the use of SaaS, utility computing and Web 2.0 collaboration technologies to leverage the Internet in order to meet the customer needs. (Rittinghouse & Ransome, 2010) As we have already mentioned in the chapter of CC and its impact on the companies' business model, enhanced and totally new business models will be developed. Hence, this would entail not only to new technologies and business operational processes but also to new security issues and challenges.

¹ SSL: Security Sockets Layer Protocol

The Evolution of Cloud Services

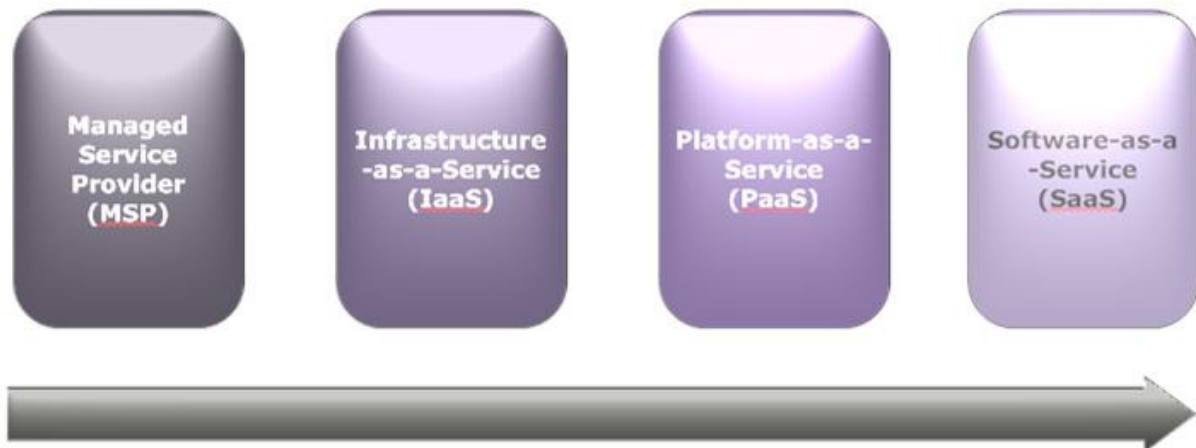


Figure 15: The Evolution of Cloud Services (Source: Rittinghouse & Ransome, 2010)¹

As Rittinghouse & Ransome states, (2010, p163) while SaaS will prevail to be the dominant cloud service model in the forthcoming future, it will also be the field where the most critical security issues will arouse and will need to be clarified.

In addition, companies or customers will need to research the policies of vendors regarding the data security in order to avoid their data becoming unstable, or inaccessible. For this reason we included seven security criteria which were originally generated by Gartner² (a Consulting Firm) in order to be taken into consideration while a company/customer is choosing a potential cloud vendor and tailor a further implementation:

1. Privileged user access: Inquiry concerning who has access to data, and proper information about the hiring and management of these administrators.
2. Regulatory compliance: Whether to be sure that vendor is eager to sustain external audits and security certifications
3. Data location: Are there any possibilities for the company to control over the location of data?
4. Data segregation: Be sure that the data is professionally encrypted at all stages while moving among the internet.

¹ MSP: (Managed Service Provider) An organization that manages a customer's computer systems and networks which are either located on the customer's premises or at a third-party datacenter. MSPs offer a variety of service levels from just notifying the customer if a problem occurs to making all necessary repairs itself. MSPs may also be a source for hardware and staff for its customers. (Source:

² <http://www.infoworld.com/d/security-central/gartner-seven-cloud-computing-security-risks-853>
(Accessed on: 5 May 2010)

5. Recovery: Which are the consequences if a disaster takes place? Is complete restoration being provided, and how long does it last?
6. Investigate support: Would any illegal activities being traced and tracked down from the vendor's side? A report should be provided to the company, in case of such incident.
7. Long-term viability: Supposing that a company is shutting down, what will happen to the data remaining "up there" in the cloud? Is there any possible format that this data can be returned back?

From all of these criteria we could determine that nowadays is even tougher for the companies to recognize and evaluate the data security issues. Nevertheless, SaaS vendors will need to enhance and continually updating the security practices that are provided for use, as the CC environment keeps evolving unceasingly.

3.6.3. Security Management & Risk Assessment

One group of people securing the whole concept inside an organization should be developed. This will sustain a shared vision among the team, and to where security leadership is driving towards. Moreover, it will also cultivate ownership in the success of the collective team. As it is happening with every IT security team inside a firm, this group also has to be aligned with the strategic plan of the organization. However if well defined roles, responsibilities and agreements on expectations are missing, it can entails to a chaotic undesired situations where total safety of the venture is fluctuating.

Furthermore, security risk assessment is also important in order to help the security team and all the involved people for better considering and recognizing the imminent risks. Apart from that, it will contribute for prompt decisions between the dueling priorities of business operations and further protection of assets. (Rittinghouse & Ransome, 2010) A typical and correct information security management should be functioning proactively and periodically. This means that technical and more detailed security risks assessments have to take place every certain period of time or better whenever is demanded according to the circumstances.

Additionally, improved relationships and links should be chased among the product management, engineering groups and the internal security team. Means of modeling the threats need to be developed, requiring both IT and business process knowledge. The security team has to be aware of the ways that applications or systems under review are working.

Lastly according to Vanessa Alvarez (2010, p1) – a journalist of InformationWeek.com- there does exist a big gap between the fast evolution of Cloud Computing and the regulatory/legal issues so far developed. Thus there is a stiff obstacle to overcome before assuming that from the security regulatory perspective is safe to invest.

3.7. Business Implications

While we were examining our concepts related to Cloud Computing, we realized that quite many authors, journalists and IT managers have given various and sometimes controversial points of view into this new paradigm. Thus, we would like to summarize at this chapter/session, the most critical business implications according to us, and discuss them further. Meanwhile these parts have been an inspiring source, especially when we were taking over the interview's session and while developing the appropriate questions.

3.7.1. Cloud Computing versus Outsourcing – CC the “smart way”

As we can observe from Figure 16 following, Cloud Computing is a smart way of doing Outsourcing, and it is the evolution of the mainframe and the on-premise systems. For example in the 1980's, companies needed to buy whole data centers in order to run their businesses. Hence too much amount of money was invested, without being fully amortized in the long run. Some years later, the solution of out-sourcing, served many companies the opportunity to grow, even with a minimum amount of investment on IT infrastructure. However, fixed subscriptions and fixed amounts of money per year was and still is a big pitfall for companies that do not use the whole hardware amount that they hire.

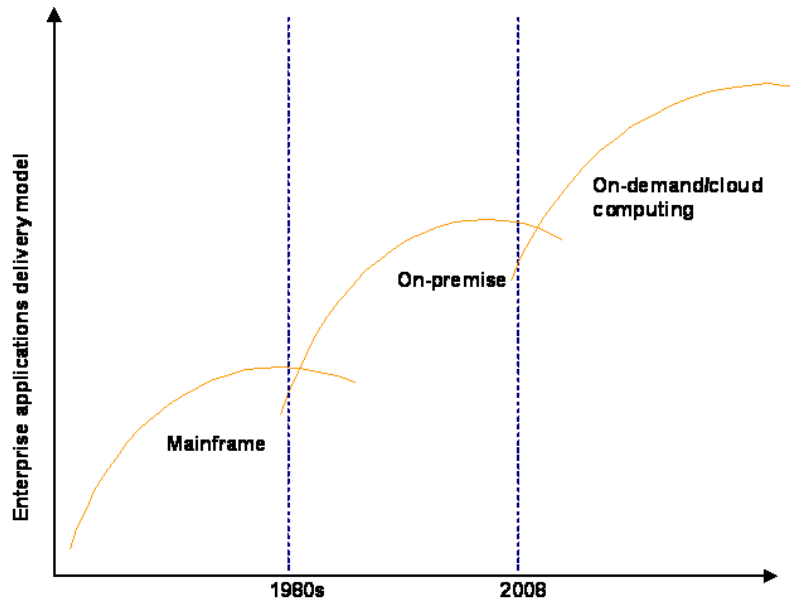


Figure 16: The emerging enterprise applications markets (Source: *Business Insights*)

CC as a new infant and a “smart” solution in the field of corporations, it can offer lots of profits. First of all, companies reduce capital cost of IT and allow them to scale resources with ease (Kambil, 2009). Moreover, companies’ CIOs do not need to worry about their hardware/software, but only for their business. According to Bob Evans (2010, Global CIO column) CIOs are eager to see the potentials of Cloud Computing turning them into tangible business. In order to do that they should cope with three different issues:

Moving faster: Suppose that companies mitigate their IT infrastructure on the cloud, they are moving faster than its competitors. They could have been characterized as early innovators. At the same time business operations and proactive behaviors are responding towards to market demands and opportunities and thus gaining higher speed, in comparison to the legacy ways.

Lower the cost of infrastructure: As already mentioned in the first chapters of our conceptual framework, the factor of cost saving is great importance. As companies are growing, it is demanding to have better performance with the lower cost available. So at this point it seems that CIOs found the gold and best solution. They hope that a thoughtful cloud strategy will let them bridge the yawning gap between expectations/demands and limited funding. (Bob Evans, 2010)

Flipping the 80/20 ratio: Companies and to an extent CIOs use to spend 80% of the IT budget in maintaining costs and sustaining expenditures. The other 20% is delivered to cover further development of the IT department, such as updating and upgrading processes. In addition not enough amounts of money are left, in order to fund new and vital customer-facing projects. However with the adaptation of CC, zero amounts of money are spending for maintenance, and bigger investments are made in other vital customer-projects. Hence, the previous ratio is flipping to 20/80, an achievement which both CIOs and CEOs appreciate.

Thus it is obvious why CC has been the most-talked about subject among many CIOs in the past few months. In addition we could encounter some more advantages while using the Cloud paradigm. (Bob Evans, 2010)

3.7.2. Lower barriers to entry

Indeed while companies are starting implementing CC services, low barriers to entry in the software business are appearing. For example it is plausible that a new market is going to emerge, as more and more big corporations are offering software services through cloud to every potential customer. (i.e. Salesforce.com) Moreover in the close future, more medium companies are expected to offer their software products to be used through cloud. Hence the software business area is going to be enhanced by more companies and even more customers for them. (Kambil, 2009)

3.7.3. Further Competition

Looking down from the same perspective, an interesting competition is experiencing its new steps. A new competition among traditional software vendors and the innovators will be launched. In other words, the small revolution in computing environment toward CC clarifies considerable promise for unleashing more innovation and more capabilities in computing. This trend probably will disrupt the status quo as some firms will adapt this model to go further than its competitors. Companies will also compete to be the leading cloud providers as they design a new landscape for information industries and services. The same can be

appeared as well to the PaaS environment; for instance, programming API¹ might experience a mass competition of newcomers in this CC programming field. (E-Science, 2009)

Despite all those advantages that can be initiated through CC, there do exist some totally dissimilar opinions that introduce negative and contradictory positions against the cloud method.

3.7.4. Cloud Computing as the next hype - Cloud doesn't matter

At the middle of 2010, according to Information Week Analytics and Witman A., 370 companies asked to rank factors impacting data center operations for the present year. Among the first three places, were the constrained budgets, storage growth, and server virtualization. However last one was Cloud Computing. According to the same research, only 9% of them are considering to move their businesses on public cloud services, 19% are considering of private cloud services, and 24% are not even considering for private cloud services. This denies healthy skepticism, and pretty typical IT evolutionary process, and as it is mainly admitted, evolution does take time. (Witman, 2010) Similarly, Cloud Computing triggers more questions than answers, as it is an ill-defined term regarding the numerous concepts that introduces. Public, private or even hybrid clouds, there are still some points that breed more queries than solved issues.

According to Collet, Cloud Computing is something more like overhyped and an under delivering technology. Others like Evans (2010, p1) believe that Cloud Computing is similar to internet. It took it 20 years to become a “big entity”. Similarly, CC needs its proper time to mature as a concept with its practical amenities. We could even compare Cloud Computing with the controversial aspects of Nicholas Carr and his article “*IT doesn't matter*” (2003, p5). For example, Information Technology (IT) was accused that it destroyed one of the most important barriers to competitors, and now the most cutting-edge IT capabilities have quickly become available to all. Besides, as we mentioned above, Cloud Computing is going to lower the barriers to entry in the software industry. What's more, as Carr is stating “*when a resource becomes essential to competition but inconsequential to strategy, the risks that creates become more important than the advantages it provides*”. Looking from this thoughtful

¹ **API:** An application programming interface is an interface that a software program implements in order to allow other software to interact with it, much in the same way that software might implement a user interface in order to allow humans to use it

perspective into the Cloud issue, we can detect some similarities. Likewise cloud usage may become ubiquitous in matter of time, however we can hardly imagine if it could integrate and be aligned with the companies' strategies. Except from the security issues, strategic risks may also appear while exploiting it.

As Wittman quotes, "*2010 cannot be the year of Cloud Computing*", but maybe after one decade. (2010, p2) A steady evolution of systems and an extensive collaboration with all the business partners involved, can lead to adequate "*cloud results*". However, Evans states that despite CC is in its infancy, companies do not have to see it through a twenty year horizon and a steady state theory. Altogether, CIOs are looking in 20-months horizon rather a 20-years one. This means that imminent actions that CIOs are planning to execute, cannot be seen through such a perdurable period. They are looking for better profits and results in a short-term period. Indeed Cloud Computing does offer such advantage.

3.7.5. Best Practices

Many may wonder, if there are particular formulas while choosing the appropriate method or Cloud type for implementing this new paradigm of computing. At this part we present some summarized opinions from experts and journalists that have lately put effort into the matter. CIOs and IT managers of Hallstahammar's IT companies can be inspired by these points of view.

According to Wittman (2010, p2) in many corporations the boards of directors are querying CIO and CEO what they are doing referring to Cloud Computing. He insists that they should watch and learn from the early innovators. The late adapter is better for this type of an implementation. In addition, CIOs are pressed to get on track at unprecedented levels of speed, global scale, flexibility, precision, customer engagements and financial clarity. Thus it is not the appropriate force that the task requires.

Instead, according to Evans (2010, p1), it is better for the CIOs to start testing, tinkering and experimenting with this new concept rather than doing nothing and just simply watching and learning. And as Cloud Computing has characterized as hype, at this point, hype could be the CIOs do nothing to keep track of this innovative paradigm.

Chapter 4 - Empirical Data

In this section, we have summarized the answers from the conducted interviews that took place in one-month period. Each interview lasted around 30-45 minutes, and thus we had lot of information provided. For this reason we have summarized with bullet points the relevant and interesting parts. Moreover, we have categorized the answers referring to the selected concepts of our framework. Depending from the type or the nature of the company that was interviewed we had customized the questions to fit with its company's profile. However the general meaning of the questions has remained the same. A sample from the questions has been included in the Appendix section.

4.1. Results from Interviews

4.1.1. Interview with: Marcus Hanson, (Director and Owner, Software engineer)



Hansson & Vrethed AB CAD-Byggkonsult, Web:

www.hvab.nu

Date: April 15, 2010 Time: 15:15, Place: Skype Meeting,
MDH

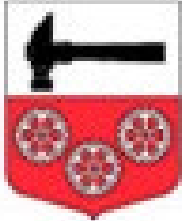
Introductory Questions	<ul style="list-style-type: none"> • Working area: Construction work company for pre-cast concrete constructions • No. of employees: 4 employees • Developing software by myself, a plug-in for application, • Reseller of this software application • Each employee has one PC with 2 screens (24") • Server: Hard disk cabinet with 2 disks with mirroring feature • Basement Server with backing up capability, shared by the whole building (other companies exist in the building) • Cloud Computing impossible to help them through SaaS, as AutoCAD is being served only through a personal computer version by now. • Outlook service e-mail per PC
Cost Leadership	<ul style="list-style-type: none"> • We are using Loopia, which is not as expensive as an e-mail service provider. • I haven't thought of changing my email infrastructure through cloud, in order to save money. However I would go for that, only if it worth the hassle, not just a couple of kronas. "Time is money" • I would change AutoCAD through cloud, because it is reliable. I trust it.
Cloud computing as an Innovation Process	<ul style="list-style-type: none"> • I would follow the cloud if AutoCAD offers me such an opportunity.
Cloud Computing & Business implications, CC and Outsourcing	<ul style="list-style-type: none"> • I would also follow the cloud way to develop the special applications (plug-ins) for AutoCAD, to serve my customers. • I would change AutoCAD through cloud, because it is reliable. I trust it.

	<ul style="list-style-type: none">• Not out-sourcing anything right now, even not IT and IS. However I believe Cloud Computing is smarter than Outsourcing.
Cloud Computing & Business network	<ul style="list-style-type: none">• It could be a way to extend my business network, but according to the nature of the service/application that I am offering (customized ones), I cannot be benefitted from the Cloud & its wider business network.
Cloud Computing & its risk factors	<ul style="list-style-type: none">• Not asked, nothing mentioned.

4.1.2. Interview with: Kent Sjöström, näringslivschef (Business Development Head),

Hallstahammar Municipality, Web: www.hallstahammar.se

Date: April 20, 2010 Time: 13:15 Place: U02-010, MDH



In the beginning of the interview we had to describe him different facilities that cloud computing can provide with few examples.

Introductory Questions	<ul style="list-style-type: none"> No. of employees: didn't ask Working area: Managing the Municipality
IT Infrastructure and Cost reduction	<ul style="list-style-type: none"> Hallstahammar municipality, two years ago moved its entire IT infrastructure to Västerås municipality office to share resources among each other. All the support service comes from Västerås IT department. If Hallstahammar's IT demand is growing we could move into cloud computing infrastructure services as it seems very cost effective, although I am not the right person to decide those things. We are building our new web site in EpiServer CMS¹ which is reputed. We could have use the same system as Västerås is using but for support we have to always rely on them as they are using their in house CMS system. In future all our system and infrastructure could be separate from Västerås.
Cloud Computing & Business network	<ul style="list-style-type: none"> Hallstahammar kommun as a municipality cannot develop business for its own income generation but if any company builds a private cloud for Hallstahammar where we could join and inspire other companies in the network to affiliate.

¹ CMS: Content Management System

4.1.3. Interview With: Björn Johansson, VD (Managing Director), PComPartner,

Web: www.pcompartner.com

Date: April 27, 2010 Time: 11:00 Place: U02-010, MDH



In the beginning of the interview we had to describe him different facilities that cloud computing can provide, illustrated with some examples.

Introductory Questions	<ul style="list-style-type: none"> No. of employees: 1 (the owner) Working area: Process software/communication system design
Cost Leadership	<ul style="list-style-type: none"> I am using no server right now but I am thinking to hire an office soon and have a server there. Right now I am using local area network with 3 computers in my home office. I am using LabView and Visual studio for software development. If that software has some interface in the cloud I will use the services.
Cloud computing as an Innovation Process	<ul style="list-style-type: none"> For my present work I need network to test my software so right now it is not possible for me to develop software in cloud development platform services like, PaaS. For the deployment of my software I am using email to the customers but I am planning to deploy it through cloud in near future, so all my customers can get the regular update.
Cloud Computing & Business model	<ul style="list-style-type: none"> If everything goes right with the cloud service according to my requirements then I can sell my services or products through cloud.
Cloud Computing & Business implications, CC and Outsourcing	<ul style="list-style-type: none"> In my case I use a testing environment in a local area network. However the cloud services don't provide me this feature. Besides if in the future they can provide this facility then I can go for that. I am not using any outsourcing now and have no plan for the future.
Cloud Computing & Business network	<ul style="list-style-type: none"> I have some partnership with one US Company where I use their libraries and develop protocol analyzing services.
Cloud Computing & its risk factors	<ul style="list-style-type: none"> Yes I can put the data in the cloud but must have a copy in the local disk as risk of losing data and during my need to use the data the internet can be down. And my ideas can be stolen from the cloud. Vendor reputations are always considerable before choosing cloud services. Internet connection can not be always stable and high speed

4.1.4. Interview With: Filip Redeen, Personal Relationship Office, LifeCenter

AB



LifeCenter

Web: www.lifecenter.se

Date: April 06, 2010,

Medium: Email Interview

Introductory Questions	<ul style="list-style-type: none"> No of employees using mail system: 48 Working area: Non profitable organization, social work
Cost Leadership	<ul style="list-style-type: none"> I have introduced the use of Google Apps in LifeCenter. The main functionality is a mail system where all is stored online at Google, up to about 7,4 GB per account. It is accessed either online, or through POP or IMAP. Additionally, a calendar function and the ability to share and collaborating documents (word processing, spreadsheets and presentations). Google Apps is free up to 50 users, which is enough for LifeCenter. It is only needed to sign up at Google and ask your host to change the DNS of the desired URL (mail.example.com). Since Google Apps is free, you reduce costs to 0 kronas per year. I don't know how much we paid before since it was part of a package consisting of domain name, server space, support, mail accounts etc. Probably a few hundred kronas per year. The setup with all planning (what users to transfer from the old system etc) took approx. 10 hours, then all users had to transfer their old e-mail themselves to keep it.
Cloud Computing & Business implications, CC and Outsourcing	<p>While doing that is such tough to manage the upper management, like VD, and others?</p> <ul style="list-style-type: none"> I do not really understand the question, but if you mean if it was hard to convince to upper management this was a good decision, then the answer is no. Since Google is a top of the line player offering professional services for free, it was an easy decision. <p>How user friendly that system is?</p> <ul style="list-style-type: none"> The system is very user friendly. It is really easy to use and configure and self-explaining in most ways. Still, it offers advanced functionality like IMAP where you have the ability to have your mail synchronized to your phone and other computers.
Cloud Computing & its risk factors	<ul style="list-style-type: none"> We feel secure and yes we trust Google, since they do not afford security breaches to keep their reputation.

4.1.5. Interview with: Anders Täpp, Graphic & Web designer, IDÉbild

Web: www.idebild.com

Date: May 10, 2010,

Medium: Face-to-face interview



Introductory Questions	<ul style="list-style-type: none"> • Working area: help companies in the marketing, obtaining advertisement methods, exhibition stands, fliers, producing web-pages. • No. of employees: 3 producers, one photographer, and 4 representatives outside the company • 4 PCs, 1 Server for backing procedures. • Every time that a recession is happening in economy, companies stop advertising, bad effect in Marketing. Reduction is happening right now, so less people are working now. • 20 years ago, IDÉbild had 4 branches in the whole Sweden, but now only 1 in Hallstahammar • I am using CC a little bit personally, Google Docs etc.(in basketball training) • Not CC in house, not even with our clients. But I am trying to bring this technology in IDÉbild company • IDÉbild's IS: Adobe Photoshop, Dreamweaver, licenses bought per user. Expensive software. • Portable disk per user, being used for backing up at the end of the day.
Cost Leadership	<ul style="list-style-type: none"> • Probably we need something like that. We would like to use an application from the cloud with lower costs e.g. Joomla, Google blogger. • This is the way we should do it. • I have also thought for moving the email domain to Cloud in order to minimize costs. But for us is not such an economical decision. However, we could propose it to our customers.
Cloud computing as an Innovation Process	<ul style="list-style-type: none"> • It is important to us, to accept such innovations in order to be ahead of our clients. (Using Adobe new facilities that are one the way e.g. Adobe Photoshop Express) • I think we could gain more potential to be innovative.
Cloud Computing & Business implications, CC and Outsourcing	<ul style="list-style-type: none"> • I could follow Cloud definitely, though it is not our first priority right now. <p>Example of buying a car, leasing a car, or taking tax driver.</p> <ul style="list-style-type: none"> • Our server is Mac, already paid-off. No administrative costs exist. It could be a good solution for bigger type of company.
Cloud Computing & Business network	<ul style="list-style-type: none"> • We have to be a bit of computer gigs, to know more things about this type of technology, and then we can deliver it to our clients. They will be more pleasant to provide them with such knowledge. Clients do not have time to search new technology fields.
Cloud Computing & its risk factors	<ul style="list-style-type: none"> • The problem for us is that we have gigantic data to be stored. E.g. images, graphics, pictures.

	<ul style="list-style-type: none">• Too much data, to put in the cloud.• Depends from the cost, to take such an opportunity.• Google is fantastic. I trust them. I am aware of their security encryption issues.• If a company comes from Västerås and offer private cloud services, I will first focus on the security facilities they are offering.• I will not just think if they have the “Google face” in order to trust them, although I will rely on other facilities like: Redundancy, data integrity, and other features.• I could follow Cloud definitely, though it is not our first priority right now. (example with External Drive)• We are dreaming that in the future we could start our computer, and back it up on the cloud... (funny comment)
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4.2. Case Study 'TotalAssist'



Type of application: A scheduling and time reporting system for personal assistant (works for people with functional impairments)

A Personal Assistant assists a person with severe disabilities to do what he or she would have done without his disability. It deals with both aspects of everyday's works and pleasures. Many of them need 24 hour assistance. There are companies which provide personal assistant to those people.

These companies are dealing with many assistants and many disable people having trouble with their scheduling and time report procedures. The time report is not only for checking how many hours they have worked; but the summary of those has to be submitted to government authority like Försäkringskassan (the social insurance Company of Sweden).

Aros Circle AB in Västerås; is an IT consultation company that has foreseen the need. As a result they came up with a great idea of developing a web based scheduling and time reporting system called *TotalAssist* for those companies. Aros Circle AB is mainly providing IT consultation to large and mid size organization since 2000 in all over Sweden and EU.

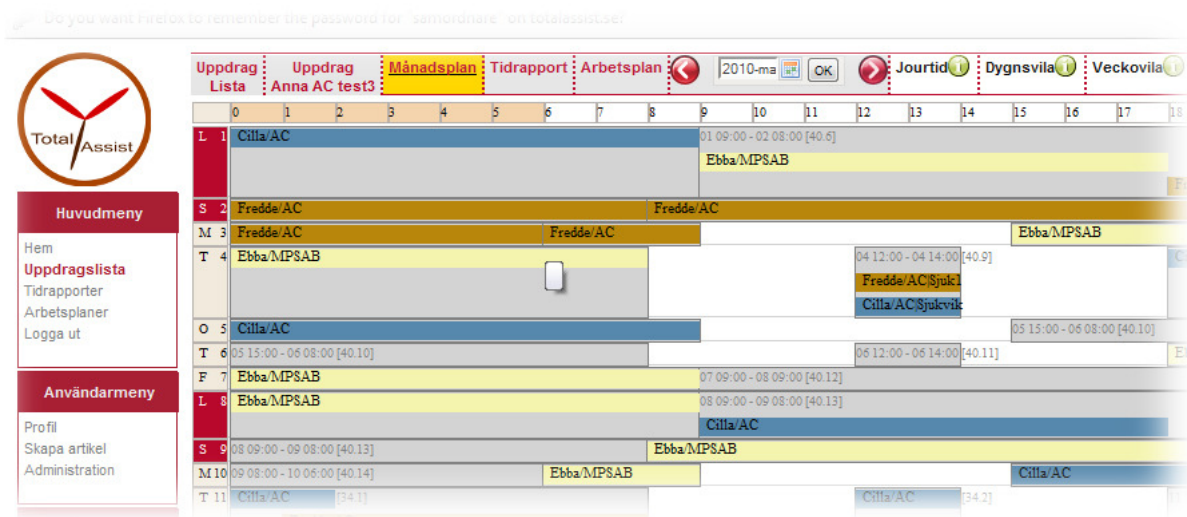
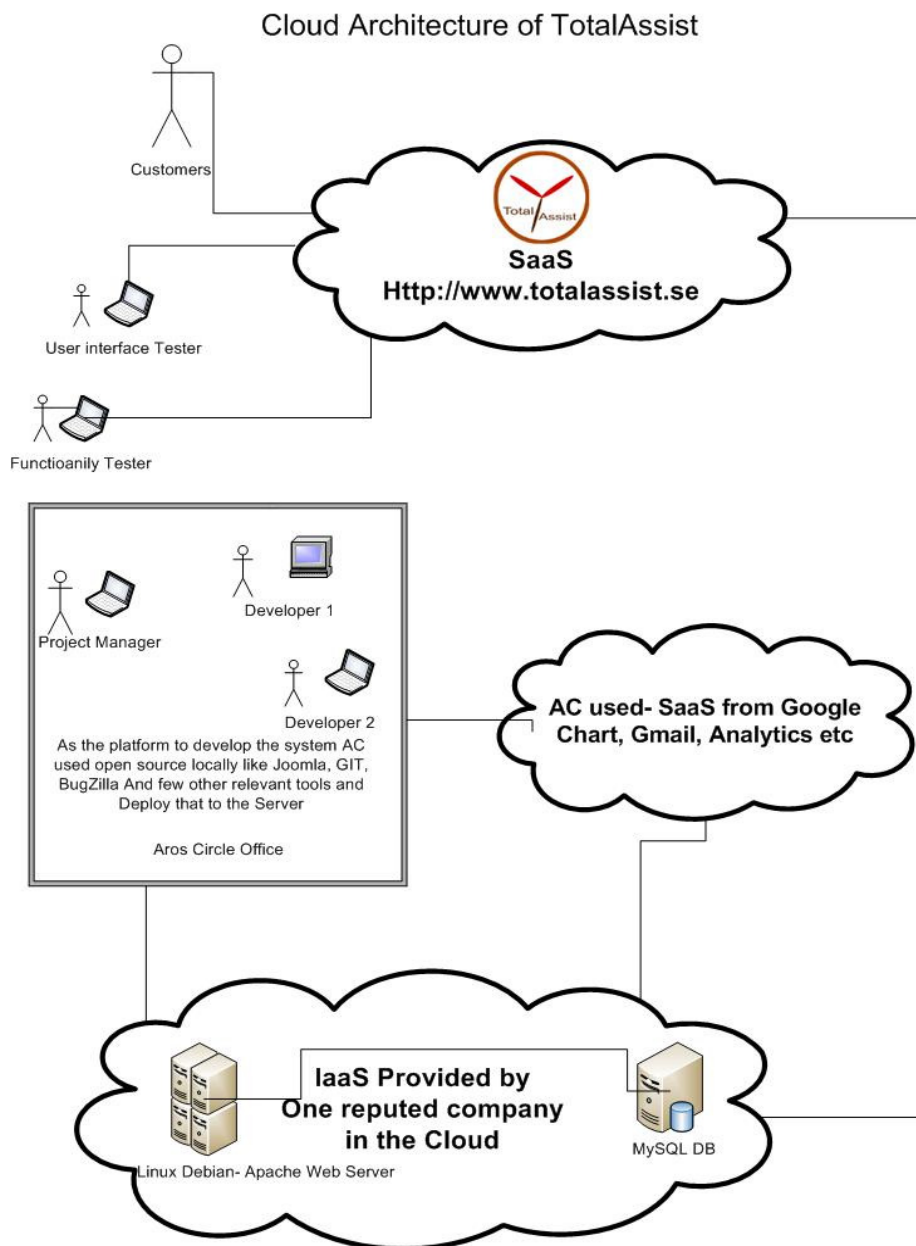


Figure 17: A screenshot of TotalAssist scheduling system

The main development concept of TotalAssist was to deliver the software service to its customers through Cloud Computing. When the justification of this development was queried, Curt-Åke Sundholm, CEO of Aros Circle and Project Manager of TotalAssist, answered, ‘User doesn’t need to have powerful computer to run the system, and he only needs an internet browser application and a medium connection to internet’. TotalAssist hired the infrastructure (implementation of IaaS); that server space belongs to one reputed computed company in Sweden. This costs approximately 250 SEK per month. While we inquired more about the criteria of selecting the IaaS provider, he mentioned *price*, *vendor’s reputation*, and other facilities; such as backup and restore policy. One more prerequisite was that the potential provider should enable his business in Sweden.



The overall development cost of TotalAssist is near about 1 (one) million SEK. The development cost (e.g. programmer's salary) is approximately the same as if TotalAssist was a client-server based application. Whereas it would have been much higher infrastructure and software application license cost, as Kenneth Nilsson mentioned -the main developer of TotalAssist-. He also stated that for PaaS they did not use any Cloud service like Google Apps Engine or Windows Azure. They have used popular open source projects like Apache web server, MySQL, Joomla (CMS) framework, Git¹ and BugZilla². This has reduced significant agile development cost. *'Using Cloud computing concept makes us easy to deploy new version, bug fixing and maintenance of the system to one place, we don't need to think about the customers' end...'* said Kenneth Nilsson. He also accentuated that anyone having programming skills in any other software platform can easily grasp these Cloud development platforms in order to enable them in making product or service through cloud.

Although TotalAssist itself is a SaaS (Software as a service), it has used others SaaS services into its functionality like, Google Charts, Google Analytics etc. Nowadays, many companies provide web based software-as-service by putting up their own servers, switches etc in their own premise. However TotalAssist used cloud services in all its aspects starting from infrastructure till development processes. Figure 18 shows us the cloud architecture of TotalAssist.

One drawback of this kind of system is the unavailability of internet connection for some unavoidable circumstances to the end users; something that is not frequent in Sweden at present.

Kenneth Nilsson mentioned also, that software developing companies can use this concept of making software for their customers with very low investment and advanced resources. Curt-Åke Sundholm, with more than 30 years of software project management experience, highlighted that managing this kind of project is much easier than any other type software development projects.

¹ **Git:** It is an open-source distributed version control system designed to handle everything from small to large projects with speed and efficiency.

² **Bugzilla:** It is a web-based general purpose bug tracker and testing tool originally developed and used by Mozilla projects.

One of the obstacles that they encountered while developing this kind of application, as Kenneth mentioned, is the *internet browser compatibility*; users have their own choice of using different browsers e.g., Mozilla Firefox, Internet explorer, Safari and Google Chrome. He mentioned “*we had problem with fixing calendar pop ups for internet explorer users, while that was steadily working with all other browsers*”

From all of the above, we can deduce that IT innovation through Cloud Computing in Aros Circle AB was accomplished successfully and enabled them to extend their business network and exploit new opportunities in the future.

4.3. Summary of the results

In the table that follows we gathered some important information regarding the companies’ answers on specific queries that were posed. Based on that table, we approach the analysis part in the next chapter.

Company Name	Already Adopted CC	Planning to Adopt CC	Encourage customers/ others to Adopt CC	Will adopt CC if platform application goes to CC, e.g., AutoCAD	Can't decide Now/ Not first priority
<i>TotalAssist</i>	√		√		
<i>HVAB</i>		√		√	
<i>Hallstahammar Kommun</i>			√		√
<i>PComPartner</i>		√		√	
<i>IDEbild</i>		√	√		√
<i>LifeCenter AB</i>	√				

Table 2: Summary of the interviews’ results.

Chapter 5 - Analysis

In this chapter, we -as the researchers- tried to be the “third angle” of the triangle of analysis as discussed in methodology. Using the conceptual theoretical framework as a basis, we analyzed the empirical data from the interviews. Besides, we have segmented the concepts related to the questions that were posed.

5.1. Cost Leadership

From our interview data, we found TotalAssist (Aros Circle AB) and LifeCenter AB have implemented Cloud computing services. Those companies invested small amounts of money in IT infrastructure, software license costs and maintenance costs. The other interviewed companies did not utilize any CC services but they are eager to reduce their costs by using cloud services. PComPartner and Hansson & Vrethed AB are developing software application using license software, like Visual Studio, LabView and AutoCAD. They mentioned that it will be possible for them to use the cloud services if those companies provide browser-based application development facilities in a lower cost. Anders Täpp from IDÉbild personally uses Cloud services and planning to introduce them to the company. Email migration of IDÉbild to cloud will not offer too much cost-saving, however the idea can be shared with their clients in order to save customers' IT investment cost.

As we discussed in our conceptual model of CC and cost leadership, most of the interviewed companies are concerned about reducing the IT cost using cloud; moreover few of them are already enjoying the benefit.

5.2. IT Innovation process

Aros Circle AB developed the TotalAssist application in the cloud, which they could had developed in the client server based environment. Outside-in process of open innovation plays a vital role in deciding the platform of their software system. Google's inside-out process of providing chart, analytics services for their customers was an inspiration to TotalAssist. The coupled process of open innovation has brought TotalAssist in alliance with Google's chart service to provide enhanced facilities to their clients.

For few companies it is not possible to do IT innovation in cloud as they are dependent on other vendor's software development platform. Nevertheless, if the vendors provide cloud development facilities for those particular companies, they can be innovative. On the other

hand, IDÉbild argued that they could accept IT innovation through cloud computing to provide more updated services to their clients. Looking from the perspective of non-profit organizations, such as LifeCenter AB, migration of all users' email accounts to Google Apps was indeed innovative.

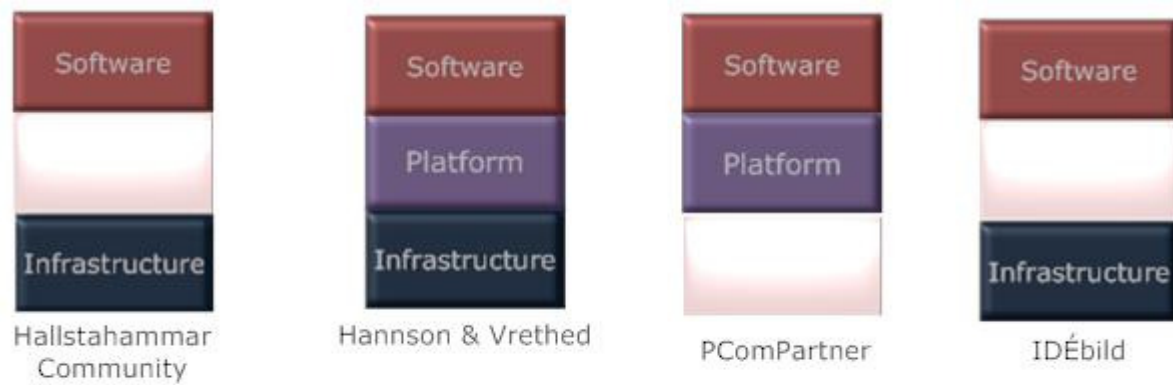
5.3. Business Model

Primarily we focused in the companies that have already implemented Cloud Computing services such as TotalAssist and LifeCenter AB. According to the concept of the potential business models for cloud ventures, we explored the models that these companies are using to operate. As visualized from the following Figure 19, TotalAssist is utilizing a combined model of Software-as-a-service (SaaS) and Infrastructure-as-a-service (IaaS), as they provide a software application through the Cloud by hiring data centre space. Additionally, LifeCenter AB is offering non-profit services to their clients while for operational and managerial tasks inside the organization, they use stand alone model of Software-as-a-Service (SaaS).



Figure 19: Cloud Computing Business Model of TotalAssist and LifeCenter AB

However for those companies that are not following the cloud paradigm, we examined and comprehended their business profiles and formulated the following possible cloud computing strategic options.



Possible Business models for the interviewed IT companies of Hallstahammar

Figure 20: Possible cloud computing strategic options (Business models) for other IT companies

Hallstahammar should use IaaS because as we observed from their last years IT activities, their demand for infrastructure was raised so they had to move it to Västerås in order to share resources. Indeed a transition to the cloud paradigm can bring them closer to their future needs as they are further growing. Referring to why they should also use SaaS, it can be justified that as from now they have started building a new website in EPiserver¹. This website and other software application appliances can be developed and implemented through the cloud environment while serving the potential clients/businesses of municipality.

Accordingly, Hannson & Vrethed as a designing construction company is using AutoCAD for developing constructions plans till customized applications (plug-ins) that are being provided to their customers. Besides, they made use of one server with a redundancy of hard disks and mirroring feature. For these reasons, they could follow a combined business model of SaaS, PaaS and IaaS. More analytically, they should implement the Software (SaaS) model instead of sending the customized application to their customers, whereas the customers by themselves could “run” it directly from the cloud. From this solution, time is being saved. The platform (PaaS) side can be justified as they could also develop these customized applications, through e.g. AutoCAD that is being provided from the cloud by Autodesk. As it is mentioned in the interview the firm would trust not any software platform from the cloud, but only such a reputed vendor as Autodesk. (*Vendor reputation*)

¹ Episerver: EPiServer CMS is a proprietary web content management system. It is used to manage information on an Intranet, Extranet or a public Website, Source: en.wikipedia.org/wiki/EpiServer [Accessed on May 24, 2010]

Similarly, PComPartner as it is a small software development company; they are using no server right now except from only 3 personal computers. So further demand for infrastructure is not present, or imminent to be in the future, hence the IaaS is not advisable here. However, as they are using LabView¹ and Visual Studio, and according to the owner/programmer statements, in the future they could operate software development platform (PaaS) from a cloud interface. In addition, after developing his software module, he can distribute that software as a service (SaaS) to his clients, instead of deploying it by email as he has mentioned.

Focusing on IDÉbild (the advertising firm), we observed that 20 years ago company had more IT infrastructure and 4 branches across Sweden. However, according to Anders Täpp (representative) as every time that a recession is taking place in economy, their sales are decreasing. Companies are stopped advertising, a bad effect occurs in Marketing and hence IDÉbild has to reduce its costs. Now it locates only in Hallstahammar through one branch. Thus the need for infrastructure has been fluctuating in the last years. For this reason a more escalating model for building the infrastructure is needed to serve the potential demand. IaaS model is advised here. Likewise, the demand for backing up services is served through an in-house old server and mainly by individual portable hard disks which are being carried out of the office at the end of the daily working schedule. Regarding the SaaS side of the proposed model, IDÉbild is eager to use a potential Adobe version through cloud e.g. Adobe Photoshop Express, or Sumo Paint². By this solution they can achieve better cost savings, as fixed prices for software licenses will not be paid every year, but in an analogical way as they are being used. (Pay-as-you-go)

¹ LabVIEW: (Laboratory Virtual Instrumentation Engineering Workbench) is a platform and development environment for a [visual programming language](http://en.wikipedia.org/wiki/LabVIEW) from [National Instruments](http://en.wikipedia.org/wiki/LabVIEW). *Source:* <http://en.wikipedia.org/wiki/LabVIEW> [Accessed on May 24, 2010]

² Sumo Paint: *It is an* online image editor and drawing application, served through cloud environment.

5.4. Business Networks

Hallstahammar Municipality is always working towards making business networks and developing new businesses in the area (Kent Sjöström, 2010). Governed by the rule, Municipality can not have any income generation project. Similarly, Hallstahammar municipality is not able to build a private cloud to offer services for other companies; whereas, they will certainly encourage companies to implement this cloud service idea. Thus some business opportunities are there to serve the business networks with cloud computing services

CC services could be a medium to increase and manage the business network. Although Hannson & Vrethed argued that they could be not benefited from CC due to the nature of their services. Conversely, PComPartner can take advantage and exploit further the effects of CC in the extension of its business network. Further partnership with more companies such as US companies as B. Johansson mentioned, can provide him with various business contacts across the world. (Personal Communication with Björn Johansson, 2010)

Similarly, IDÉbild states that CC will provide them with the means to diffuse technological knowledge to their clients, and hence extend their network. *“We have to be a bit of computer gigs, to know more things about this type of technology, and then we can deliver it to our customers; they will be more pleasant, as they do not have time to search for new technology fields”* as Anders Täpp quotes during the interview. (Personal Communication with Anders Täpp, 2010)

Hallstahammar Municipality has seven different business networks in the area (Hallstahammar Promotion, 2010,) and none of them are for IT companies. The IT companies of Hallstahammar should have their own business network. Various CC services can enhance the management of the network. For instance, if a private cloud is created by the business network of IT companies, it should be comparably cheaper and more trustworthy than any other public cloud vendor.

5.5. Risk Management

While examining the concept of risk and security of the cloud environment, we figured out: that *data encryptions*, appropriate *government policies* and *service-level agreements* are some of the features that need to be taken into consideration. Beyond that, companies' representatives from the interviews mostly agreed on these issues; in addition to others that stated *various aspects of security* as a prerequisite of adopting the CC model.

Primarily, at PComPartner they believe that the reliability and credibility of Internet connections can play a vital role in the CC environment. Connections can not always be stable and fast, depending from the various locations. Besides, they insist that data which resides on the cloud must have been also replicated somewhere locally (local disk). Only with this requirement achieved they would move their data on the cloud environment. Moreover, they are conscious about their business ideas being stolen.

Focusing on IDÉbild, their main drawback of implementing CC is that their type of data is not efficient and cost effective to be stored in the cloud. *Gigantic data* as it was mentioned because of their numerous images and graphic file formats; may or may not be accessed on short time due to e.g. network failures and slow connections.

Ultimately, *vendor's reputation* is one of the major criteria of choosing any CC services. In addition that firms are concerned where their valuable data is being saved, they rely more on the most reputed vendors, e.g. Google. For instance, TotalAssist, PComPartner and LifeCenter do agree on that. However IDÉbild and TotalAssist also argued that they would take into consideration the security issues the providers are offering, rather than their reputation; while IDÉbild notes that "*no matter how fantastic is Google*", they trust them because by themselves are aware of their security encryption issues. Moreover, TotalAssist elucidates that they prefer to hire an IaaS from vendors operating in Sweden; whilst IDÉbild will not judge if vendors have the "Google-face" in order to trust them. As Anders Täpp cites "*I will rely more on other security facilities such as redundancy, data integrity...*" (Personal Communication with Anders Täpp, 2010).

5.6. *Business implications*

Among the business implications that we observed through a potential Cloud Computing transition, many authors argued that CC is the smarter way of outsourcing. Stated on that, almost all the respondents agreed that CC can surpass the existing outsourcing. For instance, at Hansson & Vrethed AB they consider it as clever idea than outsourcing; nevertheless they are not outsourcing any of their IT and IS systems. More particularly regarding the issue of companies *moving faster* than its competitors and exploiting opportunities in better times than legacy ways; we have examined such paradigm in LifeCenter case. They implemented Google Apps, while many business firms had not started considering about it.

Although the *low barriers* to entry for new vendors and small firms getting in this new market of CC providers and services, we contemplated that in Hansson & Vrethed the *vendor reputation* has a crucial implication while choosing software designing platform. Specifically, they would choose software provided by the cloud environment only if it was developed by Autodesk¹. Thus, low barriers to entry for some particular business fields like the designing/engineering areas, will not be triggered by the CC implementations. In addition to that, the already reputed and trusted companies will not face *further competition* even after moving on cloud, and particularly at specific software industry.

Referring to whether CC is an *overhyped* concept or not, all of our interviewees responded that they do not consider it as a bubble waiting to be burst. However they argue that it needs time to be fully matured and being exploited without imminent drawbacks. We insist that CC nowadays it does matter at all; and it has been misunderstood by many CIOs.

At last, focusing on the *best practices* of how companies should react and respond to the Cloud Computing wave, as we perceived from the respondent's side; LifeCenter and TotalAssist can be characterized as early innovators. These firms –the one non-profit organization and the other software developer- managed to accomplish successfully SaaS implementations and IaaS utilization. In addition, among the firms that we proposed to shift into CC, the majority annotated that although CC could help them grow and be more pioneered; they would not follow such a transition right now as it is not their first priority.

¹ Autodesk Inc.: It is an American multinational corporation that focuses on 2D and 3D design software for use in architecture and engineering. One famous product is AutoCAD.

Thus we apprehended that following or not a CC transition, is not relevant with some *best practises, but* depending from the type, size and needs of the firm; however it depends from how every organization is realizing this issue and managed to link it with its demands and priorities.

Chapter 6 - Conclusions and recommendations

In this chapter, we summarize the main points of our thesis and we mainly answer the research question. Further recommendations are included, as well as the credibility of our research.

6.1. Summary

According to what H&V, IDÉbild, PComPartner, TotalAssist, LifeCenter, and Hallstahammar Municipality have mentioned and based on the critical literature review, IT companies in Hallstahammar should adopt Cloud Computing.

By selecting this pioneer paradigm, companies can also gain more business benefits such as cost-leadership, new innovative product/services, extending their business networks and enhancing their business models. Moreover, low barriers to entry are observed so other software companies can arise in this emerging market, while further competition can be advanced. Cloud computing can be defined as the smarter way of out-sourcing ones for company demands for infrastructure or even for more services. In contrast, the main risk implications that potential organizations may face are data security (data encryption), where exactly data resides (data location), recovery procedures, and availability of internet.

Moreover from our interviews, the case study, the primary data of Cloud Computing; and our personal knowledge and experience in management and business administration, we deduce the following recommendations explained in the next section.

6.1.1. Companies interested to use cloud service

In Figure 21, through a Gantt-based chart we illustrated how companies should proceed with the appropriate steps –concepts already explained in the thesis- while adopting the cloud services and aiming to minimize their IT cost. Companies need to determine the steps of business implications; estimating the cost, as well as assessing the risk and security factors before choosing and implementing the appropriate cloud computing services. However, as the procedure of these steps is only recommended and deduced by our research topic, we cannot estimate the appropriate time that is demanded. Mainly it could depend from the size or the type/field of working of the organization. For this reason we have exclude in both figures (also figure 22) the factor of time.

Companies Interested in Cloud Computing implementation mainly to reduce costs

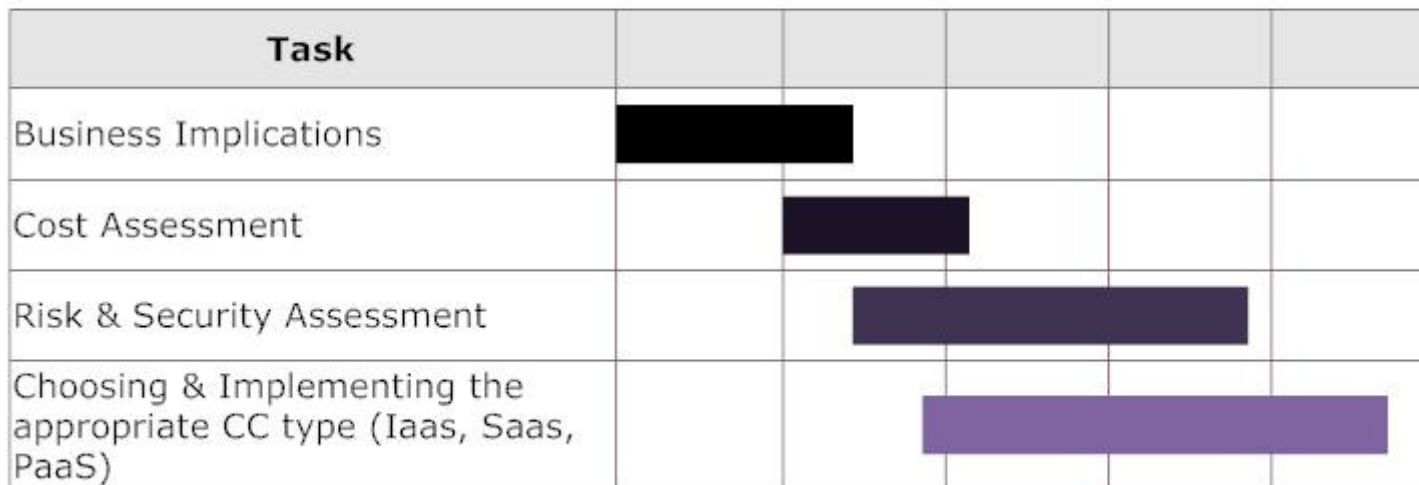


Figure 21: Companies interested to reduce IT cost using the CC paradigm

6.1.2. Companies interested to IT innovation through Cloud

In Figure 22, we showed the procedures that can be followed by companies that chase IT innovation through cloud computing. The first four rows are similar to the steps of Figure 21, as companies also need to consider the same factors. Moreover after starting the IT innovation process they need to manage risk and security of their own product or services. We proposed that they should also start to redefine their business model, right after choosing the appropriate CC type and launching the IT innovation process. As can be seen in the Figure 22, the step of extending the business network lasts from inception to the end, as companies are developing their business network before adopting IT innovation through cloud. Besides after the cloud IT innovation is accomplished, they gain more potentials and opportunities to extend the business network further.

Companies Interested in Cloud Computing implementation
to further innovate through this paradigm

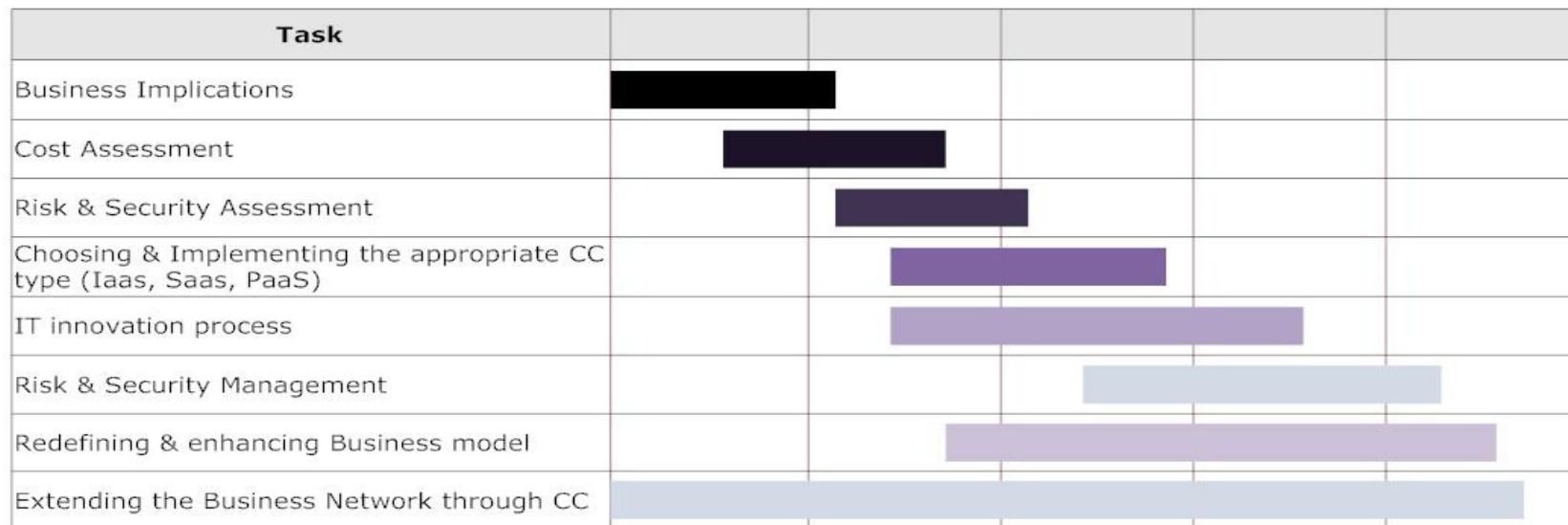


Figure 22: Chasing further innovation through Cloud Computing paradigm

6.2. Research Credibility

We attempted to produce valid, ethical and reliable results for our research in this thesis. In order to carry out this research further, we have described the technique of collecting the appropriate data, methods and approaches used, and how the interviews were conducted; methods applied for analyzing the empirical data are also presented and argued in the report.

Nevertheless, there may be two occurrences which may influence the credibility of our research. For instance, in the case of Kent Sjöström, Business Manager of Hallstahammar Municipality, we have conducted the interview before finalizing the conceptual framework of our research. Thus some concepts were not discussed properly. Secondly, the primary goal of this research was to investigate IT companies in Hallstahammar. Despite that Hallstahammar Municipality is not an IT company, we have interviewed them as it has significant dependency on IT and IS infrastructure.

Apart from those, many aspects are there to strengthen the credibility of our thesis. In total we have done six interviews; one email, one skype and four face-to-face; all are recorded with interviewee's permission in order to be published in the project. We have analyzed the entire empirical data based on the concepts of the secondary data; to effectively validate some of pros and cons of CC we carried out the case study.

6.3. Proposals for further research

Further research can be carried out in a quantitative approach, as more and more companies commenced to use the concept of Cloud Computing and exploring more untouched areas and crucial factors. In future, the wide of a research can be divided into various directions of IT innovation, cost leadership, business networks etc of Cloud Computing. Choosing any of the direction and implementing a quantitative approach, a prospective research can involve large number of participants in order to give rise to more specific results and conclusions.

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- ❖ Face-to-face interview with Anders Täpp, Graphics and Web designer, IDÉbild (Personal communication, May 10, 2010)

Chapter 8 - Appendix

8.1. Amazon Elastic Compute Cloud (Amazon EC2)

Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable compute capacity in the cloud. It is designed to make web-scale computing easier for developers.

Amazon EC2's simple web service interface allows you to obtain and configure capacity with minimal friction. It provides you with complete control of your computing resources and lets you run on Amazon's proven computing environment. Amazon EC2 reduces the time required to obtain and boot new server instances to minutes, allowing you to quickly scale capacity, both up and down, as your computing requirements change. Amazon EC2 changes the economics of computing by allowing you to pay only for capacity that you actually use. Amazon EC2 provides developers the tools to build failure resilient applications and isolate themselves from common failure scenarios.

Source: <http://aws.amazon.com/ec2/> [Accessed on: April 5, 2010]

8.2. Amazon EC2 Instance Types

Small Instance – default*

1.7 GB memory
1 EC2 Compute Unit (1 virtual core with 1 EC2 Compute Unit)
160 GB instance storage (150 GB plus 10 GB root partition)
32-bit platform
I/O Performance: Moderate
API name: m1.small

Source: <http://aws.amazon.com/ec2/instance-types/> [Accessed on: April 5, 2010]

8.3. Interview Questionnaire (Sample)

Introductory Questions	<ul style="list-style-type: none"> • What is the name of your company, your main area of work and how many employees do you have? • What do you think about Cloud Computing? Shall we give you a brief description/introduction onto the concept?
Cost Leadership	<ul style="list-style-type: none"> • Depending on your size of your company how much do you spent on your IT infrastructure and operations (IS also)? (Cost Leadership of Cloud Computing) • Have you ever thought of decreasing your company's' IT expenditure by using Cloud Computing? • As the representative of your company do you prefer to buy a new car, leasing a car or hiring a cab whenever you need it? • Are you using Google Apps? (Gmail, Calendar & Google Docs)
Cloud computing as an Innovation Process	<ul style="list-style-type: none"> • If you would be the first IT Company in Hallstahammar implementing Cloud Computing do you think it could be innovative for you – would it be innovative service for you clients? • From the perspective that CC is an innovation throughout process do you think it can lead you to gain competitive advantage in your field/area? • What is your <i>existing platform</i> for developing software systems to your customers? How much it can cost? • Do you think developing application for you customer in the cloud or using the CC for your organization can lead you to get more profit and attract new customers?
Cloud Computing & Business model	<ul style="list-style-type: none"> • For example: In order to use Visual Basic or Java you need a license fee of 5000SEK/user/year. If you had the opportunity to use the same type of application, accessed from a web-browser and store your projects “on the cloud” which can be safer than your own data center (PC, Server. HDD) and meanwhile achieve comparably lower cost than your typical way, would you use it? Why? • Will it affect your existing business model?
Cloud Computing & Business implications, CC and Outsourcing	<ul style="list-style-type: none"> • What can be the barriers of implementing your applications through Cloud Computing? (employee's/private skills, further capabilities) • From the perspective that your company is growing and your demands on IT are increasing have you ever thought of outsourcing your IT (how & why)?
Cloud Computing & Business network	<ul style="list-style-type: none"> • Are you already a member of any business network (in your area or broader scale?) • If all Hallstahammar's IT companies establish a private cloud for running their IT infrastructure, will you contributing in joining? What is your opinion?
Cloud Computing & its risk factors	<ul style="list-style-type: none"> • How many servers are you using and have you ever thought of putting your data “on the cloud”? • Which are your main worries concerning the risk perspective? (i.e. servers situated in unknown location, trust)

8.4. Interview Questions of TotalAssist Case Study

Interview Date: 2010-04-28

With Curt-Åke Sundholm, Project Manager, TotalAssist (www.totalassist.se),
(A product of Aros Circle AB)

Kenneth Nilsson, Main Developer, TotalAssist

Case Study: TotalAssist

1. What is TotalAssist?
2. How did the idea of making the application come to your mind?
3. How the project has been funded? Own money or bank loans or others.
4. How your customers will use this application? What is the minimum requirement of using this application?
5. What are the most important value propositions you think you are offering to your customers? (Price, user-friendliness, mobility etc)
6. When did you start the project and when have you finished it?
7. What are the critical factors that you as a project manager, has faced mostly dealing with the project?
8. You have long experience in project management and managed many projects of different kinds (different platform), is it much different in managing this one than any other project?
9. What piece of advice do you want to provide for others who are dealing with this kind of project?

Development:

10. Is the software compatible in all kinds of platform? (Like Mac, Linux, Windows)
11. What are the tools that you have used to develop this kind of application?
12. Why have you chosen the platform to develop this, as there are many other ways of doing it?
13. You have borrowed IT infrastructure from other companies, do you believe/trust the company where you have hosted the programming code and customer's data?
14. Can you tell us how are you going to provide support and maintenance for the application?

15. What skills are required for developing applications cloud based service like yours? Is that too much difficult for other programmers to jump in and start developing?
16. What do you think of this kind of application's future? Will many companies start selling their services through cloud?

8.5. Email Interview with Filip Redeen

Personal Relationship Officer (PRO), LifeCenter AB

26 mar 2010 kl. 14.03 skrev Ricky Stanley D'Cruze:

Hej Filip

If it is possible after the Business meeting tomorrow can you give me some time that i like ask few questions about cloud computing---that you have implemented in LC.

Questions can be:

1. What and How u have implemented Cloud computing in LC?
2. How user friendly that system is?
3. How much cost reduction LC did in a year?
4. While doing that is that tough to manage the upper management? Like VD, and others.
5. How secured you or LC feel now that all mails are now in Google server? Do you trust Google?
6. Is there any bad side of cloud computing that you feel while implementing the system or maintaining that?
7. How long hours of work you did while transferring all the user mails to Google?

It would be nice if u can briefly answer those questions tomorrow or later by mail.

Vi ses.

On Tue, Apr 6, 2010 at 9:16 AM, Filip Redéen <filip.redeen@lifecenter.se> wrote:

Hi Ricky!

Hope you are doing well. Pardon me for not answering those questions yet, I have been working on a project with a tight deadline these days... But here are the answers, come back again if you want to know more.

1. I have introduced the use of Google Apps in LifeCenter. The main functionality is a mail system where all is stored online at Google, up to about 7,4 GB per account. It is accessed either online, or through POP or IMAP. Additionally, a calendar function and the ability to share and collaborate documents (word processing, spreadsheets and presentations). Google Apps is free up to 50 users, which is enough for LifeCenter. What you do is sign up at Google and ask your host to change the DNS of the desired URL (mail.example.com).
2. The system is very user friendly. It is really use to use and configure and self-explaining in most ways. Still, it offers advanced functionality like IMAP where you have the ability to have your mail synced to your phone and other computers.
3. Since Google Apps is free, you reduce costs to 0 SEK/year. I don't know how much we paid before since it was part of a package consisting of domain name, server space, support, mail accounts etc. Probably a few hundred kronas a year.

4. I do not really understand the question, but if you mean if it was hard to convince to upper management this was a good decision, then the answer is no. Since Google is a top of the line player offering professional services for free, it was an easy decision.
5. We feel secure and yes we trust Google, since they do not afford security breaches to keep their reputation.
6. So far we have not experienced any bad sides. The new mail system is way more flexible than the old and many users keep their mail in their mail program at home, in their phones while out and check it online while at other places, all synced all the time.
7. The setup with all planning (what users to transfer from the old system etc) took approx. 10 hours, then all users had to transfer their old e-mail themselves to keep it.

Hope these answers are enough, otherwise just mail again!

See you soon!
Filip Redéen.

-----THE END-----