School of Management

BLEKINGE INSTITUTE OF TECHNOLOGY

STRATEGY OF MOBILE COMMUNICATION SYSTEM PROVIDERS IN CLOUD (IMPLEMENTATION OF CLOUD IN TELECOM BY ERICSSON)

THESIS FOR THE DEGREE OF
MASTER OF BUSINESS ADMINISTRATION

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Abstract

The telecom operators are experiencing low revenues due to reduction in voice calls and SMS in their networks mainly driven by communication services like Skype, Google talk, msn and other VOIP (voice over internet protocol) products. Instant messaging services and social networking are also taking away the operator's customers reducing them to "dumb pipes" with the OTT (Over the Top) players like Google, Microsoft and other content providers making profits at the expense of the operator. The growth of operators' revenue is not keeping pace with the growth of traffic in their networks creating the perception that the content providers and OTT players do not share their revenue generated using the operator's infrastructure. The operators are therefore increasingly being reduced to act as "dumb pipes" connecting the content generated by OTT's with the operator's subscribers. The operator's revenue stream in one-sided, only coming from the subscriber usually as a flat data plan. The operator's are looking at new revenue models and the cloud computing market is a business opportunity which allows them to monetize their network resources with the possibility to earn revenue from both the subscriber and the content providers. The communication system providers who are the communication equipment vendors to the operators are indirectly affected from the shrinking operator revenue.

As part of this thesis, we address how Telco's and system vendors can differentiate in the cloud computing market against other cloud service providers and monetize the network resources which they own. We discuss the roles in the cloud value network and activities in the value chain that could be adopted and the business opportunities they could pursue.

We begin by introducing the telecom operator market and the challenges faced by the industry today. The research question we are targeting is then discussed followed by the limitations of the thesis. The telecommunication industry, cloud computing technology and the relevant service delivery models are discussed. A literature review is then done to formulate our theory. Theory on strategy by Porter, Prahalad and other researchers who have contributed to the research on cloud computing are discussed. The method adopted is then proposed. Data collected is first presented and then analyzed before discussing the results of the analysis.

Keywords: Strategy, Cloud computing, mobile telecommunication, Ericsson.

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1. Introduction

The cloud consumer market today is mostly dominated by OTTs like Apple, Microsoft, Google and Amazon.

Many connectivity providers/ mobile operators have been struggling to maintain ARPU levels. Flat data plans have had a positive effect in attracting customers to use data intensive applications. This is mainly driven by the content produced by the content providers. However, the drawback is that the operators' subscribers are also using OTT (Over the Top) services like Skype, iMessage, Facetime and other VOIP services to communicate instead of traditional voice calls. Also SMS is being replaced by instant messaging. The operator's revenue stream is hence dwindling. They are reduced to dumb pipes being exploited on either side for almost free. "Revenues from digital content services such as Internet Protocol TV (IPTV) and mobile content (mobile video, mobile music, wireless games and mobile advertising) have not yet compensated for the decline in traditional services" (Nelson and van den Dam, 2010, p.4). Thus a separation between content and connectivity is established on the Internet. Content providers are generally better positioned than connectivity providers and gain a larger share of the actual revenue.

With the advent of cloud computing technology, the operator's have an opportunity to monetize their network resources and potentially achieve new sources of revenue or earn double sided revenue for the services offered by opening up their network resources to both the subscribers and the OTT's.

1.1 Background

While infrastructural base, maintenance and network quality remain the main task of network & communication system providers and mobile operators, searching and creating new business opportunities in order to retain the competitiveness are also equally important. The network and communication system providers (CSP) are companies providing technology and services to mobile operators. Mobile communication system providers offer services mainly to the mobile operators.

The entire Information and Communication Technology (ICT) including mobile and telecommunications is now a mature industry facing large challenges due to the high level of competition. But the industry still has tremendous potential for growth.

New areas of doing business include for instance machine-to-machine (M2M) communications with applications in transport, retail, health care, home automation and more. Operators like Verizon are already offering M2M solutions. A trend observed recently in USA is that connectivity providers are attempting to compete not only with the bandwidth they offer but also with the services and applications that take advantage of their new (Fourth Generation) 4G high speed networks. AT&T has planned its home automation and security-managed services centered around this idea. The system is a set of webcams, sensors and controllers connected to the network. Verizon will offer its customers a system for streaming live audio and video to friends and family.

A large number of telecommunication operators have opened innovation centers in the SF Bay area or Silicon Valley in California and seek innovation and partnership. One of the recent contributions was a new AT&T Foundry (R&D laboratory).

Mobile payment or mobile money is another fast growing area. Digital payments have been around for a long time but mobile payment is a new emerging area where payments are made via the mobile device. Kenya is one of the leading countries in mobile money.

Cloud computing which is the subject of study in this paper can potentially be another new area for telecom players. It is a means of obtaining IT related services on demand from a 3rd party service provider for a price which depends on the time the services are used.

1.2 Problem discussion

With enterprises moving to cloud based services and with the rising demand of employees to work on the go, from anywhere, the mobile cloud computing market place is heating up. This calls for a secure and faster access, which can be guaranteed by operators. Also with the common smart phone user, the mobile operators only serve as a pipe, with content providers at one end selling their content and the user at the other end. The mobile operator thus gains no revenue for the infrastructure provided. By smartly using the existing infrastructure, adopting diversified services based on capabilities such as security, good quality of service (QOS, which is the ability of offering guaranteed service level) and utilizing the key features of the network; mobile operators can provide differentiated unparalleled service. Example of these new opportunities can be cloud computing. As mobile communication system providers, like Ericsson, sell network equipment and services to mobile operators, they find themselves in the best position to define and implement this strategy for the operators. System providers, on the other hand, may play other roles in the cloud arena.

1.3 Problem formulation and Purpose

This thesis aims to investigate the feasibility of implementing new strategies based on “cloud computing” by mobile communication system providers and Ericsson, in particular.

We will study how cloud technology could help mobile communication system providers and mobile operators create possible business opportunities and consequently gain competitive advantage. Relevance of some significant characteristics of mobile operators (such as size, subscriber base, location etc.) will be studied in segmentation of mobile cloud market. Characterizing operators and providing tailored solutions could differentiate a system provider from its competitors.
The objective of this thesis is to discuss if cloud computing is a source of growth in telecommunication industry for system providers at all and whether implementing a strategy to provide cloud services to the mobile operators can enrich a mobile system provider’s existing portfolio. If yes, the means (business model, structure, activities, services, competencies and more) of delivering these new "products" in its portfolio will be investigated. We will study the value chain and value networks of CSPs, operators and their business models. We will analyze the vendor CSP market against porter’s five forces framework and classify the mobile operators. The focus of our work will be on one company, Ericsson and one area cloud.

1.4 De-limitations

In order to be able to create focus, we have the following limitations in this study.

For obtaining more up-to date and concrete information from direct sources, we limit our case to implementation of cloud only by one company, Ericsson, as main source of analysis. However, we believe that many of the findings and conclusions will be applicable to other players and the industry as a whole.

We have deliberately limited the study to a few regions for extensive data collection about operators' characteristics. Europe, USA, China and India are chosen for this purpose. However we will collect data in a number of other countries in order to obtain a broader data base. This limitation is mainly due to the time frame of our study.
Among forces identified for segmentation of operators, subscribers' demographical characteristics, business culture and financial situation need extensive quantitative data collection and access to extensive data from operators. We will consider these forces briefly and they can be subject for further research.

In our study we are not considering some important aspects like environmental issues such as energy consumption considerations in cloud computing. Legal and regulatory aspects are also omitted.

1.5 Thesis' structure

In the sections ahead, the research method adopted the thesis will be discussed together with the research question pursued by this thesis. A theory is then outlined based on literature review conducted on contributions by eminent personalities in the field of strategy. The empirical findings will be provided. The data collected will then be analysed and the outcome listed. Finally, a conclusion on the suitable strategy to be adopted will be outlined.

1.6 Research question

The topic of our case is to study the strategy of mobile system providers in cloud and the implementation of cloud computing in telecom by Ericsson.
The telecom industry faces challenges to resolve the issue of disconnect between the sources of revenue and sources of cost. This problem calls for searching new ways of doing business. Advantages such as cost savings for businesses moving to cloud based services for their IT needs are commonly cited by experts. We have to obtain an understanding of all advantages and shortcomings in the area. At the same time the prospective users of the cloud service are apprehensive about other issues like the security aspects of the technology.

This calls for the first research questions we pursued, as stated here:

How can implementing cloud computing be a source of differentiation for telecom and mobile industry players including system providers and operators?

The second question is a natural consequence of the first one:

How can cloud computing as a source of diversity be a business opportunity for telecom system providers and operators? How can system providers and operators monetize the cloud as a new source of revenue?

Motivation for this question comes from the challenges facing the cloud technology today especially in the mobile environment like revenue, security and bandwidth requirements. If the telecom industry is

capable of providing them, these players are well positioned to address these issues. Additionally, a system provider can position itself better by doing things differently than competitors do.

The telecom vendors provide infrastructure solutions to telecom operators. They serve operators of different sizes (capital, subscriber base etc.) and in different countries as their clients. Classifying the operators to different segments or groups and understanding their needs therefore becomes crucial in offering their cloud portfolio. There exists no theory for classifying operators. Therefore formulating and testing propositions had to include hypotheses which consider them. As mentioned earlier, we limit our case to implementation of cloud only by one company as the main source of analysis. We believe that many of the findings and conclusions will be applicable even to other players and the industry as a whole.

2. Theory formulation

In some cases concepts are assumed based on common sense to be clear enough and thus do not need to be defined or referenced. In other cases, we have explained them. A number of related expressions or concepts are sometimes used interchangeably.
For instance words like operators, mobile operators, Internet service provider, all are in the category of connectivity providers in the telecommunication world. When expressed views can be applied to any or all of them we have used operators or connectivity provider, because using mobile operator makes a distinction by limiting expressed view to the mobile world.

2.1 Telecommunication fundamentals

Mobile telecommunication is a complex industry involving a number of technological and administrative aspects because of its cellular design and limits in frequency bands. The technology has evolved from analogue to digital systems. The first global digital mobile system is the second generation of mobile communication system (also known as 2G).

In a number of less developed and emerging countries still the second generation (2G or Global System for Mobile Communication (GSM)) dominates. These systems mainly cater to voice calls and SMS and do not support high speed data communication.

The next generation of mobile networks called 3G, uses technologies that allow higher speed of data transmission, enough to transfer music, movie and running other bandwidth demanding applications and data streams. With the demand for more bandwidth growing, there have been a number of intermediate technologies from 3G to 4G and they will be around for a long time ahead because rolling out new networks is a long term activity. The fourth generation (4G) is said to be able to deploy a few concurrent technologies such as Long Term Evolution (LTE).

Current high speed networks also include HSPA+, DC-HSDPA and WIMAX in many countries.
LTE has been or is being introduced in a number of countries in Europe, Asia and the USA. (Curwen, 2011, p.50-60).

Rolling out LTE services to the entire nation will take years. These systems require a large amount of effort in the preparation of underlying specifications in order to make global coordination possible.

Figure 1 shows an overview of the Internet relevant to our discussion. The dotted portion represent the network structure of a 3G or 4G cellular mobile network, which is connected to the rest of world via the

internet backbone. The Radio Access (RAN) part of a cellular network is closer to the user equipment (UE) and handles the radio communication with UE. The portion depicted "Aggregation and backhaul" in the figure depicts the core mobile network. This part handles functionalities like traffic routing, inspection, charging, billing etc.

The 3rd Generation Partnership Project (3GPP) is a collaborative partnership between telecommunication organizations and associations. 3GPP is not a legal entity, but it is established for the preparation, approval, and maintenance of the cooperatively developed Technical Specifications and Technical reports for the 2nd and 3rd generation systems. The results of the 3GPP work shall form the basis of member contributions to the ITU in accordance with existing procedures (3gpp, 2007).

ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies – ICTs. ITU, an organization based on public-private partnership, currently has a membership of 193 countries and over 700 private-sector entities and academic institutions.

ITU coordinates radio communication services (Satellites, wireless communications), Standardization (called Recommendations) for ICT networks.

The companies competing in the telecom vendor market are Ericsson, Huawei, Nokia Siemens, Alcatel-Lucent, ZTE, Cisco, Juniper and a number of other vendors operating globally or in local markets.

Previously, voice communications represented the majority of telecom usage. Data use was marginal. However today, some Telco's in developed Asian countries have seen the proportion of voice drop to 20 % of the traffic. The rest is data (Art and Pierre, 2011). The connectivity providers offer the infrastructure required to connect the online service providers to the end user. Both the end users and the online service providers are paying a fee to the connectivity providers to connect to the Internet. The fee is usually flat. Hence the online service providers are only paying to be connected to the network but are not paying for the downstream service delivery (AtKearney, 2010, p.7).

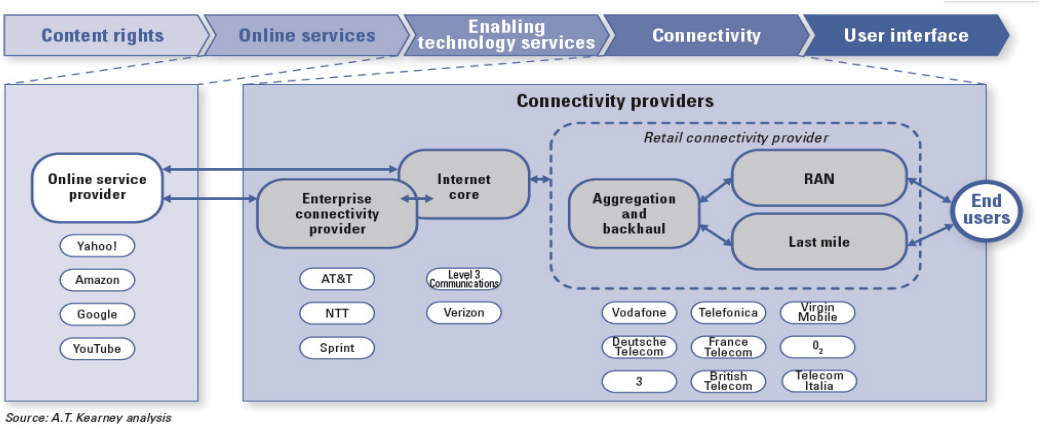


Figure 1: Internet network infrastructure

2.2 Introduction to cloud

Putting things simply, Cloud computing is a means of obtaining IT related services on demand from a 3rd party cloud service provider for a price which depends on the time the services are used. By using a cloud based service the users or consumers of services normally don't need to install dedicated applications on their devices. Processing power or storage is centralized somewhere on the Internet, in the cloud. A reliable network connection is however required to access the cloud. In a cloud based service delivery there exists cloud providers and cloud users. A person, organization or machine can be a user of cloud capabilities. Usually a company delivers cloud services in the role of cloud provider. A provider can itself use cloud services for internal operations. There are also other stakeholders.

Literature review: cloud fundamentals

According to National Institute of Standards and Technology (NIST), Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction (Mell and Grance, 2011, p.2).

The services obtained are scalable, i.e. can either be expanded or contracted without much overhead costs (Keith and Burkardt, 2011, p.1). Clouds serve the benefit that they shift the costs for a business opportunity from CAPEX (capital expenditure) to OPEX (operational expenditure) thus avoiding buying and maintaining expensive equipment/software (ibid). It therefore helps companies potentially save cost (though some people question the cost savings) and concentrate on their core competencies. Consequently, it reduces entry barriers for small companies by minimizing entry costs and infrastructure requirements (ibid, p.1) and faster time to market (Keith and Burkardt, 2011, p.18). This is substantiated by the fact that cloud eliminates an up-front hardware commitment by Cloud users, thereby allowing companies to start small and increase hardware resources only when there is an increase in their needs." (Armbrust, et al., 2009, p.1)

The cloud infrastructure is viewed as a system containing both a physical layer and an abstraction layer, i.e. virtualized.

Leimeister, Rided, Böhm and Krcmar have compared various cloud computing definitions and suggest the following: "cloud computing is an IT deployment model, based on virtualization, where resources in terms of infrastructure, applications and data are deployed via the internet as a distributed service by one or several service providers. These services are scalable on demand and can be priced on a pay-per-use basis." (2010, p 22). We apply this definition and believe that this definition has the advantage that it includes content which makes streaming services like music part of the cloud.

NIST (Mell and Grance, 2011, p.2-3) has defined the cloud to have the following basic characteristics:

On-demand self-service: A consumer can configure, add or remove computing capabilities as and when required automatically without requiring human interaction with a service provider.

Broad network access: Cloud services can be accessed over the network by laptops, smart phones, tablets etc.

Resource pooling: The provider's computing resources (physical and virtual) are allocated dynamically among different customers based on consumer demand. The customer has no knowledge of the location of the resources.

Rapid elasticity: The cloud service providers should be able to provision resources to customers on demand i.e. either increase or decrease resources seamlessly.

Measured service: Resource usage can be monitored, controlled and reported, providing transparency for both the provider and consumer of the utilized service. Typically this is done on a pay-per-use or charge-per-use basis.

The cloud model draws inspiration from the service oriented architecture. The model is composed of several offerings all sold as a service. The functions are all termed "resource as a service".
The cloud services offered can be broadly grouped into the following Service models as outlined by NIST. A collective term XaaS is also commonly used on the Internet for all kinds of services offered by the cloud (Anything as a Service) over the internet. The most prominent of the XaaS services are described below:

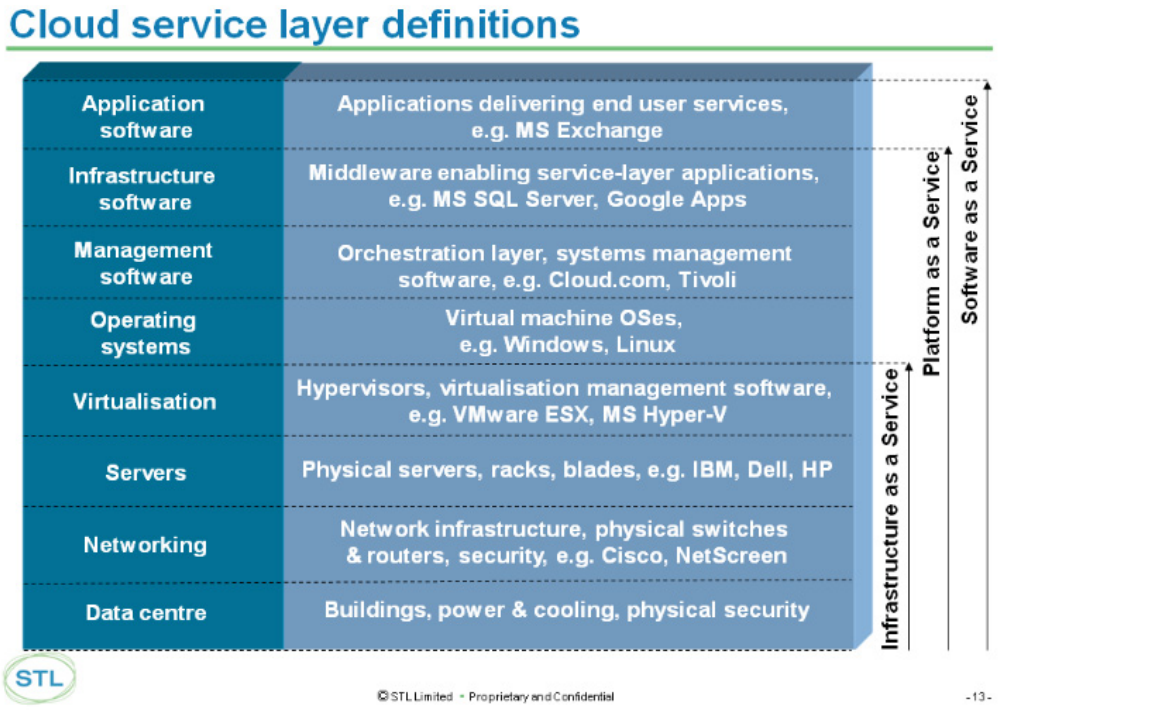
Software as a Service (SaaS): With the SaaS model, the consumers subscribe for the software applications running on the cloud provider's infrastructure. The applications are accessible through a web interface or a program interface. The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, storage etc.
Examples: Google Docs, Salesforce, CRM, SAP Business by Design.

Platform as a Service (PaaS): With the PaaS model, the consumers run their own applications on the cloud provider's infrastructure using programming languages, libraries, services and tools supported by the provider. The consumer hence controls only the application but has no control over the physical resources.
Examples: Force.com, Google App Engine, Windows Azure (Platform).

Infrastructure as a Service (IaaS): With the IaaS model, the consumers get access to network, storage or other computing resources hosted by the cloud service provider. The consumer is able to deploy and run software, which can include operating systems and applications on this resource allocated. The consumer does not manage or control the underlying cloud infrastructure but has control over operating systems, storage and deployed applications; and possibly limited control of select networking components (e.g., host firewalls). (Mell and Grance, 2011, p.2-3)
Examples: Amazon S3, SQL Azure.

Examples are taken rom Keith and Burkardt, (2011, p.13-14).

The cloud service layer definitions are depicted in the figure 2, below :



Source: STL Partners/Telco 2.0

Figure 2: Cloud service layer definitions

NIST also defines the deployment model for cloud as below:

Private cloud: where the cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple consumers (e.g., business units). It may be owned, managed, and operated by the organization, a third party, or some combination of them and it may exist on or off premises. (Mell and Grance, 2011, p.3)
Example: eBay.

Community cloud: The cloud infrastructure is provisioned for exclusive use by a specific community of consumers from organizations that have shared concerns (e.g., mission, security requirements, policy, and compliance considerations). It may be owned, managed and operated by one or more of the organizations in the community, a third party, or some combination of them and it may exist on or off premises. (Mell and Grance, 2011, P.3)

Public cloud: The cloud infrastructure is provisioned for open use by the general public. It may be owned, managed and operated by a business, academic, government organization or some combination of them. It exists on the premises of the cloud provider. (ibid, p.3)
Example: Amazon, Google Apps, Windows Azure.

Hybrid cloud: The cloud infrastructure is a composition of two or more distinct cloud infrastructures (private, community, or public) that remain unique entities, but are bound together by standardized or proprietary technology that enables data and application portability (e.g., cloud bursting for load balancing between clouds).

The figure below gives a brief and easy overview of the cloud concept.

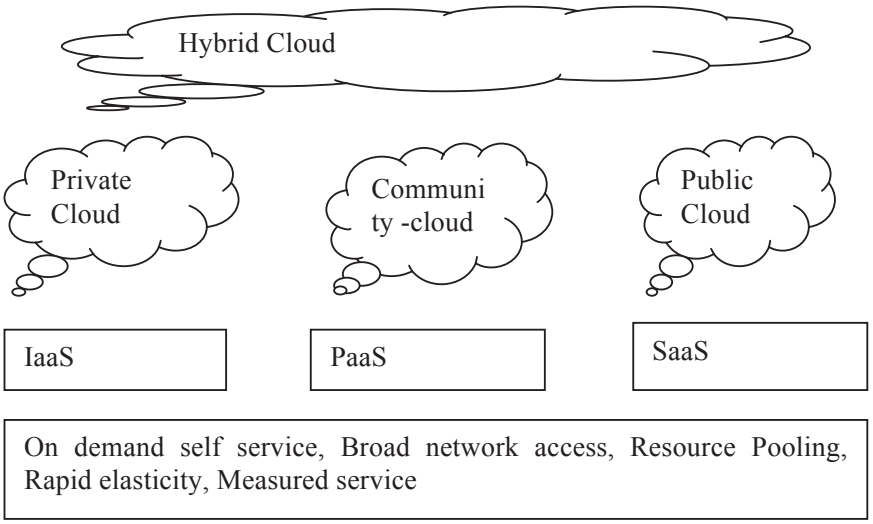


Figure 3: NIST Cloud Definition

Implementation of cloud

However, cloud also has a number of problems to be addressed.
Privacy and Security of the data posted on the cloud by consumers is a big concern, especially if the data is sensitive to the business or is private to the consumer (Keith and Burkardt, 2011, p.1). As cloud infrastructure is maintained by 3rd party service providers and most likely shared among many clients security concerns arise as sensitive information could be tapped. Information leaked could lead to industrial espionage (Keith and Burkardt, 2011 p.30).
Availability of the service and support 24/7 is a major concern. The business is more dependent on the cloud service provider to stay in business. If not the switching costs of moving to a new cloud provider can he high (ibid, p.1).

The network speed to access the cloud services is also a major concern. A network upgrade to provide higher bandwidth may be required to support a large number of cloud servers (ibid, p.1).

Lack of standardization results in interoperability issues with other cloud providers (ibid, p.16).

Quality of Service support is a relevant capability that is essential in many use cases where specific requirements have to be met by the outsourced services and / or resources. In business cases, basic QoS metrics like response time, throughput etc. must be at least guaranteed so as to ensure that the quality guaranteed to the cloud user is met. *Reliability* is a particular QoS aspect which forms a specific quality requirement.

Reliability, denoting the capability to ensure constant operation of the system without disruption i.e. no loss of data, no code reset during execution etc., is typically achieved through redundant resource allocation.

Data lock-in and transfer bottlenecks are the other two major challenges.

Data Lock-in: With cloud programmable API's not standardized yet, the cloud users cannot move their applications to another provider. This increases switching costs and increases the power of the cloud service provider. The users are hence vulnerable to price rise by the provider and risk providers going out of business.

Data transfer bottleneck: With applications becoming data intensive, the bandwidth required can be a bottleneck to deploy cloud services efficiently. Cloud users and cloud providers have to think about implications of placement and traffic at every level of the system if they want to minimize costs. (Ambrust, et al., 2009, p.p15-16)

The cloud service providers should overcome these above challenges to be successful.

A few examples of scenarios in which companies can move to the cloud include:

If a company has a high variable spike in resource demand then it has to build infrastructure to meet this demand if it runs its own data center. However, as the high demand is only temporary the data center infrastructure remains underutilized. The company could draw motivation from this example to move to the cloud. By doing so it can scale up the resources when required and only pay for the time it is using the resource. In normal times it can scale back and hence save money in the process and be efficient (ibid, p.10).

According to Byuya et al. consumers of cloud services should be able to determine the required service level through Quality of Service (QoS) parameters and Service Level Agreements, also called SLAs (2008, p.7). There are a large number of cloud platforms already available for commercial and academic purposes. Bany Mohammed, Altmann and Hwang give a list of these implementations in an annex attached to their work (2009). Academic efforts include Virtual Workspaces and OpenNebula. The most well-known open source cloud implementation framework is OpenStack, an open source cloud platform for public and private clouds founded by Rackspace and NASA. It aims to be simple, scalable and feature rich. It is being adopted by a number of developers worldwide who are actively contributing into it. The motivation for the adoption of Openstack is reduced fear of lock-in from service providers (openstack, n.d). It is supported by a large number of companies, Ericsson being one of them.

Popular examples of cloud services offered commercially and covered by Byuya et al include (2008):

Amazon Elastic Compute Cloud (EC2), where user can run Linux-based applications using offered libraries. The results can be stored on Amazon Simple Storage Service (S3).
Google app engine is a similar product but for applications developed using python language. It also contains Application Programming Interfaces (APIs) for the data store, Google Accounts, URL fetch, image manipulation and more. Microsoft and other vendors have their own offerings.

Byuya et al believe that commercial cloud offerings must be able to include support for a management based on customer profiles; i.e. customers should be able to control rented resources. There should also

exist automatic schemas to manage service requirements to satisfy both new service demands and existing service obligations to meet the SLAs (2008, p.7). We will address management system later in section 5.

From a Telco's perspective of cloud implementation, research suggests improving the delivery of the network by offering low latency services, enhancing QOS (IBM, 2010), offering unified communication (video conferencing, messaging, voice communication bundled in one package) (NSN,2011), online gaming and offering Network as a Service (NaaS) by renting out the network to other operators or opening up the network assets to developers as API's thus creating its own ecosystem (Yrjo and Rushil, 2011, p.1). Improving existing cloud offerings by means of technological enhancements such as local caching can improve mobile efficiency, reduce latency and decrease amount of data transferred to the Internet.

2.3 Literature review

In this section we begin with discussing the concept of strategy by reviewing a number of researchers' ideas in this field.

2.3.1 Porter's frameworks

Perhaps the most widely discussed and cited views on strategy, in the last two decades, stems from Michael E. Porter. He is a Professor of Business Administration at the Harvard Business School and has published many highly cited papers on this subject. A few of his papers have been referenced to in this thesis. A briefing of these papers is as follows:

Strategic positioning

According to Porter (2001) strategic positioning, not operational effectiveness is the key to achieving competitive advantage. Achieving only operational effectiveness, the most optimum way of doing things, will not suffice as competitors can easily copy and replicate the model. A company needs to do things differently to create a competitive advantage. A company usually incorporates a chain of activities before a product is brought to the market. Porter suggests gaining efficiency in each of these activities, thus adding value at each stage such that the chain of activities as a whole is difficult to imitate. The value added by this chain of activities is greater than the independent activities' value. Porter in his book "Competitive Advantage: Creating and Sustaining Superior Performance" (1985) describes this in detail and refers to it as "**value chain**". The strategy of the company therefore must incorporate a value chain, which can differentiate it from competitors. One way to make activities unique is by deliberately restricting itself to a set of activities from a choice of many. Porter calls this tradeoff. He goes on to add that the activities that the company decides to adopt should be well knit and relate to each other. By doing this, the entire chain of activities becomes difficult to imitate thus creating a sustainable competitive advantage. Porter calls this fit. Strategy must therefore revolve around a chain of activities incorporating trade-offs, which fit together to create value. Concrete activities combined, often affects one another. The cost or value of one activity is affected and can be enhanced by company's other activities.

Competitive advantage (CA) can't be understood by only considering the company's activity as a whole. CA originates from a set of distinctive activities. In order to gain CA, these activities should be run in a way that the value obtained by pursuing them, should exceed the cost of doing them, resulting in a profit margin.

This process of dividing the company's business into separate value-creating activities is referred to as the value chain. Porter divided these activities into two categories: "primary activities" and "support activities".

Primary activities:

Inbound logistics (Receiving goods and material from, warehousing, etc)
Operations (the process of production, manufacturing, transforming to final products, etc)
Outbound logistics (storage and distribution of products to retailers or customers, etc)
Marketing and Sales (identification of targeted customers and sales, etc)
Services (after-sales support, etc)

Support activities:

Firm infrastructure (legal. management structure, control systems, etc)
Technology development
Human resource management
Procurement

By combining these activities in a right way i.e. performing them efficiently, the company can add value to the offered products or services. The company can gain competitive advantage through either cost advantages or differentiation or both, thereby resulting in a profit margin, which depends on the level of efficiency. Cost advantage may be created either by cost reduction in individual activities or by reconfiguring the entire value chain.

Porter identified a number of drivers or ways through which managers can influence differentiation and cost advantages, such as capacity utilization and degree of vertical integration for cost and timing and integration for differentiation advantage. There are a number of drivers that affect both, for example linkage between value chain activities, which indicates that they are not isolated and changes in one driver may result in changes of the others. Modification in product design for instance can reduce costs for production or service. An illustration of value chain is shown in figure 4 below:

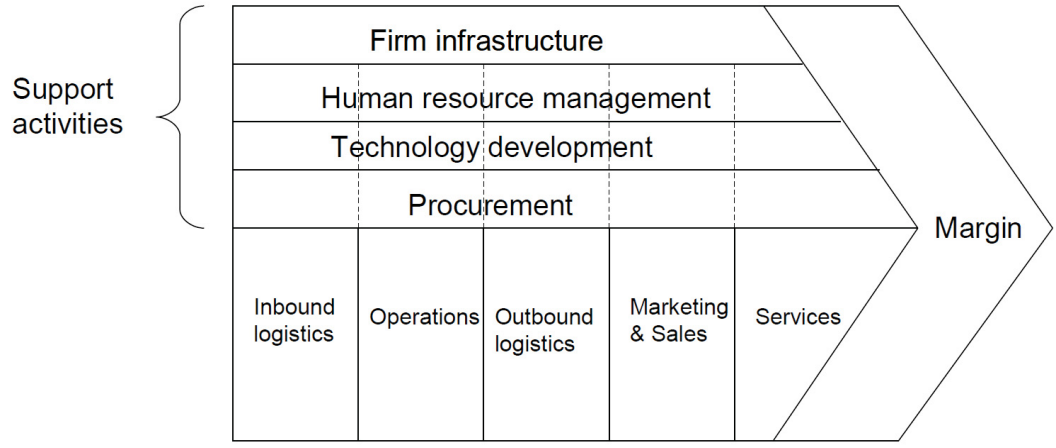


Figure 4: Porter's depiction of value chain

Cloud value chain

Below a value chain for cloud is presented based on Bany Mohammed, Altmann and Hwang, who have developed a reference model based on market configuration and Porter's and Hergert & Morris (1989) theory with some additions to fit the more complex nature of cloud business structure (2009). Matching it with a number of anticipated cases later validates their model.

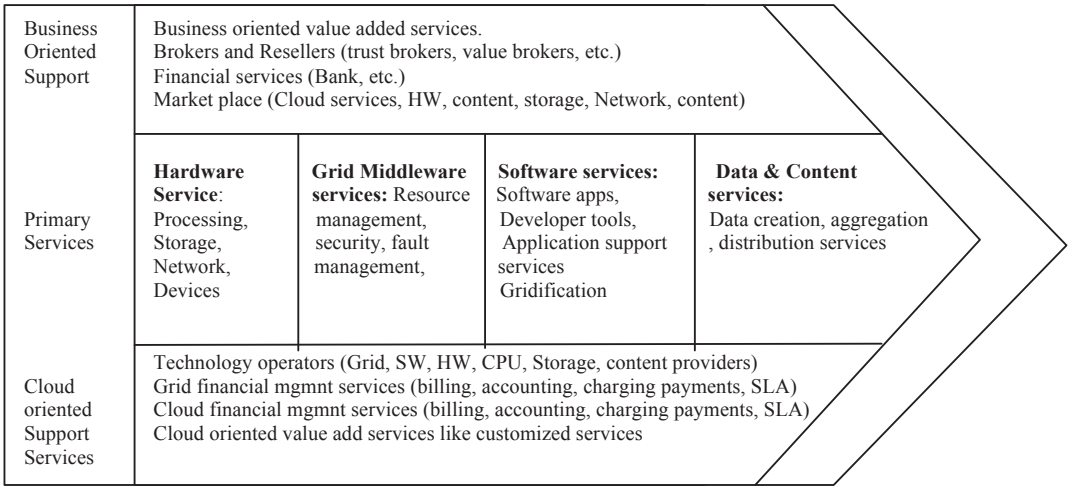


Figure 5: Cloud Value chain

An upgraded value chain model, shown above in figure 5 compared to classic one from porter shown in figure 4, reflects the fact that "Porter's original value chain is believed to be linear and fixed".
The model is a reference model for the entire cloud industry including all service models. As cloud embraces different layers of abstractions for particular of kind of services, some levels or sublevels in the reference model are not required.

Activities are broken down into three main virtual layers (one core and two support layers).
"Linkages between layers or independent services can take horizontal, vertical, and diagonal paths. Value is transferred and accumulated by flow of money and knowledge through these linkages.

Primary (Core) Services Layer consists of hardware services, Grid middleware services, software and data and content services, sub layers, which can be compared to cloud service models.

Cloud Value networks

From a business perspective value creation and transfer should not be considered in a linear way from producers to customers. It is more of a multidimensional value exchange between different sets of stakeholders (customers, distributors, suppliers) in a network called value network. "Value Networks are sets of roles, interactions, and relationships that generate economic or social value." (Allee, 2012)
What in the past was considered external to the value chain today may be included as a part of the transactions, becoming an internal part of the process of value exchange, thus including other participants, forming the concept of value network.

(Allee, V. 2008) views value network from the perspective of roles, interactions or exchanges of tangible or intangible values, between participants or stakeholders in a network. Value networks are presented by a mesh network, where the nodes represent the roles and the line represents the relationships in term of exchange of values (tangible value like money or products and intangible value like knowledge).

(Leimeister, Rided, Böhm and Krcmar, 2010) presents a generic value network of cloud computing (2010, p.10), including roles like service providers (development and operation of services platform and hardware); aggregator (special form of service provider, merges and combines pre-existing services incl. business services); integrators (provides data and system integration); platform provider (offers an environment, a platform for deployment of cloud applications; a catalog service provider) and infrastructure provider (supplies the technical infrastructure like computing and storage). In figure 6, a generic value network of cloud, only the common and most likely relations are depicted. Lines in the figure show streams of value and money.

Ojala and Tyrväinen have studied change of value networks in cloud computing over a long period of time (2011). The researchers look into value network of the firm "Game Cluster" (G-cluster), a little company with 25 employees over a period of 5 years and investigated how it changes under this time. G-Cluster delivers game online without need for installation, i.e. by the use of video streaming. Players can play games alone or with each other over the Internet.

Some changes have appeared after 5 years, whereby Value adding mediators, brokers have disappeared while new actors in form of a server provider have been added. G-Cluster's network has been changed and simplified. These changes have been due to transformations in the market environment and product development. After changes, with a more advanced product G-Cluster negotiates with operators and enters in agreement with them directly without mediators who were needed for the company earlier (ibid, p.18).

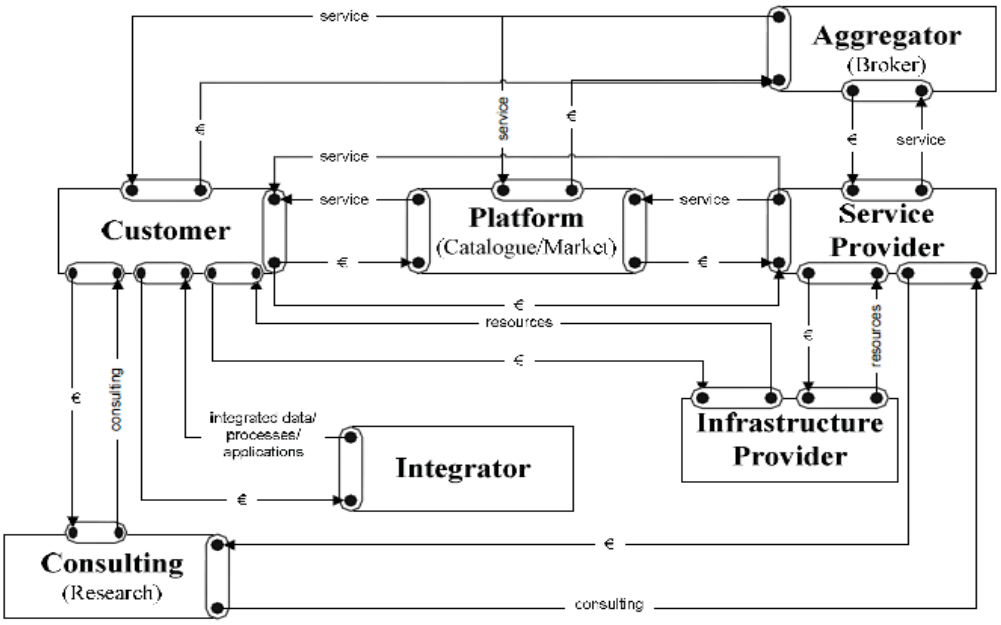


Figure 6: A generic value network of cloud computing

This study shows that value in the network benefited not only customers (end users), but also other actors in the network. The actual revenue was delivered through operators. Value networks changes over time, for instance participants (partners) may change i.e. be added or removed. For managers, it is important to assess how the partners might benefit from the value of products and services in their own portfolio. Managers should also monitor the network and match the product development and market situations to be ready to find new partners and remove unnecessary ones from the network.

Vertical integration and outsourcing

A company can outsource distribution or transport and save costs if it sees benefits in doing so, thereby shrinking the degree of vertical integration. If on the contrary a company takes the reverse action of including an activity such as transportation in the value chain, the phenomenon is called forward integration. Companies can forward integrate and perform activities that previously were done by customers or backward integrate and exercise more of the activities done by suppliers. Innovation and creativity in reconfiguring the value chain can lead to more differentiation. Porter linked up the value chains between different companies to describe a chain that he called a "value system".

Supply Chain and Value Chain integration

Feller (2006) discusses the need to relate the concepts of value chain and supply chain in a more comprehensive manner.

Value is derived from customer needs and the activities can be value-added or non-value-added. Improving the process of production that in turn leads to improved profit margin should minimize the latter.

Marketing strategies on the other hand, can focus on customers' perception of the value rather than operational excellence, as is the case in production. In either case, the ultimate goal is increasing the profit margin, which is the difference between costs and perceived value.

Supply chain management aims to manage the flow of goods and businesses along the chain of supply, i.e. the flow of materials from their sources to their final destinations. The focus of supply chains is on costs reduction and efficiency.

"A supply chain and a value chain are complementary views of an extended enterprise with integrated business processes enabling the flows of products and services in one direction, and of value as represented by demand and cash flow in the other". (ibid, p.3)

Porter’s five forces

In another article titled “The five competitive forces that shape strategy” (Porter, 2008) porter comes up with a framework to analyse an industry structure. This is a widely adopted framework to analyse different industries. It helps understand competition and how the economic value added by a product, service or technology is divided among the companies in the industry on one hand and the suppliers, buyers, new entrants and substitutes on the other.

As an example, the powerful suppliers can capture more of the value for themselves by charging higher prices, limiting quality or services, or shifting costs to industry participants. If the forces are intense, as they are in such industries as airlines, textiles, and hotels, almost no company earns attractive returns on investment. If the forces are weak, as they are in industries such as software, soft drinks, and toiletries, many companies are profitable (ibid, p.2). A combination of these factors makes a structure for competition in the given industry. By analysing this industry structure and understanding the interaction between these forces the companies may redefine their position in the market.

These forces are shown in figure 7 below and discussed briefly thereafter.

Bargaining power of buyers

This force determines the impact that the customers (buyers) have on the vendors. The power that the buyers yield can be understood by an example of a market scenario where there are few buyers compared to the number of vendors. In this case the buyer sets the price and the vendors have very little or no influence and usually have low margins. This can lead to some of them quitting the market.

According to Porter (ibid, p.5) customers have more bargaining power when:

There are few buyers, or each one purchases in volumes that are large relative to the size of a single vendor.
The industry's products are standardized or undifferentiated encouraging buyers to switch to another supplier at ease.
Buyers face few switching costs in changing vendors.
Buyers can credibly threaten to integrate backward and produce the industry's product themselves.

The buyers can bring down prices when:

The product it purchases from the industry represents a significant fraction of its cost.
The buyer group earns low profits or is otherwise under pressure to trim its purchasing costs.
The industry's product has little effect on the buyer's other costs.

Rivalry among existing firms

High rivalry among customers limits profitability of the industry, in perfect competition economics says the profitability is zero. Porter (2008, p.6) says profitability based on rivalry among competitors depends on 2 factors, intensity of rivalry and the basis on which they compete. The rivalry among firms in an industry

The intensity is greatest if:
Competitors are numerous or are roughly equal in size and power.
Industry growth is slow.
Exit barriers are high because of high costs in abandoning the product or also because the business controls highly specialized assets.
Rivals are highly committed to the business and have aspirations for leadership, especially if they have goals that go beyond economic performance in the particular industry.
An attractive market with a potential of high profitability invites additional players (ibid).

Intense rivalry mostly translates to price competition. Price competition is most likely to occur if
Lower switching costs because of identical products.
Fixed costs are high and marginal costs are low forcing firms to expand capacity and hence supply into the market altering the demand- supply equation of the market.
The product is perishable. Perishability influences the company to sell its product at a lower price even when it still has value.
Competition on dimensions other than price like features, support, brand image etc are less likely to erode profitability (ibid).

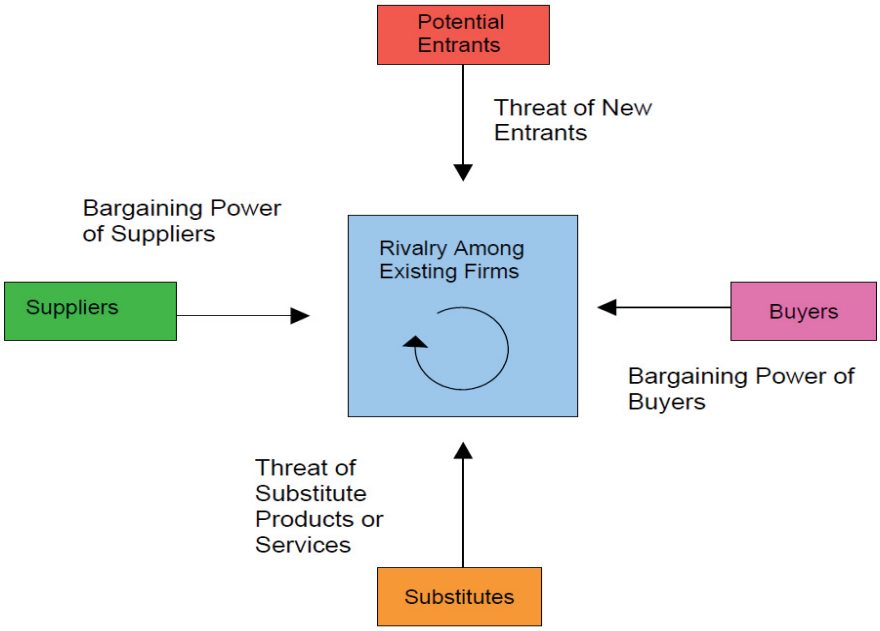


Figure 7: Porters five forces framework

Threat of new entrants

New entrants add capacity to the industry thus changing the demand supply equation. This could result in them applying price and cost pressure on the company's existing in the market already. They could eat into the market share of the established companies in the market. To maintain profitability and market share, the incumbent companies are forced to come up with strategy to overcome this threat. If established companies from other markets are entering a new market they bring with them capabilities and experience, which could add a new dimension to competition (ibid, p.3). The threat of entry, therefore, puts a cap on the profit potential of an industry.

It is the height of entry barriers that determines the threat of new entrants (Porter, 2008, p.3). Barriers could be reaction from existing competitors, capital required, technological knowhow, experience etc. Companies can use barriers to gain competitive advantage.

The barriers to entry can arise from:

Supply-side economies of scale: when incumbents are producing at lower costs per unit, using latest technologies or command better terms from suppliers.
Demand-side economies of scale: Arises from network effects that are buying a product on recommendation from existing users (ibid). The buyers patronize themselves with one company and are not willing to switch to a new one. This raises barrier to entry.
Customer switching costs: Switching costs arise when product specifications, manufacturing process or information systems as a few examples are altered. The larger the switching costs the larger the barrier to entry.
Capital requirements: Greater the capital required to enter a new market lower the threat from small/medium sized businesses as the cost of capital to finance the investment could be very high.
Incumbency advantages: Incumbents may enjoy cost or quality advantages, which cannot be replicated. They could have access to best raw materials, brand identity, proprietary technology which could deter new entrants (ibid).
Unequal access to distribution channels: New entrants need to distribute their products or service. If the distribution channel is already well controlled by the incumbents the new entrants may have to build their own which could prove a higher barrier to entry (ibid, p.4).
Restrictive government policy: Government regulations like patenting, licenses, restrictions on foreign investment in the country; subsidies etc affect barriers to entry. Providing subsidies for example lowers the barrier to entry while increasing license fees for assets in the country will increase the barrier (ibid).

Bargaining power of supplier

Powerful suppliers capture more value for themselves in markets where the competition is so severe that the company is not able to push the prices of the suppliers to the consumer. Suppliers if powerful can capture a good chunk of the industry's profits. Microsoft is one good example of this as it erodes the profits of the PC manufacturers by charging high prices for its operating system while the PC manufacturers are not able to increase PC prices as the market is very competitive (ibid).

A supplier group is powerful if:

There are very few of them in the industry compared to the consumers.
The supplier group does not depend heavily on the industry for its revenues.
Industry participants face switching costs in changing suppliers.
Suppliers offer products that are differentiated.
There is no substitute for what the supplier group provides.
The supplier group can credibly threaten to integrate forward into the industry.

Threat of substitute products or services

A substitute product is a product, which threatens to move customers away from one industry to another. As an example, email is a substitute for express mail. When the threat of substitutes is high the profitability of the industry is eroded.

The threat of substitutes is high if:
It offers an attractive price-performance trade-off to the industry's product.
The buyer's cost of switching to the substitute is low to (ibid, p.6).

Also changes in other industries could make them attractive substitutes. This calls for the incumbents to be aware of developments in industries even loosely related to theirs.

National diamond

In his paper "the competitive advantage of nations" he explains how companies from a particular nation create and maintain sustainable competitive advantage against competition from companies in different countries in that particular industry. The answer lies in innovation. Changes in government regulations, a new developing industry segment, new technologies etc. can all trigger innovation. A firm gains sustained competitive advantage at home when it supports accumulation of specialized assets and skill sets. He says nations achieve competitive edge in a few of the industries because their home environment for that particular industry is the most dynamic and efficient (Porter 1990, Pg.73).

The company's internal dynamics in the context of four determinants or conditions which he calls the national diamond (factors of production, demand of market, presence or absence of related and supported industries and the company's strategy, structure and rivalry) creates condition for competitiveness in every country. Factors leading to sustained competitive advantage are the ones created and not inherited by the nation. Availability of skilled labor, good infrastructure, knowledge resources and other specialized factors which cannot be easily created elsewhere outside the nation help maintain a sustained competitive advantage. A strong demand for the products at home triggers innovation among local firms eventually leading to sustained competitive advantage. Presence of supplier and related industries which are successful worldwide can achieve competitive advantage when these industries collaborate closely and share activities in the value chain. Management practices and structures of firms in a nation are influenced by the national circumstances, which are local to the nation and difficult to replicate outside it. Presence of strong domestic rivalry forces firms to innovate quickly and hence leap ahead in the race compared to other nations.

With an insight into Porters principles from the papers mentioned above we can summarize that the concepts of five forces, industry structure, sustainable competitive advantage, diversification, trade-offs, fit and strategic positioning are drivers of profitability to be studied. Porter's idea can potentially give us both understanding and tools for analysing the data collected in this thesis.

2.3.2 Segmentation of operator market

Dividing the customers to different groups, identifying different customer needs in each of them and targeting those customers is the essence of market segmentation. It involves dividing the market into groups of smaller individual markets of customers with similar purchasing behaviors and identical characteristics and then targeting each market with the right products. The contributing forces have often been broadly discussed in the literature, for a consumer markets.

There is no thorough research in segmentation of business-to-business market, especially in the fields of cloud for mobile operators. For a business market, these forces should be extrapolated and applied. In addition the factors that contribute to these forces must be enlightened (Best, 2009, p.144). Therefore it requires formulating and testing of propositions. In this thesis the mobile operators are segmented according to their characteristics and the characteristics of the population they serve. We have explained these factors in more detail later in this section. This segmentation is useful to the system providers who are suppliers to the mobile operators, because important for mobile system providers to understand the operators and their customer base to offer the right products/features.

Operators can be classified based on the following forces and factors:

Size: segmenting operators based on their size may provide information regarding their investment abilities. The more cash rich the operators are, the greater their chance of investing in new technology and services. The factors to assess the size of the operators are number of subscribers and sales volume. Market capitalization of the operator, number of employees, the geographic reach, and global presence are also factors that influence may influence the size of the operators.

Geography: The market can be segmented based on the geographic area the operators are functioning in. The factors describing the geographic presence could be whether the operators are present in Urban/Rural markets or both and the global presence. The country the operators are operating in can result in different needs due the economic situation of the country. The demographics of the subscriber base they are serving also plays an important role in shaping their needs, which can in some cases be the needs propagated by their customer. Geographic factors are typical examples of interrelation between different forces.

Financial situation and Growth outlook: Investment abilities depend on financial indicators. Access to capital and financial stability, growth prognoses and forecasting are contributing factors. The company's credit ratings can serve as a proxy in this case.

Subscribers' demographical characteristics: factors like age, gender, income, education are normally important demographic parameters. There are more factors that can serve to the demographical characteristics of the users, many of them being listed above. Relating these factors to the operators' behaviors need reliance on qualitative analysis.

Business culture: The culture or attitude of the operators shape their needs. The factors contributing to the business culture can be innovation and decision-making, technological orientation. Other factors as aggressiveness and risk taking can also be considered. Relating such factors to behavior of operators as cloud providers need information about their ongoing policies and future plans. Surveying relevant people at a number of operators that deploy cloud is required.

In addition to these basic forces the other factors which could shape operator needs, are:

Politics: (such as Restrictive or liberal government policy, regulations); This creates an opportunity to innovate or to overcome the restrictions imposed by the government.

Level of competition: can be factors such as number of cloud providers and maturity of cloud market.

Important population habits: can be factors such as spending habits, technology adoption and use of social networks.

As operators can be functioning in separate geographical locations in a country, their geography may potentially differ from the country as a whole. We will greatly assume the same characteristics for both and consider the differences, if clear evidence and data is available.

Description of forces

The text below explains in more detail the factor contributing to the structure mentioned above. These factors are grouped together to make them more understandable. Some of them are related to the people's characteristics, but will affect behavior of the business and perhaps need to be aggregated. Note that these factors are sometimes inter-related, meaning that it's difficult to draw an exact border as to how we can classify/divide them. For example size, amount of capital and geographical and market conditions affect one another. Excess cash and unused borrowing power can be a factor related to both size and politics.
In addition the level of correlation among the factors depends on the exact situation in each particular market. We are not going to statistically determine correlations among these factors but instead rely on existing research and reports from industry.

Political and regulatory factors

Regulations like licensing or patent regulations, bankruptcy rules, as well as security, privacy and safety policies can highly impact the functioning of a business. Political and regulatory factors are mostly related to the government regulations that impact the business. An example here is when the government of a country is responsible for allocating the spectrum for mobile frequencies like 3g and LTE.

Porter believes in an indirect role and influence of government on companies' competitive development, which implies that the role of government policies and regulations should be understood through analyzing the influence it has on the five forces, i.e. investigate how policies affect the forces by adopting the framework described earlier. As an example, bankruptcy rules may result in excess capacity and intense rivalry if the government supports failing companies. Government help will hurt the competitiveness of companies in the long run except the rare situation in the beginning of industrial development. (Porter, 1990, p.84).

Economic policies of the government also influence the strategies of businesses. With governments in emerging economies offering attractive conditions for promoting business, the number of companies set up either locally or through joint ventures with multi-nationals will increase. The government could also promote certain sectors of the economy by providing subsidies and low interest rates to borrow money. Thus, Restrictive or liberal government policy can make it either difficult or easier for entry into new businesses or industries. Requirements for foreign investment can make it more convenient for domestic companies if the government is allowing foreign investment in the country. In China, government provides subsidy to local industries and companies. This can help Chinese companies ease the international competition to win market share. Today Chinese companies produce in some cases high technological equipment at lower prices. That type of systematic industrial policy is the way to approach a changing infrastructure technology.

The network equipment vendors and operators have to cope with other regulations, industry standardization etc.

Economical and business factors

Positive free cash flow, subscriber growth, growth outlook in market share (not only in mobile, but in fixed lines and other markets) are examples of favourable indicators. A company with a bad financial situation is likely to be more vulnerable. The growth outlook can depend on the factors like economic and political stability in the market where a company is operating. They are likely to impact for instance, risks in the currency. Analysis from research institutes or credit evaluation companies include evaluation of

these indicators. An operator's credit rating can give a roughly correct picture of its economic situation and serves as a simplified indicator.

Keat and Young found income elasticity for subscribers to the Internet in OECD countries was estimated to be in excess of 1, thus making it a superior commodity (2009, p.98). It indicates a strong relation between internet subscription and the income of the subscribers. Thus this factor has intimate relation with customer characteristics such as income and can be affected by inflation and exchange rates. Rise in income, falling ARPU (Average revenue per user) and mobile handset prices promote adoption of telecommunication by the population. At the same time, the rise in inflation can curb spending habits and hence deplete the revenue of mobile operators, as people are more careful with their spending.

Social and demographic factors

These are social and cultural characteristics of a population such as sex, age, level of education, income etc. The demographics of a population in most cases determine the market for a company's product. The per capita income of the country also helps determine feasibility of starting a business catering to that population. An ageing population can drive the market for health related services as an example. Adoption of the population to new technology and services could be attributed to the average age of the population. Communication habits tend to be different based on the age of the population. An educated population is looking for services more than basic connectivity.

Technological factors

Technology is a great enabler in improving quality of life and also revenue for a business. Feijoo et al. cite Rice and Katz and state that privacy concerns and communication technology use should also be included as factors explaining the interest of users in advanced mobile services (2009, P.65). Barnes & Huff state that "mobile Internet is highly compatible with the Japanese cultural values, in particular, enthusiasm for novelties and group conformity, which helps adoption once a technology reaches critical mass" (ibid).
As seen with smart phones, a technically sound product translates into huge profits for a company. New technological innovations like Machine 2 Machine (M2M) communication open up new business opportunities for existing businesses with complementing technologies. Mobile communications has served a wider population and has penetrated to serve rural population compared to fixed line communications especially in developing countries with poor infrastructure and lower reach to geographically dispersed population. The cost of installation and the time to put up infrastructure has reduced with mobile communications driving wider adoptability. NIST is driving the adoption of cloud computing services in the US government, educational institutions & industry.

Size of operators

If a mobile connectivity provider has a large amount of subscribers and excess of capital, it possesses powerful assets. Stakeholders like investors and technology providers are more willing to provide support if the potential of assumed future customers for the new future opportunity could create sustainable attractive returns.

"Network rollout costs are determined by the scale of the new network, with the cost of additional radio access network and core network upgrades being incurred prior to revenue generation. Subsequent capital costs will be incurred through coverage upgrades and the uptake/traffic demands on the network." (UMTS Forum, 2011)

Excess cash and unused borrowing power can be a factor related to size or economy since investment of large financial resources for new entrants and up-front advertising and capital expenditures for development are needed.

But it is important not to overstate the need for capital for companies with a large number of existing customers. If capital market sees opportunities in supporting a company they would provide the funds needed.
In countries like India, there is very low Internet reach based on computers, but high number of mobile phone users, which is increasing. This creates huge opportunities for the mobile operators. The size of the operators plays a major role in how they can take advantage of this opportunity.

2.3.3 Business model

As the traditional services (voice, SMS) decline and voice over IP, instant messaging communication or social networks replace them, the stream of revenue deviates from operators to OTT players (content providers). The connectivity providers therefore seek new ways of doing business.

The concepts of business model and strategy are defined in a variety of ways and have been used interchangeably. The following definition of business model describing it as answering who, what & how questions, has its similarities to some descriptions of strategy:
Markides gives the following definition of business model: "a business model is the sum of the answers that a company gives to the three interrelated questions:
Who should I target as customers?
What products or services should I be offering them and what should be my (differentiated) value proposition?
How should I do this in an efficient way?" (Markides, 2008, p.6)

In fact, many aspects of strategy and business model overlap. In this paper we see the business model as an abstraction of strategy. The differences between strategy and business model stem from the competitive aspect of strategy. Strategy is more concerned with competition, whereas business models are more about the “economic logic”, a model for underlying economic logic that explains how we can deliver value to customers at an appropriate cost? (Magretta, 2002, p.92)

Magretta describes business model as a short story plus mathematics of numbers. Creating business model is like writing a two part story: "Part one includes all the activities associated with making something: designing it, purchasing raw materials, manufacturing, and so on. Part two includes all the activities associated with selling something: finding and reaching customers, transacting a sale, distributing the product or delivering the service." (Magretta, 2002, p.89-90)
You have to re-examine your model if you failed to achieve the expected results by doing two critical test: the narrative test controls whether the story is true and the number test will control the profitability.

"The essence of a business model is in defining the manner by which the enterprise delivers value to customers, entices customers to pay for value, and converts those payments to profit" (Teece, 2009 p. 171). A successful business model will provide customers with a demanded value, in return collecting a portion of it in revenue and profit.

The razor and razor-blade model is a classic example of a business model creation. According to this model, the razors are priced inexpensively, but the razor blades that are the more frequently consumable parts are priced more aggressively. Selling car a little cheaper and offering spare parts and service at a higher price is an example of applying this model.

Markides believes that established companies find business model innovations unattractive, because they find other alternatives for growth, for example taking the existing business model internationally (2008, p.xvii). Innovation comes in many forms (product, technology, etc.) and innovation of business model in just one of them.

By offering cloud services by leveraging the network features the operators have also to define a profitable and attractive business model which could differentiate them from the OTT's.

One of the lucrative business models for generating revenue is a two-sided model. In the value chain a participant can benefit from revenues both from downstream customers and upstream third parties. A two-sided platform brings together different groups of stakeholders. By exposing their network API's operators can create a market place for applications which utilize the network capabilities like QoS, increased bandwidth etc (Mavrakis and Kamal-Saadi, 2009).

2.3.4 Core competencies

Prahalad's concept of core competencies (CC) evolved in situation where corporations focused on restructuring. According to Prahalad (1990) the companies must develop core competencies by innovating along the product line.
Prahalad puts more value in the concept of core competencies than beating competitors in R&D or sharing the cost with them. According to him it is all about: Collective learning i.e. coordinating diverse production skills and integrating multiple streams of technologies; Harmonising technology streams, organising work and delivery of value; Communication and commitment to work across organisational boundaries.

Identifying core competence in a company is done using the following pointers:
Core competence provides potential access to a wider market.
It adds to the customer benefits of the end product.
It should be difficult for rivals to imitate.

Prahalad compares an organisation to a tree. In a tree like structure, end products are leaves of the tree relying on core products that have core competencies as root. Top management should analyse businesses and competencies and not only products. Without core competencies as a collection of co-ordinated interrelated streams of technologies, a company is a collection of distinct businesses. As an example Canon by combining it's core competencies in optics, imaging and microprocessor control has become capable of entering and dominating diverse markets of copiers, printers, camera and image scanners (Prahalad, 1990, p. 83).

The role of top management is to identify, build core competencies and deploy administrative means for assembling resources across businesses and business units.

However, in introduction of a newer edition of his book from 1980, Porter warns against relying only on core competency by saying "Concentrating only on resources/competencies and ignoring competitive position runs the risk of becoming inward looking. Resources or competencies are most valuable for a

particular position or way of competing, not in and of themselves. While the resources/ competency perspective can be useful, it does not diminish the crucial need in particular business to understand industry structure and competitive position" (1998, p.xvi).

2.3.5 Intermediary role and Control of customers

Customers are a company's assets. All classic marketing papers are overwhelmed by these two words: "customer" and "value". In the ICT sphere the user of services are often the same as customer. Today's complex business environment often requires that players (companies) use intermediary services offered by others.

With help of a study of MultiSided Platforms (MSP's), in this subsection, we will first discuss the relevance and importance of control over stream of the value created and users who are the origin of this value and secondly illustrate some aspects of acting as intermediary and partnering with them.

MultiSided Platforms (MSP's) connect independent user groups. They connect buyers and sellers who are either independent users or enterprises. Examples of MSP's are Amazon, Microsoft and Google. In their article "What's Your Google Strategy? " Hagiu and Yoffie discuss how advantageous or disadvantageous it is to use such a platform from a business perspective (2009). An MSP is not necessarily an online service. It can be a provider of an operating system of a PC as well.

An MSP is both a platform and an intermediary. It can deliver additional opportunities to players in form of reduced costs or greater customer base like Google Adds. But joining an MSP does not guarantee success although it may offer greater efficiency. In fact MSPs are businesses that can insert themselves between a company and the users and can potentially affect the business toward their own benefits, without actually "owning" the players' users. Negative influence can be done by competing with the players, pulling value out of the successful players and inviting new competing players to join the platform (ibid, p.1-3).

Players should pay attention to not give away customers to an MSP for free. Two common mistakes that companies make before deciding to go with an MSP's are:

They do not understand the objectives of MSP's they choose to go with. The MSP's when they get powerful can wield their power and squeeze the player.

When the role of partners, enablers and facilitators are emphasized in our study, the following advices must be considered:

If a company decides to go with an MSP then it has to ensure it will reduce risk of being over powered by the MSP in the future and differentiate itself from others using the same platform.

A company can decide to be an MSP itself (like a Telco which is aspiring to be a cloud service provider) when it is a strategic player and wields substantial power over the market; Possible to team up with other players to form a MSP (ibid, p.1).
To form an MSP with partners a company should partner with ones offering positive net value in the case that the partner is not asking for exclusivity. In the case of a partner, which demands exclusivity, the opportunity can be used to its own advantage by demanding favorable conditions (ibid, p1).

3. Hypotheses

We have made the following hypotheses to test or investigate:

Support activities and in the cloud value chain and different roles in the cloud value network offer a variety of opportunities such as a catalog provider, online service provider (for billing and payment), aggregator (broker) etc. If we refer to these roles as enablers, then:

H1
An enabler role allows for a variety of opportunities and innovations and must be considered by a communication provider in addition to providing technology and consulting services to operators.

H2
Partnerships in different forms (acquisition, start up, etc.) are key strategies in successful cloud implementation.

There is no single appropriate way for implementation of cloud computing. Since operators differ in many ways, there is no simple recipe for all of them. A classification to cater to different categories should be done after exploring the applicable forces. According to discussion above under Segmentation of operators, the forces that contribute to these differences are suggested as below (factors or parameters corresponding to each of these forces are given inside parentheses). We have distinguished between operators' attributes and the contextual or environmental forces. Finding and classifying these parameters will help system providers in their choices.

H3
The forces and parameters that could matter in segmentation of operators could be:
Size (subscriber base (number of subscribers), revenue (sales volume))
Financial situation and Growth outlook (like access to capital)
Geography (local or global, operating in rural or urban areas)
Subscribers' demographical characteristics (age, gender, income, education)
Business culture (Decision making, innovativeness, technology mindedness).

The contextual or environmental factors that could matter in segmentation of operators could be:
Level of competition (number of cloud providers and maturity of cloud market)
Politics (such as Restrictive or liberal government policy, regulations)
Important population habits if any (such as spending habits, technology adoption and use of social networks).

4. Research Method

We will choose single (embedded) case study as method in our investigation, based on Yin. Once the general research question and the case is defined, it becomes important to clarify the unit of analysis in more details: "implementation of cloud", "operators in distinct regions" and "Ericsson" are the suggested three units of analysis.

The proposition under Theory section about operator classification, gives our investigation an exploratory character. The rest can be classified under explanatory (casual).

Our choices of research design, the unit of analysis and data collection will be revised if necessary, because we will iteratively review the material collected and match it with the units of analysis.

Sources of data

We will largely rely on sources of evidence, data and data collection as below:
Collection of historical and current documents; Direct information from the company, conferences and other events; Library research and Internet; Interviews and Direct and secondary observation.

Material from leading industrial and analytical researchers like NIST Cloud Computing Program and IBM cloud computing research shall be used extensively. Data, analyses, interviews etc. from articles in newspapers like Financial Times and Wall Street Journal will be referred to.

Data collection will begin by preparing questions (based on research question and our propositions) and choosing evidence and data that address formulated questions.
The proposal at this stage is to begin with generic questions like:
Does cloud provide any Strategic Opportunity?
Does cloud provide any Differentiation Opportunity?
And advance towards specific questions which should be answered with reference to the theoretical framework and chosen analytical techniques.
Qualitative method for data and evidence is the main form of evidence where pattern marching and explanation building, in narrative form, are the main techniques.

4.1 Method

In this section we will discuss the method we have used in our study.

We have chosen case study as method in our investigation, mainly based on Yin's approach (2009). In this book he details the principles of good case study design together with how to collect, present and analyze data fairly (ibid, p.1).
A case study is a research method suitable for studying complex social phenomena in order to illuminate process and events. This approach according to Yin, can help investigators find answers to a "how" or "why" questions being asked about a real-life, contemporary set of events, over which the investigator has little or no control (2009, p.19). It can help find the relationship between a phenomenon and the context in which it transpired. This requires a comprehensive data collection and data analysis strategy to cope with many variables of interest. This is made possible by multiple sources of evidence converging on reliable findings and prior formulated theoretical propositions guiding data collection and analysis (ibid, p.18). Different types of cases have been recognized in literature: exploratory, explanatory (casual) and descriptive. The classification of operators gives our case an exploratory character. The other aspects of the study can be classified as explanatory.

The first step in conducting a case study is to come up with a design on how to approach the problem at hand. A sequence of events to collect data and establishing its link to the phenomenon being investigated has to be outlined. Yin calls this “research design” (Yin, 2003, p.20). Research design involves making choices or decisions about questions, methods and techniques used in the study to collect data and analyze.

Yin stresses theory development prior to collecting data, which helps establish a framework around which research design could be tailored. This offers clarity to the researcher regarding how to collect data. Theory helps build propositions and hypotheses that can find possible answers to study questions. Theory also helps with the analysis of data and its interpretation. The framework importantly can offer analytic generalization when comparing the findings against the established theory, which adds credibility to the study. If two or more cases support the same theory, replication may be claimed (Yin, 2003, p.33). Yin calls this “Level 2 inference”. A literature review on existing articles in the field of study is the first step in developing the theoretical framework.

We therefore did an exhaustive literature review which involved articles from eminent authors which were part of our strategy course. We also searched for information on the Internet and the online journals in the university library. We used keywords like “strategy”, “porter”, “cloud implementation”, “cloud strategies”, “telecom cloud opportunities”, “classification of telecom operators” etc to find related articles and finally came up with a theoretical framework outlined in section 2.3. We have also used other credible sources like NIST, research institutions and international standardization organizations in order to explain concepts needed. These sources have helped us gain the required knowledge to formulate our hypotheses.

In the subsections that follow we will explain our method approach in more detail.

Research Design:

Yin cites Philiber, Schwab and Samloss pointing out at least four problems to be dealt with "what question to study, what data are relevant, what data to collect and how to analyze the result" (ibid).

The discussion below explains our approach to research design based on the 5 components listed above.

4.1.1 Study questions

The topic of our case is to study the strategy of mobile system providers in cloud, the implementation of cloud computing in telecom by Ericsson. The research questions we pursued are stated here again for convenience.

How can implementing cloud computing be a source of differentiation for telecom and mobile industry players including system providers and operators?

How can cloud computing as a source of diversity be a business opportunity for telecom system providers and operators? How can system providers and operators monetize the cloud as a new source of revenue?

As explained earlier in section 1, motivation for these questions arises from the challenges facing the telecom industry today like the issue of decoupling between the sources of revenue and sources of cost and challenges facing the cloud technology today like compensating for reduced revenue, security and bandwidth requirements. If the telecom industry is capable of providing them, these players are well positioned to address these issues. Additionally a system provider can position itself better by doing things differently than competitors do.

Additionally, classifying the operators to different segments or groups and understanding their needs becomes crucial for system providers, in offering their cloud portfolio. There exists no theory for classifying operators. Therefore formulating and testing propositions had to include hypotheses that consider it.

4.1.2 Study propositions

Based on the theory we came up with propositions listed under Hypotheses in section 3 above. They reflect predictive ideas on elements of a presumably suitable and differentiating cloud strategy. They are formulated as hypotheses to be tested or investigated. In testing them we have even considered alternative explanations.

4.1.3 Unit of analysis

We have chosen "strategies and implementation of cloud services", "operators in distinct areas" and "Ericsson in the cloud market" as units/levels of analysis in our study. We have used the characteristics of telecommunication industry, Ericsson's competitors and the Internet players (like online services and enablers) as contexts to base our study on. Analyzing the existing cloud services offered by cloud providers today, the trends in this industry, the challenges faced, identifying the existing loopholes and scope of new players entering the market we believe can help us find answers to our research questions. There is a lot of research material available on this topic and a number of articles available on the internet. This can help compare the findings of this study against available literature. Regarding analytic generalization we believe our findings can be generalized to the telecom vendor industry as a whole.

We have deliberately limited the study to a few regions for extensive data collection about operators' characteristics. Europe, USA, China and India are chosen for this purpose to span the study in both established and emerging markets. Extensive data on the African and South American operators have not been collected and can be part of future research. This limitation is mainly due to the time frame of our study.

We have iteratively revised the material collected and matched it with the elements in our research design as suggested by Yin. "Do not consider closure permanent. Your choice of the unit of analysis as with other facets of your research design can be revised as a result of discoveries during your data collection" (Yin, 2009, p.30).

4.1.4 Linking data to propositions & criteria for interpreting the findings

This forms the analysis part of the case study research. In our work we will largely rely on qualitative method of data collection. Pattern matching and explanation building (which is one special case of pattern matching) in narrative form are used as main techniques for analysis of data and evidence as explained below. Other techniques like time series analysis and logic models which is (like pattern matching but sequential or chronological) are note especially applicable to our work and have been avoided.

4.1.5 Pattern matching and Explanation building

Pattern matching compares an empirically observed pattern with predicted or expected one(s). It is a tool used to match the results of data collection with the propositions. The anticipated event is specified a priori. It is thus a useful tool to test a proposition (or theory). If patterns and predictions match, the propositions can be confirmed to be positive and internal validity will be improved. One special case of pattern matching is Explanation building. A series of how and why questions are often described in narrative form. This method must be iteratively applied. We have applied in the following manner: theoretical statements and propositions -> match or compare them against the findings of an initial case -> asking "How can the new evidence be explained?" and "Why is that so?" -> Revise the statement or propos if needed -> compare other details against the new case -> compare the revised propositions to the facts a number of times.

4.1.6 Quality of research design

This ensures trustworthiness, credibility, conformability and data dependability of the research findings. Yin suggests 4 tests to ensure quality (presented in Appendix A, Case study protocol).

4.1.7 Data Collection

Yin lists six common means of collecting data: documents, archival records, interviews, direct observations, participant observations and physical artifacts. In this study the following were used:

Documents: sources of documents were articles in journals, reliable sources from the internet, university library and documents shared with us by Ericsson. Material from academic research, leading industrial and analytical researchers (like NIST Cloud Computing Program and IBM cloud computing research), were used extensively. Data, analyses, interviews etc. from articles in newspapers like Financial Times and Wall Street Journal were also referred.

Archival records: survey reports on the mobile industry (mobile services in demand or having potential, mobile market growth, demographics, market capitalization of telecom operators etc) in different countries.
We have had two video conferences for open discussions and interviewed three people (1 manager and 2 consultants).
Direct observations, participant observations and physical artifacts were not considered, as both of us authors did not have access to the Ericsson office.

4.1.8 Reporting

The report is the final result of the work presented in written form. It brings us to closure and conclusions. Our report is primarily directed to an academic audience. Interested people in the telecom industry or cloud business may also find it interesting. While reporting we have followed directions and conventions in writing academic papers. While composing the document guidelines set by our university tutors, such as using suggested templates etc. have been strictly adhered to. From a presentation perspective we have divided the report into sections according to these guidelines. The report is in narrative form and includes written and visual material. Several drafts were made during an iterative review process by group members, peer reviews and comments from supervisors, before the final document was agreed upon. We have found Yin's tips very useful: Define audience(s). Display enough evidence for reader to reach own conclusions. Review and rewrite until done well.

4.2 Case study protocol

Yin also advises using the case study protocol for a single case study approach. Preparing a case study protocol ensures that all participants in the study follow the same procedure.
In this study the protocol laid out by Brereton, P., et al (2008) has been adapted and is part of Appendix A.

In addition to following Yin's case study approach we also incorporated recommendations by Kazdin (1995). He discusses how reporting of a research work is prepared in the best way by reviewing the main

sections of the paper. This is in line with our tutors' guidelines. While presenting the results, the tests performed and the method of analysis are justified. Results deal mainly with test of hypotheses or propositions. He also considers discussion as a section. In this section all conclusions and interpretations are finalized. Findings and their relation to objectives of research and future studies are clarified. The report must present motivation for choices and decision about methodology and design among the alternatives for answering the research question. Kazdin believes that acknowledging the limitations as far as they don't cause flaw in the process of research leads to critical understanding and can direct attention to future works (1995, p.4).

5. Results

Cloud market overview

For cloud computing to succeed as a model in which applications and infrastructure are delivered as service, over the Internet, the overall quality of network becomes more important for a good customer experience. Therefore ensuring a reliable connectivity and maintaining network quality remain the main task of network & communication system providers and mobile operators, searching and creating new business opportunities in order to retain competitiveness.

Cloud computing is still in its early stages especially in the mobile world. Before considering the cloud as an opportunity we have to get an understanding about the size of the opportunity. A large number of research organizations have made estimations about the size and growth of the cloud market. A comparison between estimations about size and growth of cloud market is summarized in table 1.

Table 1: A comparison between estimations about size and growth of cloud market

Forecast by / for the year	$billion	Forecast made in
Merill Lynch / by end of 2011	160	May 2008
Gartner / by 2013	150.1	March 2009
IDC / 2014	55.5	June 2010
Cisco / 2013	43	October 2010I
IBM / 2015	88	September 2011

Source: Telco2.0 Research

As seen in the table, there is a large variation in predictions before and after 2008, which can be explained by the effect of uncertainty created after financial crisis in 2008. It should also be noted that there is not a unified view of what each prediction include and what the assumptions are. Since there are not enough historical data available, it is not possible to rely on these forecasts completely.

US companies are major cloud providers. In US also major Telco's consider cloud as a major business. US share of global cloud market was 58 percent in 2011, while China had 4.7. AT&T alone has invested USD 1 billion on enterprise cloud in 2011(China daily, 2012).
SaaS is forecasted is to reach $14.5 billion in 2012, a 17.9 percent increase from $12.3 billion in 2011 (Gartner, 2012).
Cloud will also be one of the major businesses for Chinese operators in the future. All three invest billions in data centers. China Unicom is the first telecom operator that has started commercial operations of cloud-computing technology. A similar trend is seen in India, Singapore and Malaysia where the Telco's

are also offering cloud services and are one of the big cloud service providers in their respective countries.

Governments and cloud

Cloud computing has been a major focus of government agencies in a number of countries. Cloud computing has a strong support from the Chinese government. China has allocated substantial funds to cloud computing, especially for the SaaS industry in its US$586 billion stimulus package (Kshetri, 2010).

US Chief information Officer (CIO) estimates migration of $20 billion of the Federal Government's $80 billion in IT spending to cloud computing solutions and believes that " The cloud computing model can significantly help agencies grappling with the need to provide highly reliable, innovative services quickly despite resource constraints" (Kundra, 2011).

The Government of Singapore aims to move all its departments to the cloud by 2015. It is looking a combination of public and private clouds to achieve this. Called the G-cloud it offers sharing of computing resources and applications at the whole of government level, thus offering cost savings (Cloud computing for government, 2011).

The Government of India is also actively promoting the adoption of cloud computing services by its departments. Some of the governments at the state level have already started to consume cloud services for e-governance initiatives. (ExpressIndia, 2011)

Cloud in developing countries

We have already mentioned that China's share of global cloud market was 4.7 percent compared to 58 for USA.
Cloud will be one of the major businesses for Chinese operators in the future. All three Chinese operators invest billions in data centers. China Unicom is the first telecom operator that has started commercial operations of cloud-computing technology.

Kshetri believes that IT industry in developing countries is playing a crucial role in the development of the cloud. In this research especially the role of companies in China, Brazil and India is recognized. "Some highly visible examples of developing world-based firms supplying cloud related services are based in China, India and Brazil…India's CRL and AdventNet are among the high-profile Indian cloud providers" (2010, p.6).

Kshetri describes the potential and impact of cloud in emerging countries drawn from findings and conclusions from surveys and studies, as inconsistent (ibid p.1). Unavailability of network resources like bandwidth is one of the shortcomings in these countries.

Data collected by us shows that operators in China, India and a number of other countries are aggressively offering cloud based services. Please see appendix B and discussion on segmentation of operators.

Strong economic growth in emerging markets like BRIC countries especially is driving development towards high bandwidth networks, which will boost the expansive use of data intensive traffic. We have pointed out that mobile phones are the primary computing device and means for accessing the Internet for a large proportion of population in emerging countries. In India for example, research conducted by

Google showed that the Indian smartphone users are more active on the internet than the ones in USA by accessing content on the internet and social networking. Also the demographics in developing countries like India and China with a high percentage of young population are expected to boost consumer cloud services accessed through mobile devices in the future. A research conducted in Europe has shown that the younger population is very active in accessing mobile broadband compared to their older counterparts. The cloud industry numbers for India: US$27 million in 2007, US$165 million in 2010, estimated to be a US$15 billion industry in by 2013 (Kshetri, 2010). Even if this forecast is considered optimistic our data collection has shown that the trend is very clear. We will present more information about mobile operators and use of their network in this section.

Research conducted by Microsoft (Microsoft study, 2011) in 5 different geographies which also included India, where such laws are surveyed to be inadequate, found otherwise. The Indian SME's feel their IT to be more secure in the cloud than maintain their own. 64% of the SME's reported enhanced security in the cloud against data security and cyber attacks. The SME's do not have the finance or skills to manage security efficiently themselves. They feel better off relegating the task to the expert services offered by the cloud service provider. They are able to allocate resources to grow their business than worry about security. This clearly suggests that though the regulatory policies of the government do help, the advantages offered by the cloud can help overcome this barrier.

Cloud computing market trends

According to Deloitte, SaaS will grow and among the SaaS applications the fastest growing are Customer Relationship Management (CRM), Supply Chain Management (SCM), Integration as a Service and Content, Communication and Collaboration (CCC). Business process as a service will face moderate revenue (Deloitte, 2009.)

A Deutsche bank study in 2011 of the SME's in Germany revealed that 10% of the SME's were using cloud based services already with the number expected to touch 25% by 2012.
IaaS was the preferred service due to the flexibility of the IT departments to dynamically allocate resources. SaaS was limited to a only a bunch of software applications, mostly ones like CRM which employees accessed while travelling. PaaS was unpopular and seldom used by the SME's.
The reports states that the large companies prefer the private cloud model while the smaller ones prefer public cloud models (Heng and Neitzel, 2012).

Mobile Operating Systems:
Alibaba, a Chinese e-commerce giant, has recently introduced Aliyun, a cloud OS for mobile phones and has rolled out its K-touch range of W700 smart phones. It is the first mobile cloud operating system allowing users to use the power of the internet. It provides users with 100GB of space and allows them synchronize and share pictures, videos, contacts etc. with others. It will support android apps and apps developed for its operating system. Cloud services like email, internet search, weather and navigation are built in. Features like Web apps are introduced which allow developers to use standard HTML5 and javascript to develop apps. From the user perspective they need not anymore download apps to their mobile phones.

Below, we will try to give a picture of the operator world along with an attempt to classify them to different segments based on differentiating factors mentioned in earlier sections.

Segmentation of operators

As mentioned earlier in the thesis due to limitations of time we restricted our study to a few operators in India, Germany, Spain, China, USA, Australia, Singapore, Malaysia & Turkey to span 3 continents.
In India where a number of operators were present only those which were offering cloud services were studied. A few of them were selected depending on their cloud service model for segmentation purposes. Among operators offering similar cloud services only 2 were selected for the study.

All the operators studied and their current cloud offerings are provided in the Table E3 in Appendix E.
Also in the same Appendix, the political and demographical factors in these countries which affect the cloud industry are presented (Table E1 & E2). In addition to the economic policy of the government, the political factors affecting the cloud industry are availability of sound policies and regulations in the country for data privacy, intellectual property (aiding innovation), e-commerce, cybercrime, data security all of which help build confidence in the enterprises and the general public in storing their either personal or company specific confidential data on the cloud. Powerful laws in each of these aspects will be a very strong driver for adoption of cloud by the enterprises. It will motivate the enterprises to move business critical data to the cloud thus increasing the traffic on the cloud. Another aspect important to encourage cloud service providers is promotion of free trade in the country. This basically means the extent to which the country is imposing restrictions on the operators to adopt local business solutions, run data centers in the country, store data within the boundary of the country or in other countries where the data security laws are equally stringent etc. Ideally, cloud industry will thrive in situations where there are no such restrictions. The presence of standardization bodies specifying the standards for cloud services is important to avoid the data lock-in and business continuity of the enterprises and play a key role in the industry flourishing. The most important aspect for cloud computing like pointed out in various parts of this text is the availability of good broadband infrastructure. The inclusion of broadband connectivity in the policy of the government makes the industry more attractive. Finally, the demographics of the society and the penetration of technology in the population will act as a powerful driver of adopting cloud based services.

A brief description of the operators and the political and demographical factors corresponding to the country they operate in are provided below. For more details Appendix B can be referred.

China and Chinese operators

The whole of Asia Pacific is a fast growing mobile market. Asia Pacific accounts for 40% of global mobile data traffic. In AP17 (the 17 largest countries in Asia Pacific) operators earned more than $310 billion in revenues in 2010 compared to $240 billion in 2008" (Chua, 2011)
China as a fast growing country has attracted huge attention in many business and industrial studies, due to its role in the global economy as the second largest economy and its high growth rate.
China's telecom industry can be characterized by high governmental regulation and fast growth. China has inadequate regulatory policies which the government should look to amend. The government is in most cases not promoting free trade, as is the case with the government banning popular international content providers and social networking sites. Also the government is encouraging operators to adopt local technology solutions than foreign ones. The government has a broadband policy in place where it plans to provide 45% of its population with broadband access by 2015. Regarding the demographics in Table E2 the population of china and the number of broadband subscribers are attractive enough for the service providers to see potential in the market.

Chinese operators

China has three major operators who are very active in the cloud. China Telecom Limited,China Unicom and China mobile.

China Mobile is the largest mobile operator in China. Its subscribers are mostly GSM. Only 7% of its subscribers are 3G broadband subscribers. It is mostly offering IaaS through its numerous datacenters across china. More information regarding this operator is provided in Table B3of Appendix B.

China Unicom is the second largest operator in china offering IaaS, PaaS and consultancy services. It rolled out the first Data center for commercial operations in the Chinese market.

China Telecom has the world's largest fixed-line network with operations in Asia Pacific, America and Europe. They offer Data Centre services like virtualized, hosting to managed and professional services, and telecommunications connectivity. They run Data Centres located in Beijing, Shanghai, Shenzhen, Hong Kong and Singapore, plus over 260 locations throughout main land China. They also offer virtual telephony system called "ContactWorld" and a real time network monitoring system called "Netcare".

Cloud will be one of the major businesses for Chinese operators in the future. All three invest billions in data centers.

India and Indian Operators

The cloud industry in India is estimated to be a US$15 billion industry by 2013 (Kshetri, 2010). The regulatory policy in India, like in China, is underdeveloped and needs amendment. Again like China the penetration of broadband and the PC in the population is a hindrance to the cloud industry. The government however promotes free trade to a great extent and has a broadband policy in place thus encouraging the cloud service providers to offer best in industry products and services.

According to Google (MobileIndian, 2012), Indian smartphone users are more active than their US counterparts. They access Internet from their smartphones more than the subscribers in the US. The US citizens preferred to go online using their personal PC's. Refer Appendix G for more details.

Indian operators
Bharti Airtel is the number one operator (GSM) in India. It has a presence all over India in both Urban, Rural and semi urban areas. Airtel offers cloud services to SME's and also runs an app stores accessible by their subscribers.
Airtel has entered a partnership with Ericsson for managed services of its networks. Airtel has established a partnership with Savvis, an enterprise IT solutions provider to resell its managed services portfolio in India and hence acts as a cloud broker. Airtel has also entered a partnership with VMware, Cisco and EMC to enhance its product offering. The cloud services offered by Airtel to the SME's are IaaS, virtualized PC as a service, co-location, managed hosting and Security as a Service.

Reliance Communications is the second largest operator (GSM and CDMA) in India holding 16.79% market share of the Indian market with 144.78 million subscribers. Like Airtel, Reliance has also ventured into the cloud market offering similar cloud services like IaaS, managed hosting, co-location, server hosting, disaster recovery, automatic security updates, SaaS like ERP and email, Paas. It has partnered with Microsoft for the email exchange and SW platform support. It caters mainly to the SME's. It also runs an app store for it mobile subscribers.

BSNL a public company with government holding majority of the shares, has also ventured into the cloud market operating 6 datacenters across India in both Urban and semi-urban locations. It is serving both SME'S and government offices that are migrating to the cloud. It plans to extend its services to maintain government databases in its datacenters for access to general public. Services offered today are IaaS, PaaS, SaaS, co-hosting, storage, managed services.

BSNL innovated a model of public-private partnership by partnering with Dimension data India Pvt. Ltd. The core competence of BSNL as a leading communication service provider and that of its partner in the field of Data Center services were leveraged to provide Data Center and IT solution services to provide BSNL with new sources of revenue. This model has inspired many incumbent Telco's the world over.

Aircel is a mobile operator in India with 6.9% market share and 63.25 million subscribers. It is co-owned by Maxis Berhard group of Malysia and Apollo group of India. It is currently offering music cloud wherein subscribers can buy audio/video clips of songs online. The songs reside online and not on the physical device. The songs can be accessed anytime anywhere. It is also targeting the SME's with the global cloud acceleration service from Virtela. It has partnered with Virtela to provide faster, secure cloud services to its enterprise customers.

Europe (Germany, Sweden, Spain)

Political and regulatory factors across Europe are quite similar. The regulatory policies are advanced and the countries promote free trade policies. The governments all have good broadband policies and the high internet and PC penetration only serve to promote cloud computing.
According to a survey Germany is ranked as the 3rd favorable country in the world for cloud based services because of data privacy laws and policies on the security aspects of cloud services. It is required by law that the cloud services are offered out of data centers located within Germany and that they adhere to strict restrictions regarding data security. This level of security which is required by law boosts enterprise confidence in moving to the cloud (BSA Global Cloud Computing Scorecard, 2011). The cloud services offered are Video conferencing, highly secure stotage as service, email, SaaS (CRM,ecommerce), IaaS, app store. It specializes in offering both public and private clouds. It operates through 90 data centers distributed throughout the world.

The German government has a national policy in place to have 75% of the households with a download speed of 50Mbps by 2015. EUR 250 million has been ear marked for this purpose. Around 600,000 rural households without broadband connectivity have been identified and the government is contemplating broadband connectivity.

The European commission targets to have all European households to have at least 30Mbps download speeds by 2020 and 100Mbps in 50% of the households by 2025.
Refer to Appendix G for the survey on the European and UK mobile broadband user.

Deutsche Telekom
The German giant is operating in many countries worldwide. In Germany it is the second largest operator behind Vodafone with 31% market share and 35 million subscribers. It is offering IaaS, SaaS, co-location, app stores, storage, Music etc. as cloud services. For more details refer Table B4, Appendix B.

Telefonica/O2

Is a large Spanish operator with presence in most of Europe and Latin America.
In Germany O2 is the 3rd largest operator with 16.1% Market share. It caters to the enterprise cloud segment through business email and SaaS. It caters to the subscriber cloud market through its music streaming through the cloud. Subscribers can buy music and store them on the cloud without having to store them locally on their mobile phone.

In Spain, Telefonica is the largest operator with almost 40% market share and 22.5 Million customers. It serves the SME cloud market by offering IaaS, PaaS and SaaS services. For the individual subscribers it has partnered with Fonyou to offer internet calling services from the cloud which gives them a second number with value added services like visual voicemail, call registers and advanced call screening. With this initiative Telefonica aims to compete directly with OTT players like Google talk and Skype and retain the customers in the process. This is comparable to Rich Communication Services which is part of the GSMA standard and discussed later in this section.

It is also offering the enterprises with a cloud service named “Dual Persona”. To enable this service Telefonica Digital has teamed up with VMWare which allows the customer to use his/her personal smart phone for corporate purposes. It allows demarcating corporate data and personal data stored on the android device. The product facilitates IT departments to provision as well as manage all the corporate applications, emails and also data present on employee’s Android smartphones across the air through VMWare's cloud based Horizon Mobile device-management software. With the new service companies will be able to access and wipe out corporate information from employees devices even if the device is not accessible and that to without touching the device owners personal profile.

TeliaSonera and Telia in Sweden
TeliaSonera operates in 17 countries incl. Russia and shows high degree of willingness to adopt different segments of cloud. It has stepped into the cloud with mobile applications and telematics services in the Nordic and Baltic countries, as well as secure data storage and video conferencing.
Telia, its Swedish arm, is a technology-oriented operator with potential. It already has rolled out LTE. After privatization and merger with Finnish Sonera, the company has gained international markets. Sweden is home base for both Telia and Ericsson and they share a tradition of cooperation. We believe that Ericsson can take advantage of cooperation with operators like Telia in cloud area, especially in early phases of their cloud strategy. The fact that Telia has access to a variety of other markets is also beneficial.

USA and US operators
USA has cybercrime, e-commerce laws in place. The privacy law though in place has a number of deficiencies. The absence of security audit requirements are offset by consumer laws i.e. a company claiming data security of hosted data can be taken to court if seen to misleading customers. The service providers are liable for the infringement of content they were made aware of. The service providers may be subject to civil penalties and in some cases criminal penalties. Standardization aspects in the cloud space are overseen by NIST. No formal standardization is in place yet. The US government promotes free trade and places no restrictions regarding the mandatory use of certain products, services, standards or technologies by cloud service providers. The country does not discriminate cloud services based on nationality of the vendor, developer or service provider. The government has a national broadband policy in place to have at least 100 million homes have access to affordable broadband with download speeds of up to 100Mbps and upload speeds of up to 50 Mbps by 2020. Also by the same year the plan is to have all households have access to 4 mbps of download and 1 Mbps upload speeds. The country has the ambition of having the most extensive and fastest wireless network also by 2020.

US companies are major cloud providers. In US also major Telco's consider cloud as a major business. US share of global cloud market was 58 percent in 2011, while China had 4.7. AT&T alone has invested USD 1 billion only on enterprise cloud in 2011 (China daily, 2012).

The four largest US mobile operators are Verizon, AT&T, Sprint Nextel and T-Mobile USA.
All major US operators either have already deployed LTE or announced their intensions in doing it. T-Mobile is late with its LTE deployment and has recently made contracts with Ericsson and Nokia Siemens for building its 4G network. Sprint Nextel also lags behind. The company which originally deployed a technology called WiMax, for its 4G networks, plans to launch its LTE network this summer with equipment from Ericsson. It will shut down Nextel networks.
A trend observed in USA is that connectivity providers are attempting to compete not only with speed of the network, but also with the services they will offer upon the bits transferred.
These services are applications that take advantage of the new high networks. AT&T has planned its home automation and security-managed services. The system is a set of webcams, sensors and controllers connected to the network. Verizon will offer its customers a system for streaming life audio and video to friends and family. The latter is an example of cloud.

AT&T is the largest US telecommunications group by revenues. It is aggressive in the cloud with a USD 1 billion investment towards deploying next generation services like mobile applications, as a service cloud based solutions and network sourcing. It has set up cloud innovation center in the bay area where developers and companies can use the available resources from AT&T and partners to develop new services. Cloud services offered by AT&T are Storage (IaaS) and computing, PaaS. Cloud storage via a public or private network connection; Utility computing (hosted infrastructure, managed hosting, 38 AT&T enterprise-class data centers); examples: web hosting services for SME, PaaS (SaaS enablement for software vendors) virtualized, scalable infrastructure of application and database servers, 50 application development templates.

Verizon Wireless (part of Verizon Communication Inc) is the largest wireless connectivity provider in the US. Verizon is actively working on M2M for instance through its open Development initiative in Verizon BUGs labs, where developers and enterprises can certify their devices.
Cloud services: Verizon has acquired cloud and managed IT infrastructure leader Terremark Worldwide in April 2011, and cloud software technology provider CloudSwitch in August 2011. It has also acquired Nirvanix's (Storage Delivery Network), thus offering"everything as a service". They claim their storage will be faster due to better network reach and more secure inside Verizon network. CloudSwitch takes advantage of VPN, by launching an encryption tunnel into the cloud, bridging the customer and the cloud so that the network configuration, IP address, hypervisor and other settings are maintained..
Verizon performs "Cloud-based delivery of integrated IT, security, mobility and collaboration solutions" (Verizon Newscenter, 2012).

Maxis
Maxis is the largest Malaysian mobile operator with 14.25 Million subscribers. It is one of the early cloud service providers in Malaysia. It is offering IaaS services to schools and SME. Maxis can address growing bandwidth demand. It offers both private and public clouds. It has recently launched *Loker*, Malaysia's first personal cloud service on multiple devices. Subscribers receive 5GB of storage and can sync, store and share pictures, video, music with others and on social networking sites. Maxis is operational in a number of other countries. Tapping it can hence opens up business opportunities in several other countries.

Digi and Celcom which are the other big operators in Malaysia along with Maxis have not ventured into the cloud market much yet.

SingTel
Singapore has a strategic geographical position, advanced local infrastructure, and strong government support and funding for ICT.

SingTel is the largest mobile operator in Singapore with 3.2 Million customers. It is quite mature in its fixed cloud offering to the enterprises in Singapore with the "PowerOn connect" platform. More than 150,000 users and 800 companies are using SingTel's cloud services today. It offers Applications On Demand (SaaS), Infrastructure On Demand, Connectivity On Demand and Managed Services On Demand, bandwidth on demand (increase bandwidth on demand by up to 2 times to cater to a temporary or sudden increase in access). SingTel is bringing a strong funding and support model for partners.

It is offering web based office suite including email, calendar, documents, sites, eSMS and eFax services and a web based video conferencing service.

SingTel believes in a strong partnership strategy and has entered strategic partnerships with Cisco, Google (oneoffice), Intuit, Samsung, Arkadin, Ericsson, RIM, Juniper Networks, Nokia, Polycom, Riverbed, Sybase, and V3. For IT services, SingTel has its own system integration company, NCS, but also partners with a number of ISV players in major verticals (SingTel's Cloud Service).

Turkcell (Turkey)
Turkey is a big market with a sizeable population. Turkcell is the biggest Turkish operator with 34.5 million subscribers. It is also operating in middle east and other Asian markets. It is offering cloud services in Turkey with the aim of becoming 'one-stop shop' for cloud-based services for businesses in Turkey. Its closest competitor in Turkey Avea has also ventured into the cloud.
Turkcell's cloud services mostly cater to enterprises with services such as IaaS, SaaS, CaaS (communication as a service). It has partnered with Cisco, VMWare, Microsoft and HP.
Depending on its success in its home market it plans to take it to its other markets mostly in Middle-East Asia.

Avea
Turkish operator Avea is the second largest operator in Turkey with 12 million subscribers.
It is in the cloud market with SaaS offerings including Microsoft email exchange, Livemeeting, Microsoft Sharepoint and other integrated communication tools to enable SME customers work using the mobile.

Telstra (Australia)
Telstra is a private company which originated from governmental Telecom Australia. In addition to being Australia's largest provider of fixed lines and mobile (both number of subscriptions and coverage), Telstra is a provider of TV, media and other services. The company has also activities in other Asia Pacific regions. In Australia it operates a HSPA (fast 3G) mobile network called Next G, with coverage in large cities. It is currently rolling out an LTE network in cooperation with Ericsson, with coverage in the center of large cities. Telstra's media network includes BigPond brand, which adds to media diversity by providing Australians with online and mobile news and sport, as well as movies, music and games. Telstra owns half of FOXTEL, a pay-TV company with more than 100 channels. With BigPond Telstra is playing a role as a content aggregator and will benefit from a share of the revenues, cooperating with

Panasonic, LG and Samsung. Telstra is also providing this content outside of its own network, thus stepping into the OTT market. It is also set to launch CDN to use with its pay-TV operations.

Optus
Owned partly by SingTel, Telstra's largest rival, also owns fixed line telephone network, pay TV and cable networks. Optus offers online storage for consumers (Optus smart Safe, free up to 2 GB) and runs its own appstore for different devices. Optus partners with Google to offer Google Apps for Business as part of its new range of cloud-based solutions for SMB customers. It provides business customers with virtualized computing and storage capacity on demand.

Communication system provider market

Ericsson

Ericsson is a provider of telecommunication products and services to mobile and fixed access operators. Over 1000 networks in more than 180 countries use equipment provided by Ericsson. Ericsson has products and solutions for infrastructure of mobile and fixed access, microwave networks, IP networking and broadband devices, billing and charging systems, multimedia, network management, M2M communications etc.

The company's origins date back to 1876 when it was founded as a telegraph equipment repair shop. It has made a lot of important contributions to communication systems such as Bluetooth and LTE, which is the technology for the fourth generation of mobile systems (4G).
Like many other telecom companies, Ericsson grew significantly in 1990s and suffered the crash of early 2000s. In October 2001 Ericsson and Sony formed their joint venture SonyEricsson (SE), integrating their efforts in the segment of handheld devices. SE, facing competition from Chinese, Korean and Taiwanese manufacturers on one side and increasing presence of smart phones on the other, was not able to keep up with the pace. Delivery of new products was delayed compared to market leaders. Market share in this segment shrank year after year. Ericsson dropped out of the joint venture in 2012.
Ericsson did very well in the network (equipment) segment and is now a market leader in this segment. In 2010, after Nortel's bankruptcy, Ericsson acquired Nortel's CDMA (3G) business in order to strengthen its position in North America (Ericsson annual report, 2011).

Ericsson addresses the following market segments: Networks (incl. mobile and fixed infrastructure and equipment, xDSL, 2G, 3G, 4G) with 58% of total sales, Global Services (incl. managed services and network rollouts, system integration and consulting) with 37% of total sales and Multimedia with 5% of total sales (incl. OSS and BSS business).
The business segments Networks and Global services together account for 95% of revenue. In these segments Ericsson is larger than its competitors. Ericsson has among others, taken over management of Sprint Nextel in USA and Vodafone UK's RAN (as part of market segment Global Services). France Telecom Orange has a similar agreement with Nokia Siemens. Indeed the number of outsourcing deals has risen from six in 2004 to nearly 90 in 2008 (Nelson and van den Dam, 2010, p.5).

Ericsson in Cloud

Ericsson as part of its cloud initiative has formulated the "Network-Enabled Cloud" (NEC) that can be summarized as a collection of the following activities.

Offering SaaS to operators (like Billing, not real-time data).

Mobile Cloud Accelerator (MCA):
MCA includes and requires Policy control and End-to-end QoS enabled in the operators' network. Cloud acceleration also includes media and content delivery networks (CDN) which are built to reduce the costs of transport and increase the quality of experience. Ericsson has partnered with Akamai in order to offer products for this purpose. Thus incorporating the cached data in the mobile operators' networks requires co-operation among 3 parties: Akamai, Ericsson and MO's.
The Mobile Game Accelerator (MGA) solution is built on MCA to enhance gaming experience. In-Game communications enhancement will use network capabilities like QoS to enhance gaming experience for example by prioritizing voice chat during the game.

By adopting MCA, the delivery of content will be efficient in two ways. Firstly, the content will be cached locally at operators' premises, which reduce round trip time for traffic to and from the Internet. Secondly, the traffic will have more priority in the radio access network which is the actual bottleneck for mobile networks. Adopting Akamai's servers for caching content closer to the end-users makes web-based applications faster. This feature is the company's primary service and is referred as Web Application Accelerator. This enhancement in speed is achieved without significant changes or complexity for the customers' (service providers') infrastructure.
This will create added value and better quality of experience for users. For OTT players, it means that their services are delivered seamlessly. Operators can monetize on the premium quality both from consumers and content providers.

Management suite:
Ericsson will also deliver Integrated Cloud and Network Management suite based on Telcordia's solutions.
The management suite will embrace the arrangement of virtual clouds and provisioning of cloud services and configuration of the network resources. This tool is supposed to automate deployment of distributed clouds. It will also allow use of an automated service-level agreement (SLA) that facilitates the end-to-end implementation of SLAs. It will support service exposure by invoking network resources through application programming interfaces (APIs).
The Suite is supposed to embrace characteristics that differentiate it from competitors. This management tool will be the first virtual data center management system based on OpenStack, which is an open system and will be hypervisor agnostic, meaning that it will work with virtual DC's with virtual machines from different manufacturers. Network resources are out of reach of large cloud providers and this is another differentiating factor.

Service enablement and exposure of network capabilities:
Service enablement gives the operators tools for exposure of network capabilities for their own or external development based on Ericsson's Service Delivery Platform (SDP) and Composition Engine for Service Enablement. The telecom capabilities like user profile, location, QoS especially in radio network will be exposed by API's to developers. These tools help operators in building an as-a-Service business where developers can create applications.
These functionalities can create a two-sided business model as described earlier where operators can earn more revenue.

Data Center Build and Optimization:

A program for operators to dedicate one or more telecom-grade cloud data center(s) for enhancing the level of quality and security for the applications they offer such as unified communications and enterprise applications. Ericsson will contribute with key competence within Ericsson Services. With this offering, Ericsson will enter the market for data centers without offering its own infrastructure and hardware.

The "Network-Enabled Cloud" (NEC) concept embraces all of Ericsson's cloud strategy today. This should put forward new business models and lead to improved quality of experience and reduced cost. (Ericsson NEC, 2012).
NEC is based on a "5C" approach:
Connect: Anytime, anywhere connectivity;
Control: Efficient operations through integrated management; Compute: Embedded capabilities through telecom-grade infrastructure;
Create: rapid service creation like enterprise SaaS or service enablement;
Customize: Design, build, optimize and operate professional services).

Ericsson has developed the Business Communications Suite which is a unified communication tool based on telecom standards in contrast to Cisco's product which is adopted by some operators as seen in the table segmentation table in Appendix B. BCS provides business communication support tools including: video conferencing, multimedia, document sharing, interactive collaboration tools such as instant messaging (IM), mobile telephony and IP telephony (Christian and Ulf, 2010).

Ericsson seems to be late in cloud market. Some system providers like Huawei already have entered data center market for instance in China.

System providers

Below we will shortly introduce Huawei, Nokia Siemens Networks, French Alcatel Lucent and Chinese ZTE Corporation and Cisco in the telecom market followed by their cloud activities and operations.

Huawei

One of Ericsson's strongest competitors is Huawei Technologies which is a Chinese vendor. It has narrowed the gap with Ericsson during the last few years. Huawei's annual sales for 2011 were $32 billion, compared to Ericsson's $34.5 billion. Competition, driven by Huawei, in the telecommunications infrastructure (equipment) market has been tough during the last years. But 2011 has been a good year for Ericsson. Ericsson's market share in this segment is now 38%, twice as big as the second largest player Huawei's share.

Huawei makes telecom equipment including radio masts (base stations), equipment for core network (computing and switching equipment), data centers and offer managed services and software.
It also produces handsets using its own chip set for Android phones.

Huawei is providing product and services such as end-to-end IPTV solution, Digital Shopping Mall, Unified Communications and Collaboration solution and consultancy to operators. It also offers a unified service platform that aggregates mobile Internet applications and cloud computing (data center, storage, etc.). These products are results from a joint venture between Huawei (51%) and Symantec (49%) with Symantec storage software running on the JV's server and storage platforms.

Huawei OceanStore Cloud Storage System (CSE)
From 2008 to 2009 Huawei has built a new service delivery platform (SDP) for Telefónica's Latin America network which was spread across 13 different countries and hence not integrated. It has helped Telefónica to create new integrated mobile services and applications across its network
(Huawei – Success story, n.d)

As a phone maker the company offers a service called cloud+ to customers who buy its mobile phones, either out of the box or via subscription. It includes services like messaging, storage for data and backup, etc.

Nokia Siemens Networks

Nokia Siemens Networks (NSN) was formed in 2007 as a joint venture between Siemens Communications division and Nokia's Network Business Group. In order to expand its operations, NSN has since then acquired a few companies or business units of companies, one of them being Motorola's wireless network equipment.
NSN provides customers with solutions, equipment and services for fast and mobile networks.

In 2011 NSN launched the first cloud-based development and test environment. This is an , integration center, including software development kit and public, cloud-based test environment for use by operators and third party developers. This will make the integration work in network operation centers easier.
NSNs portfolio of cloud offerings include developing the Telco application on cloud and providing Telco applications as a service to the operators, (voice, messaging, OSS/BSS, M2M, marketplace development platform), developing M2M solutions which enables operators to seek opportunities in adjacent industries, help with integration of solutions and consultancy (NSN 2011).

Nokia is facing decline in sales of its mobile phones and has given up its Symbian operating system. Nokia has encountered problems especially in smart phone segment and has entered into a strategic alliance with Microsoft for deployment of Windows mobile OS that also faces hard challenges from Apples' IPhone and Android mobiles.

Alcatel-Lucent

Headquartered in Paris, with revenues of Euro 15.3 billion in 2011, Alcatel-Lucent (ALU) is a large vendor in mobile, fixed, IP and optic networking technologies.
ALU promotes a portfolio named CloudBand, largely based on cooperating with a number of partners primarily HP in realization of a "carrier cloud" which is supposed to present a cloud ready infrastructure for communications service providers (ALU-HP, 2011).

HP and Alcatel-Lucent have jointly produced a cloud solution for communication service providers with a 10-year agreement. It provides an "end-to-end distributed cloud solution", a packaged infrastructure that can be embedded in existing network of communication providers.
They address providers' advantages like user proximity and their ability of offering guaranteed service level (QoS), which in combination with their product is supposed to create a high quality of Experience (QoE) for users.

The offered data center components, pre-integrated with storage and networking equipment are supposed to be committed to industry standards and thus reduce data lock-In. This is a content providing platform on the edge of network.

Capabilities and functionalities include multi-tenancy support, rich API, management system and programming SDK, CDN and WAN services, access to memory, storage and other resources through Web API.

The solution has different layers with APIs for management from both companies. For instance, implementation of software for managing CDN and WAN services is based on ALU's software, while management of data center functionalities comes from HP. The management layer controls network, storage and applications. It also optimizes quality of experience by managing latency and bandwidth.

This solution, initially include only actual functionalities required by service providers and can be delivered in different sizes (small. medium, large) due to modular design of units called cells.
The alliance is extending the offerings with solutions based on both company's existing products and consultancy services. Unified communication based on HP's consultancy services, including ALU's and third party products, is an example.

"In addition, our offering allows service providers to markedly differentiate themselves in the market by exposing combined network, server and storage APIs to customers or third party developers" (ibid, p.12).

ZTE

ZTE Corporation is both a provider of telecommunications equipment and network solutions and a handset maker. In recent years it has aimed on selling low cost mobile handsets for low prices to gain market. Today it targets even smart phone market. ZTE is growing fast and claims to rank third in coming years in the market for network equipment and infrastructure (Yee Chyen L., Yuntao, 2011).

ZTE is set to address cloud with high ambition and aims to make cloud computing account for a third of the company's total revenues in future, covering telecom market, government agencies and enterprises. It has built a cloud computing unit, which will expand the operations into the IT domain.
Offerings include newly unveiled, proprietary operating system, "Cocloud", management tools, virtual computing and more. ZTE believes in the role of complete network architecture and commercial model innovation with cloud operating system as the key element CoCloud OS has many differentiating qualities and enables heterogeneous management of the services.
The company has built its Global Cloud Computing Center in Nanjing, which employs more than 3,000 people (ZTE, 2011).
The vendor states that it will work on "transformative aspects" of cloud computing with respect to operators in coming years, without explaining more details. Making several partnerships with government agencies and enterprises, ZTE will be a part of development for E-government, E-affair, etc. ZTE ranks No.1 within China with 107 cloud computing patents (ibid).

As a handset maker ZTE has greater possibilities for innovation by integration and tying together products and services in its different fields of activities. One example is developing use of its smartphones as controllers in cloud based-gaming in partnership with Aiwi, a cloud-based gaming platform. It supports both Android and iOS (Apple's) systems. ZTE also offers other solutions like cloud-based applications

store iMarket for operators. The company will also invest in one of its data centers to support China Unicom's WoReading e-book service (ZTE, 2012).

Cisco

Cisco Systems Inc. is a very large manufacturer of networking equipment, communication and collaboration solutions and data center (DC) equipment like DC networking devices. The company is one of the largest providers of routers and switches for processing of data traffic in large scale (Internet operation centers).
In recent years Cisco has entered the market of core network segment of telecommunication mobile networks (not the radio access part), competing with CSPs in this area.

In cloud, Cisco provides IaaS providers with its Unified Computing System (UCS). It is a complete data center platform consisting of server hardware, virtualization capabilities, data center networking equipment and management software. Cisco UCS supports several virtualization platforms including VMware, Microsoft Hyper-V, etc. Cisco products are part of the infrastructure of Internet Exchange centers and IaaS cloud providers.
Cisco also offers its Cisco Collaboration Cloud, which includes its WebEx Conferencing, Instant Messaging and Presence and Cisco TelePresence Callway. These make web meeting, video conferencing and file sharing possible. Operators like Teliasonera and Telstra have already deployed Cisco UCS.

Cloud service providers can get help from Cisco's Cloud Services Reseller program by working with Cisco reseller partners in marketing and sales.
Similar to Ericsson, Cisco also has billing and policy control solution that can help operators in monetizing their capabilities by defining data plans, policy definition, classifying data traffic and so on.

Summary

Companies that have direct relations to the end users have generally greater opportunities to compete in the consumer cloud market, because this market is already taken over by global OTTs in large. See how Huawei that has its mobile device segment is offering its Cloud+.

ALU-HP solution looks very inclusive but is difficult to know how good the functionalities are without studying (business) cases. NSN has poor offerings and seems to be late in cloud market.
Huawei has an aggressive cloud approach especially in China. ZTE has very high ambitions in cloud. Participating in the government's e-government program gives the company greater opportunities for expanding its operations into IT domain. Its presence in handset segment is also another advantage. While it is difficult to find reference cases for some of the competitors, it is not the case for Cisco. The company has a large number of functional cloud deployments.

Ericsson does not have extensive offerings in XaaS. Ericsson has a few products that are shipped to end users or to the consumer market. Companies like Huawei and ZTE are better off in this respect, especially considering the Chinese market where entry for global OTTs has been difficult. Being engaged in the consumer cloud market and possessing direct access to customers is an asset that makes possible practices that may be difficult to achieve otherwise.

6. Analysis

Telecommunication industry has reached maturity and faces declining margins and slowing growth. A number of companies have entered to this industry during the last decades, while others have merged. As mentioned earlier, Nortel Networks, a Canadian multinational filed for bankruptcy in 2009. Mergers and Strategic alliances has been one of the ways of adapting to new situations in this industry like many other industries with a high degree of competition. In the equipment segment Companies like Alcatel Lucent (ALU) and Nokia Siemens (NSN) were formed through mergers with competitors. Entry into telecom industry as a vendor is not so easy because of barrier to entry such as large amount of capital, very high level of competence and long experience and contact networks required. Rivalry among players is high as stated above. Despite these limitations there are a number of players in the industry globally. These are Chinese companies and giants like Cisco, which is competing in Core network. Competition is driven both by differentiation and cost. Innovation and being first to the market in newer technologies is still important, especially while transitioning from 3G to 4G. The Chinese companies have mostly driven competition based on lower price.

Challenges with services models

IaaS
A number of vendors offer equipment for IaaS, middle-ware, network elements and firewalls, management system and services for installation integration, optimization. In this case the buyer may be locked in the vendor's solution. From a operator perspective, other obstacles to growth mentioned by Armbrust et al., such as performance unpredictability, scalable storage, data transfer bottlenecks and scalability has to be considered while choosing a provider. The views of Hagiu and Yoffie on the choice of MSP presented in the theory section must be considered, otherwise supplier's power will be high (2009). Before going on with a MSP a strategy must be in place. Reliance on open platforms is to be preferred.

A factor that discourages entry to this market is intensive capital required, but the barrier to entry is reduced by use of commoditized hardware and in the absence of data lock-in. Our survey showed that only the large operators in a country are offering this service. Bargaining power of buyers is high because of intense competition. Harmon et al. believe that while commoditization is creating opportunities for customers of services in IT domain, it is creating new challenges for the service providers (2009). The IaaS market will be commoditized if a large number of operators enter the market.

PaaS
These activities include developing and running user applications using APIs and tools provided by the cloud providers. From a CSP perspective it means providing operators with the platform (software, APIs and software libraries). Developers must be attracted to develop applications and reveal the actual potential of the platform to build software applications. We will discuss the role of business models required later in this section. Operators have a good chance for obtaining revenue based on some differentiating capabilities like location and QoS.

SaaS
A number of operators are already delivering SaaS. Bundled special purpose software as described in discussion on SME can be a more appropriate choice. As discussed by Naganathan and Bellave, in general, SW can be assumed to have shorter life cycles and must be changed or upgraded more frequently. In a cloud environment the users expect the software to work flawlessly. Changes must be well prepared and should not impact existing online users. Validating upgrades and check of consistency

with users' expectation is another challenge. Therefore, it requires a competent skilled team for development and test in cloud environment (Naganathan V., Bellave , 2011).

Value chain and value network

A model for successful identification of opportunities should begin with defining a need. From a system provider perspective, identifying the needs of different operators is important but not sufficient. It should be completed by recognizing the market situation (maturity, competition, timing) and realization plan (internal resource allocation, partnership, etc.). As we discussed above, operators have taken course of a very wide range of activities (services) which to a great extent cover the entire range of activities in cloud value chain. On the other hand there exist a lot of other players who can meet the needs of operators in different value chain activities. Ericsson as a system provider has made certain choices. For instance the choice of not entering the market of IDC's may be based on the access to markets, level of competition and so on. The timing is less favorable because other players have entered this market already and established themselves. Another obvious choice has been to not enter the consumer cloud provider (OTT) market.

An overview of cloud value chain and value networks show that it is possible to search for a number of possible activities or roles including:
Activities due to backward or forward integration in value chain: for an operator providing a customer with data center for cloud or offering a virtual telephony system or BSS applications are all forward integration activities in the value chain.
Activities due to embracing new roles in a value network like payment and integrator. This can overlap with previous point. This value in a network comes not only from the customer / end user but also from other participants in the network (Google adds). In this thesis we consider value network from a system provider perspective and only.
Activities seeking new possibilities in the primary or support activities in the value chain like publishing API's for use by a greater audience for development of new applications.

Here we are talking about how value is transferred between the participants in the network. The roles must not be seen as single stand-alone entities. The roles are also changing. For example, operators owned the market places and were once the main player who could enable payments. The situation has changed today. Below we will discuss the role a system provider can have in the value network as an enabler. Users especially enterprise users must be equipped with right tools, capabilities and channels to fulfill their functions. There must be providers who help the companies, organizations (or users) with their capabilities.

Some of the functionalities or capabilities exemplified below involve qualities other than technologies such as security, trust and policies. Role of an external enabler may be needed to help providers.

Enabler role

The current cloud management concepts are very detailed and adopt a strong control on different components in the infrastructure. For instance, one can manage switches or servers or directly control hypervisors. Migration of virtual machines of different vendors is possible only if they follow the same format. A more automated scheme is required for different tasks. The Desktop Management Task Force (DMTF) has released Open Virtualization Format (OVF) for describing a VM. This specification can be used for migration of VMs. Separation of data and control plan is also desired for virtual switches. This

makes migration of VMs seamless because access-lists and policy is easier. As an example XML as a machine readable format can be used for automation of management schemes (Stridhar, 2009).

We have previously mentioned the problem of data lock-In. Interoperability between clouds is a problem for customers although the providers might not see it as an urgent problem. If we see private cloud as an extension of enterprise data center (DC), need for "one DC" of two or more DCs of different cloud providers and transfer of VMs become more critical? It can happen in a situation like merger of two companies or similar situations. The interoperability, therefore, brings us to the cloud federation. Once again the importance of open formats like OVF and agreement upon single sign on model, secure connectivity forms (like VPNs) and similar issues are issues for standardizations bodies to address (Stridhar, 2009). A management system must be designed with modularity and scalability in mind to address this issue. One operator can operate many clouds DCs. Managing operators' clouds can be perceived as managing distributed cloud and IDCs (Internet DCs). The management of clouds comprises managing thousands of components, a complex system. Each physical server consists of several virtual machines and there is a hierarchy of elements in the system (Omid and Bauer, 2011 p.1). For example In Amazon EC2, applications of different users with different requirements and parameters (SLA) are organized in data centers with physical machines in multiple clusters. There are a variety of services running on, therefore there are a large number of components involved.

Thus the MS can be thought as a tool, addressing interoperability, complexity and for allocation of resources in a way to support market-oriented resource management for exchange and trading of services and can be extended to support cloud federation. In a cloud based model in which resources are dynamically used on demand, there will be period of bursts and idleness of resources. Since one of the main purposes with cloud model is efficient usage of resources, there is a need to dynamically allocate and free resources and especially manage efficient usage of idle resources. Exactly in the same manner as with airline seats, in a future scenario, the need for management of cloud resources may need involvement of agencies or brokers. While a management system specially developed for this purpose will be required, the actual task will require experience and competencies like market knowledge and relationships with players. This can be achieved by involving the players who already have participated in those practices.

Developing a management system (MS) is an initiative that can be expanded further to cover an enabler role, a broker.

IDM

Involvement in Identity Management (IDM) like managing exchange of authentication data between multiple parties like business partners in a supply chains is an example of such a role. GSMA Association and IETF (IETF's Internet-Draft proposition "Federated Cross-Layer Access" by ZTE), address this issue in detail and show why the operators can and how they are able to support both authentication of identities and the federation of various identities (GSMA, 2007, IETF, 2011). Certificates and a public-key infrastructure (PKI) for arranging the authentication and authorization by distribution and exchange of public keys are is another example that already has many players on the map. But it does not mean that operators having access to (U)SIM card (which is an UICC (Universal Integrated Circuit Card), also referred to as Smartcard) connected to each user cannot find new applications. (Here it is enough to see UICC as a mobile phone SIM card). Any way operators' networks can be seen as a valuable resource (channel) because reliable distribution of certificates is one of the main challenges in PKI.

Identity providing services can for instance facilitate usage of partners' cloud services based on agreements between providers without actual need for subscription like roaming in the mobile networks.

For implementation of IDM (IDM) capabilities standard tools and technologies exist such as SAML (Security Assertion Markup Language) and RADIUS protocol.

The example of Eduroam which is based on Identity federation, shows that the role of authority is important. Universities and research institutes in each member country as independent bodies rely on the national research network, which in turn relies on the multi-national associations like TERENA in Europe. This chain of trust is a key factor for identity management. Telecom and Operators' international bodies mentioned earlier in this report can have this role. An enabler can act as a consultant authorized by these organizations.

Another example of enabling role is mobile payments where Ericsson already has activities by means of Ericsson IPX – Internet Payment Exchange. We don't know the exact status of IPX today. Considering that this is a more direct intermediary role targeted by a huge number of large players, partnering with the right player may be important to facilitate the right functionality. E-trading of consumer goods needs to have storage and transport. In the same manner a chain of operations are required to facilitate payments.
In addition to these background operations, in both examples as mentioned earlier, role of an enabler must be regulated by trusted relationship and policy regulations.

There are a few other aspects of providing these functions. One is the management aspect. In the management tool already being developed by Ericsson, it is an advantage to reinforce these requirements as they are part of the SLA provisioning.

Another aspect is partnership and cooperation. The role of partnership itself in different forms (start-ups, joint ventures, alliances, etc) needs more attention and we will consider it in different discussions. Cooperation can bring great benefits especially when the knowhow required lies on the edge of more than one industry or knowledge and competencies required are from different disciplines. One partner can only bring trust to the playground. For instance in case of IDM, the operators' trusted organizations must be involved to build a federation.

The security aspect is probably the one that weights most. In payments for example, the reliance on security is obvious. A provider to providers or an organizer in an enabler role means that in addition to the technical realization a chain of activities between different providers must be maintained in the form of a federation or hierarchical structure. Achieving this role requires a clear policy formulation and a dedicated strategy together with efforts to meet the requirements like security and management tools. Partnership can be essential for the success of the work.

Partnership

Ericsson has a long experience of partnership. The example of formation of "Eritel" is a very interesting one as Eritel was a successful joint venture with an operator (Swedish Televerket, later Telia).
The cooperation to form a little company, meeting a need for developing a product called Mobitex Eritel, emerged as an important driver of development of TCP/IP based networks and developed a large part of today's core cellular networks 3G/4G.

The relevance of this example shows how well planned, unforced partnership can benefit the development of new businesses and even extends core competencies.

Partnership is like a double edged sword. Challenges often arise in situations when competition between the participants is like the ones described in the discussion about role of control of users and intermediaries in the theory section of this report. We have outlined that if a player is aspiring plans to form a multisided platform, it should not seek a partner, which is asking for exclusivity. If the demands exclusivity, the opportunity can be used to its own advantage by demanding favorable conditions.

As information technology has evolved we have seen new industries taking form, new companies and new businesses evolving. A large number of today's giant companies incl. Apple, Microsoft, Google and Facebook have blossomed as small start-ups. Without referencing, it is easy to claim that this trend has been on going. The difference is that large corporations are today acquiring many of them.

Start-ups

Markides's notion about unattractiveness of innovations in established companies may be arguable. It is a fact that we hear most about success stories of innovations in small start-ups. We find it very beneficial to monitor small companies that are highly profitable. It is hard to find an answer to the question of how we can identify successful ideas and coordinate true cooperation with start-ups.
There is no straightforward answer to this question, but making trials based on market investigations is not far from the truth. In Sweden for instance, a number of successful start-ups like Skype, Spotify (a music streaming service) etc. have found their way out to international markets. Introducing Spotify in mid 2000's to a global network of operators could open up greater opportunities in media and entertainment sectors for a large company.

Role of SMEs and private cloud

Small and Mid-sized Enterprises have various sub-segments, depending on size, (very small (5-20 employees), small, and medium (110-250) or industry and other differentiating factors. Each sub-segment has its own priorities, characteristics and challenges or incentives. Drawing a hard line between these segments and upwards towards large enterprises can sometimes be misleading. This means that some part of this discussion can be applied to large enterprises as well. SMB's needs are important due to prognoses in the growth of cloud market in this segment. According to Telecom-IT, at least 35 percent of medium-sized enterprises in the US will be using cloud computing solutions by the end of 2011 and 40 percent of small and medium-sized enterprises in the world will be using cloud computing based applications (Ojala and Tyrväinen, 2011, p.4). A well-known trustworthy provider has very good prerequisite to offer these kinds of services in addition to its other cloud services. For enterprise segments, SaaS and Machine-to-Machine (M2M) areas like Smart Object Enablement Services (SOES) are interesting applications.

Cloud for SME's has both challenges and opportunities. "cloud services will be best suited to large consumer markets and to similar professional markets." (Ojala and Tyrväinen, 2011). Despite these challenges, operators like Vodafone Spain's have made SME's a priority in cloud because 98% of their enterprise customers have less than 50 employees. Employees of large companies only account for 25%. While having 90-95% mobile and broadband access, SME's often lag in IT investments. Only 30% of companies with less than 50 employees have invested in applications. Only 1% use vertical ERP applications. Their first attempt was in voice, a cloud-based fixed and mobile convergence, a voice service with a unified user interface for all employees' devices. A Deutsche bank study in 2011 of the SME's in Germany revealed that 10% of the SME's were using cloud based services already with the number expected to touch 25% by 2012.

Competition in SaaS is severe and many cloud providers are targeting different customer segments. In general competing in segments based on SaaS and storage is not recommended for new entrants unless they have favorable market conditions.

Besides voice, Vodafone Business Place has been set up in cooperation with Huawei. It is a cloud based market place which acts as an app store for SMB's.
Vodafone has adopted solutions to create a development environment and access to business customers, partners, and developers (winwin, 2012)

Our interviewee number 1 believes that SMEs absolutely can afford cloud and in most cases they are interested in hybrid clouds. Business model has still to be worked out (Interview, 2012-05-16). However another interviewee sees no need for SMBs in adapting cloud.
SM's need administrative and office tools together with an integrated purchase and ordering system with invoicing and billing capabilities for internal and external use (by suppliers or customers in the supply chain). There are a number of platforms that meet these requirements and there is severe competition in the market today. Many SMBs need private/hybrid clouds, whereby their needs of security are better met. Closeness to the edge of network can provide enhanced availability. A provider that has investigated the market under question and is willing to offer these solutions can bundle prepackaged products based on open platforms that can meet the requirements of a broader audience. Openness can mitigate data lock-In. Offerings can be grouped into different categories (simple, advances, primary, a “freemium” model as examples) for different levels of need.

Maintenance of this platform and tailoring of the services offered is a differentiating factor. It is possible to tailor these products because as mentioned above it is mostly about hybrid clouds which means companies are likely to outsource their resources in different degrees. Secondly differentiation is possible in most of products. Companies like Fujitsu offer appliances for private cloud (NuVola Private Cloud Platform) (Fujitsu, 2012).

The simple examples mentioned above (office suite, etc.) are provided for the audience of this thesis. More complicated examples include unified communication, document management platforms where Ericsson already has products. The point is that these products have to be bundled with others to meet the needs of a wider range of SMEs in hybrid cloud scenarios, which may make it favorable for the companies that use it. Here partnership with a player already offering this kind of services must be considered.

Although Cisco states that SMEs are drivers of public clouds due to their less complex needs compared to large enterprises, we still believe that needs of SMEs are much more complex than individuals and in many cases demand a hybrid solution. Cisco also believes that “Services tailored for SMBs” is the single biggest driver of provider choice (Taylor et.al. 2011).

Role of innovation in mobile devices

The discussion of cloud will not be complete if we do not consider the role of handheld devices. The rise of smart phones is one of the factors that has boosted cloud computing. There is tough competition in this market segment which presents a typical market of rapid changing patterns where innovators who succeed to extend their vision into a concept that users can benefit gain new opportunities. Other vendors have surpassed Nokia which a decade ago was the absolute dominant player. Samsung is approaching Apple.

For large Internet players, control over devices is important, especially when most network vendors have lost their influence. China mobile's "terminal+service" model mentioned earlier is an example of increased understanding between operators. One of the latest trends in this segment is cloud-based mobile device. Alibaba, the Chinese e-commerce giant has in 2011 launched its in-house developed Operating System, Aliyun. It is a Linux-base OS that for the first time will be run on a phone manufactured by Chinese K-Touch. Alibaba apparently will not manufacture the devices, the cloud mobile, itself. Aliyun adopts a similar approach like Android but with a big difference. This is a cloud and web based OS that supports application like email and search directly from Alibaba's web store. Users get 100 GB of storage and can run many other features. Network performance becomes more important for such a device (Duncan, 2011).

The launch of a mobile cloud phone or cloud mobile is an attempt that may affect the future of the concept of mobile cloud and applications development for mobile ecosystem. While cloud computing will reduce the requirement of high-end handsets, the challenge will be network resources and availability. Presence in mobile device market can give possibility to capture new opportunities.

Business models

In information technology changes are fast. Some of early attempts to adopt older web techniques to mobile usage a decade ago like Wireless Application Protocol (WAP) are now considered to be obsolete. As mentioned above the software has shorter life cycle. In addition to this the models for creating values and"underlying economic logic", i.e. the business models are also subject to more frequent changes and innovations.

Weinhardt et. al. present a generic Cloud Business Model Framework (CBMF), which roughly reflects technical layers in cloud realizations, such as the infrastructure layer, the platform-as-a-service layer and the application layer on top (2009, p.5). This model these days is de facto standard. A model for successful identification of opportunities should begin with defining a need. From a system provider perspective, identifying the needs of different operators is important but not sufficient. It should be completed by recognizing the market situation (maturity, competition, and timing). In other words attractiveness of the industry and cost of entry must be considered.(Porter, 1987).

Every good business model begins with creation of value that customers want to retain. In order to offer services with good quality, cloud providers have to address the main challenges mentioned in Introduction to Cloud in the theory section of this report. As overcoming each one of them has costs associated, achieving an appropriate level of compromise combines trade-offs and fit. Security is one of challenges that cannot be compromised. Delivery or distribution channels of services are connected to customers' quality of experience and need attention. A "good" service with unacceptable availability harms the whole concept of business models. For example see our description of challenges for test of software in SaaS clouds under the Theory section.

Flexible and innovative business models are very easy to wish but difficult to achieve. As discussed earlier, the business model is more abstract than strategy and strategy is concerned about competition. Although Porter used fits and trade-offs in discussing strategy, we believe that the complexity of adapting new business models can also be understood by Porter's notion on "trade-offs" and "fits". In other words while composing a business model we have to also think about which activities we choose and coherently what we disregard and how we link them together. There is no need for business model to be unique. However it must fit well to existing processes.

Although there are advantages in imitation or copying of activities, if trade-offs or fits are not part of the "collection" success is not guaranteed. Activities like providing equipment and solutions, support, consultancy, facilitating and enabling infrastructure create value. Finding the customers, distribution, delivery and pricing and getting paid complete the activities and have to be combined in right proportion.

There is no ready recipe for the right approach. The connectivity providers are looking to capture more value by different methods like moving vertically into online services. An example in this direction is O2, UK mobile operator owned by Spain's Telefónica, which recently announced that it would provide free voice calls (Thomas 2011). Clearly an effort to retain customers being drawn away to free/cheaper communication services like Skype. VoIP is attractive and is used specially by younger people and it is long time left to adaptation of Voice over LTE (VoLTE), which will happen earliest 2013, for those operators that have LTE in place. Different approach to resolve the problem is implementation of GSMA's Rich Communication Services (RCS). RCS is a richer communication method which makes it possible to chat during the call, send messages and video. It has support from many operators (DT and Orange) and handset makers including HTC, Huawei, LG, Nokia, Research in Motion, Samsung, Sony, ZTE and many others. Ericsson has implemented it in its RCS (Suite). Adopting any of these two approaches to tackle the same problem involves strategic thinking and designing a business model. In the first approach a free pricing is used with no upfront cost. The latter involves investment in new technology.

We believe in operators' clouds, one of the challenges for the business models offered is that they must be flexible and overcome commercial barriers between small developers and large operators.

For users, cloud adopts a service model called pay-as-you-go (PAYG) or pay-per-use (PPU) model meaning that the users pay for actual use of services. For users there is no up-front cost but this is not the case from the providers' perspective.

Internet players have deployed different elements in their models: creating and offering platforms, software and resources like storage and services; cooperation with developers in making new applications by making platforms and APIs; Integration of services; offering app stores and portals; offering the same services as free or paid; acquiring revenue from third parties and so on. This list can be long. In each case the trade-offs, fit and linkage between activities must be considered. A potential opportunity is created each time by linking activities together to build a model that describes the economic logic of the business.
To exemplify the whole idea we can show the example of service enablement and exposure of network resources, which is one of the components of Ericsson's cloud concept. Connectivity providers have advantages like ability to enforce QoS in the network, location based advantages, knowledge about users, contacts with local businesses and channels.

Based on API's that expose network capabilities (QoS, local or user info) provided by Ericsson, operators supply developers with a platform for design of new software applications that use these API's. The applications are delivered with agreed QoS and enhance the quality of experience for users. Examples of adoption can be offering promotions from local companies in form of video films, services, games, etc. in local languages. QoS has always been understood as a service that must be charged and has not gained a real push in the network because it has been perceived as a source of increased costs to providers and/or users.
It is especially worth to outline role of two components here: pricing model and partnership.

Partnership in broad sense is one of the key enablers in new business models. In the example above, allowing developer or R&D firms to participate in the value network can play an important role in adaptation of new business models in this market. Developers must find attractive incentives in cooperation. The pricing model in the example is also a key component. The movement of value in the value network depends largely on how the value is transferred between the participants and must be investigated with precision and care based on market research. We discuss these two components in more detail in this section.

To simplify the example, other important roles/aspects of the value network are intentionally avoided. The payment model is omitted in example. It is important that services are running seamlessly. Creating a good quality of experience is discussed earlier in this report. The fit and linkage requires adoption of right model of payment. It can be either through operator billing or in any other form depending on type of application. With adoption of proper model operators can also benefit from enhanced revenue by adapting proper payment channels. Mobile payment is one of the fields of activities for telecom players.

Two sided revenue model

Only a few operators have reported significant amount of revenue gained from this model. Telenor Norway is an exception with estimated US$126 million annually (6% of its mobile revenues in Norway) generated using this model (Mavrakis andKamal-Saadi, 2009). The two-sided model can be extended to include a broker role in the mobile communication ecosystem. Yrjo (2008) describes this role as an enabler that facilitates the cooperation with Internet players acting as an interface to OTTs and content providers. The operators must adopt a two or N-sided model and should be willing to share the revenue. Exposing APIs alone isn't sufficient. Operators are currently connected to Internet player by no mediation. A successful service delivery requires that services work across the operator boundaries, since it does not create global access to mobile users. The broker can facilitate this connection to the outside world (ibid).

Pricing model

We have earlier explained the decoupling of connectivity and content in the network, which has resulted in disconnect in sources of revenue and cost. It has had implications for the adopted payment forms and pricing models. In the past the customer benefit or value was the connectivity provided for call (and SMS), which originated from the operators' networks. They encouraged user to make more calls or send more SMSs and tried to maintain prices to generate more revenue. With the recent changes the players outside the network generate customer benefit or value in the form of content provided and related enabling of support activities. These content providers and online enablers have also found ways to charge the users of their services (which include operators' customers) either directly or indirectly in form of advertisements and more. Operators like O2 are trying to use the same pricing models ("free" voice calls). It seems contradicting for a carrier to offer free calls but the future will show the outcome.

Cloud pricing model

While pricing the services, demand must be considered. Weinhardt et.al. review a number of cloud providers and show that until now pricing models are mostly pay-per-use or subscription-based and the most frequently used pricing model of the presented providers is Pay-Per-Use. In this model the user pays a price for a used unit (like GB or CPU-hour). (Weinhardt et al, 2009)

There are a variety of pricing models. One of them that have been largely discussed is providing the products for free. While revenue is generated from ads (Google model) it does not seem reasonable to rely on this kind of model for a start-up unless the customer base is really huge. Advertisers normally do not like to pay when their ads are ignored. That is why pricing models like Pay per click (PPC), Pay per view (PPV) and Pay per action (PPA) have been formed.

Other pricing models include revenue generated from services while the product is free, free basic services, charge for premium - "Freemium" model, Razor-blade model explained previously, pricing based on features, portfolio and competition. Competitive pricing for instance is a way for outperforming competitors. Weinhardt et al. stress that users often prefer simple pricing models. The dominance of the pay-per-use or subscription-based models can be explained due to this fact, The reasons might be the ease of understanding and accounting and also psychological reasons.

In adopting pricing models in cloud, the level of services and features in terms of SLA is an important factor. A business customer might pay more for uninterrupted availability.
In Google App Engine scalability, operational support and redundancy are among factors that determine the price. Flexibility in pricing is also a key factor. The company might choose a combination of models that can change over time as needed.

Pricing has to fit with other activities. A company may choose to give away an attractive product (as extra cost) for selling new products or offer featured prices for business users. Developers can access those end-customers who don't have credit cards, by operator intermediation. This is especially helpful in places that use of credit cards is not usual and creates an opportunity for operators to monetize their billing relations to post-paid customers.

Payment model

We have earlier explained the decoupling of connectivity and content in the network, which has resulted in disconnect in sources of revenue and cost. It has had implications for the adopted payment forms and pricing models. In the past the customer benefit or value was the connectivity provided for call (and SMS), which originated from the operators' networks. The content providers and online enablers have found ways to charge the users of their services (which include operators' customers) either directly or indirectly in form of advertisements and more. Operators like O2 are trying to use the same pricing models ("free" voice calls). It seems contradicting for a career offer free calls but the future will show the outcome.

Cloud RAN (C-RAN)

Ericsson and Huawei for the time being are not willing to support Cloud RAN. ALU is on the other hand a supporter of it. This technology can encourage the usage of communication between mobiles in neighbouring areas over radio access. CSPs should prepare themselves for C-RAN, because it is a technology with may emerge when LTE matures.

Creating high value in network

Tatsushi believes in a balance between open and closed policy. While open policy creates interoperability, it makes it possible for copiers to take advantage of the position of the leading firms. The diversification strategy is adopted when both platform and networks are open (2011, p.1). To create differentiation a

balance is needed because excessive differentiation is associated with higher costs. The network functionalities and resources consist of both standard and proprietary material such as communication equipment and software. Opening up network capabilities for developers, as long as system providers pay attention to this balance is a source of differentiation.

Tatsushi also believes that a telecom company's success in long term competitive advantage depends on right use of internal resources and vertical integration in value network and consequently creating high network value. The gap between consumers and providers' perceptions of value must be realized and understood by providers. This gap can lead to failure. Providing value-creating network to the end-users is essential and brings significant economic returns to the company (2011, pp.141-142). This means that QoE at the user end is essential in creating differentiation strategy. The degree of value is also associated with platform strategy capabilities and resources associated with involving partners to create complementary assets (ibid).

Managed services in cloud - system providers as cloud users

We have previously mentioned operators as cloud users. They have also outsourced some of the functionalities and operations in the network (managed services).
A CSP like Ericsson can of course benefit from outsourcing some of its activities to the cloud (as the company has already outsourced the operations of its IT department). Operators working in different countries want to partner with a company that consolidates their activities and understands the multinational scale. This business is no longer limited to telecom operators. The drivers for managed services have been cost efficiency and complexity of the networks. For a system provider, this creates an opportunity to manage these activities in cloud due to their similar nature and as long as they are not concerned with critical and real-time functionalities, their transfer to cloud may be possible..
Ericsson has already developed tools and processes for delivery of services even in multi-vendor networks where equipment from other vendors also exists. To what extent these tools support transfer of appropriate parts of these activities to cloud is not clear to us. Since they are operations of similar nature economy of scale can be achieved. Cloudification of managed services complemented by the required tools is suggested for Ericsson as a user of its own cloud services.

Segmentation of operators

In terms of revenue there seems to be a clear differentiation between AT&T, Verizon, Deutsche Telekom, Telefonica and Vodafone compared to others. These companies have revenues close to USD 50 bn or greater and hence classified as very large operators. These operators are seen to acquire other companies in the cloud ecosystem like Verizon (3 acquisitions). Telefonica's investment in Joyent Inc, Vodafone's acquisition of Bluefish, a UCC consultant, are just a few examples.

Operators with revenues between USD 3.5 bn – USD 20bn are classified as Large operators. Most of the Indian operators, all the Chinese operators, Telstra, Optus, TeliaSonera fall into this bracket.

Avea, Aircel and Telia which are mostly regional operators are classified as medium. It seems also that operators having a large amount of subscribers with fixed connection are operating in IaaS and SaaS. China Telecom has many DCs and so does AT&T. It is understandable because cloud requires good connections and is in the present date used more by fixed users. All operators having multinational presence (Very Large and Large) have deployed cloud services in markets other than their own country.

Turkcell has declared that it will take the success of its cloud services offering in Turkey to its other markets in middle-east Asia. The large and very large operators are highly active in the cloud willing to adopt any new technology or value added services while medium sized operators are very selective in their cloud offerings. The very large operators are also acquiring cloud based companies to enter new markets or offer new cloud services instead of ramping up on their own.

The very large and large operators are also the ones offering IaaS & SaaS, Storage, content as a service like video and mobile TV in most cases. They operate app stores providing value added services due to the sheer size of their subscriber base thus also attracting more developers to develop apps for their ecosystem. They also offer enterprise grade cloud services as private clouds. The medium sized operators are not seen offering IaaS or SaaS in large extent in the countries under study. This may depend on factors like small market, intense competition, lack of capital, etc. Vendors should study and address the issue appropriately. For instance if, in a particular market, it depends on financing, the question that could arise, is that can the operators apply their existing vendor financing models like pay as you grow model, revenue sharing model to the cloud market?

Communication and IM services seem to be popular among all the operators irrespective of size. This falls into the category of UCC and Rich communication services already discussed earlier. One of the challenges from OTTs, as mentioned earlier is that traditional telecom services (voice messaging) are threatened. "Revenues from digital content services, such as Internet Protocol TV (IPTV) and mobile content (mobile video, mobile, wireless games and mobile advertising) have not yet compensated for the decline in traditional services" (Nelson and van den Dam, 2010, p.4). Due to popularity of VoIP, the operators attempt to offer similar services, preparing themselves for VoLTE.

Music in the cloud is offered by the operators today though not by all of them. We have only seen it being offered by Aircel in India, O2 & Deutsche Telekom in Germany, Telia (in co-operation with Spotify) and Telstra (offering multimedia content to its subscribers among the countries studied in this thesis.

The named services are latency critical applications and the system providers can offer differentiation to address this market by reducing latency in their networks for such applications. By opening up API's to their networks applications developers can utilize this feature to provide a rich user experience.

Irrespective of size the cloud service providers are today partnering with OTT's (like Google, Microsoft) and others in the value chain to provide value based services to customers.

The very large and large operators are all offering enterprise grade cloud services. They offer private and public clouds. They are mostly offering cloud services based on fixed connections, which they sell to the enterprises packaged with their broadband plan.

The cloud services for the individual mobile subscriber is mostly restricted to offering storage to share or access personal content like video, music, documents and email. Few operators are offering music on the cloud (Aircel, O2, Telia) and multimedia content (Telstra) can change with 4G LTE deployments. With the fixed access providers like cable and DSL providers also offering TV channels on their networks the model can also be copied to the mobile and offered over the cloud.

Operators in developed countries and smaller countries have very high percentage of 3G penetration (SingTel has 100% in Singapore, Maxis has 81% in Malaysia, the European and American operators also have > 80% penetration in general). Operators in India and China are now extending their reach into the

rural areas aided by the broadband policies of the governments in these countries. Operators in India are adding subscribers at a higher rate in the rural areas compared to the ones in urban areas which is mostly stagnating. With a wider subscriber base the operators can transition to also offer value added cloud based services to the individual subscriber. As mentioned earlier, broadband access through smartphones are bound to increase with the smartphones gaining popularity.

With more disposable income with individuals in the developed countries and growing income levels in developing countries like India and China a survey conducted by credit Suisse shows that such households are spending more on luxury and mobile phones (Appendix H). Keat and Young found income elasticity for subscribers to the Internet in OECD countries was estimated to be in excess of 1, thus making it a superior commodity (2009, p.98). It indicates a strong relation between internet subscription and the income of the subscribers. The broadband penetration can hence assume to increase. As mentioned earlier in this thesis research has shown access of mobile broadband is higher among youth in the age group of 15-35. The average age of population in India expected to be 29 by 2020 and that in China to be around 35 years. Thus these countries can be expected to hook onto the broadband through their smart phones (mobile user survey in Appendix G).

Social networking has become a key driver especially for young people. Content is an important factor in bringing more people online (ITU, p.129). An Australian research shows that life habits, including communication habits are important in our choices of communication method. Younger generation adopts mobile communication to a higher degree and many 18 to 24 year olds do not prefer a fixed-line phone in their residence (ACMA, 2012). Awareness of technology affects the way we use new products. An Australian research shows that VOIP services were popular among 69% of the Australians surveyed (ACMA, 2012).

Internet is transforming into a necessary commodity with the governments of all countries studied in this thesis aiming to connect a larger part of their country's population with broadband. The governments are driving their cloud initiatives with those of Singapore, Europe, India and USA already announcing their intentions to move government offices to the cloud in some cases as part of the e-governance initiative and in many cases to save costs and easy professional maintenance.

Political regulations favour SME' and large enterprises in European countries, USA and Singapore to adopt cloud services. Also the broadband policy of these governments together with the broadband and PC penetration in the country make the operators in these countries highly attractive for vendors to offer new cloud services. The PC and broadband penetration together with the high percentage of broadband connections also point to the ease of technology adoption by the population. The operators in these markets depending on their market share are most likely to adopt user specific cloud services like content delivery requiring low latency. They hence offer system providers an attractive market for promoting their cloud acceleration technology thus providing content at lower latencies.

In the developing countries like India for example though government policies (data privacy, and data security laws) are not favorable for SME's the adoption of cloud based services continues to grow. The top 2 broadband service providers which also operate mobile networks are investing heavily in their cloud services. They are very active in the cloud offering variety of cloud services. Though PC and broadband penetration is lower compared to the developed countries the sheer size of the subscribers they address make them an attractive cloud investor. Also the demographics of the population with a good percentage of the population in the age group of 15 – 35 make operators in countries like India and China attractive customers to the Vendors like Ericsson. It should however be noted that entering the Chinese market can

be difficult considering China does not promote free trade to a great extent. It tends to favor the local suppliers to foreign ones.

Porter's five forces model of the cloud industry

Using Bany Mohammed, Altmann and Hwang value chain model (2009), porter's competitive forces (2008) in the cloud service provider industry can be depicted as shown in figure 8.

The value chain in cloud computing reduces the number of links between consumers and providers compared to traditional services, thus decreasing the need for unit manufacturers, appliances, service suppliers, software and media sellers and physical units. Cloud providers will act in the role of distributors, retailers and service providers. Cloud provider links customers directly to the content providers.

In this scenario the role of an operator as cloud provider in the industry will be determined by the cloud service offered (XaaS, content) and the consumers' bargaining power in a specific country or region, the level of rivalry among cloud providers etc. The forces must be determined for each individual case. Below we will consider a number of scenarios for validation of this model.

Scenario1: SaaS in consumer market

In the cloud SaaS market, a number of global providers exist. Only Google offers services like Google apps, email, search, etc. There are a number of other free services, increasing bargaining power of buyers and rivalry among existing players. These forces should be considered in this scenario for an operator considering entry into the market.

Scenario 2: Music (Content)

In most developed countries music is distributed online by the Big Four (Sony, EMI, Warner, and Universal) and thus the bargaining power of suppliers is low. Presence of free music services for streaming such as Grooveshark and Spotify (sometimes offering "freemium" services) can also play a substantial role in increasing the bargaining power of users/customers. But in this scenario the copyright violation depends on the country in question and thus affects the bargaining power. In the presence of good network capacity and coverage, the threat of substitutes can be considered to be low.

The factors below are believed to have impact on the forces, but as mentioned above, each concrete situation must be considered in the appropriate way.

Threat of new entrants
Large capital is required for IaaS, PaaS infrastructure. Barrier is reduced in the absence of data lock-in when the SME's can easily migrate from one operator to the other i.e. if the switching costs are lower. Government regulations can act as a barrier if it poses strict restrictions. An example here can be the German government requiring the data centers to be located within Germany like mentioned earlier in the Results section or the Chinese government, which is known to not promote free trade and encourage its own companies. As an example we briefly name a few common factors that impact the forces in cloud, but as mentioned earlier the details of each exact situation should be considered carefully.

Bargaining power of suppliers

With the advent of standardised cloud services and open source platforms, the SW and HW vendors lose bargaining power because of lower switching costs unless they offer differentiated products.
In IaaS adopting the commoditized hardware decreases the bargaining power of suppliers, while differentiated hardware can have the opposite impact.

Bargaining power of buyers

If the competition is intense, the buyers demand more bargaining power driving the prices down. Until the standardization of the cloud services becomes a reality, the bargaining power of buyers is reduced as they are locked-in to the existing service provider with high switching costs.

Threat of substitutes

Substitute to the cloud industry in XaaS's are mostly traditional IT services. The government regulatory policy regarding data security, privacy, cybercrime etc., its broadband policy to guarantee bandwidth high enough for low latencies are instrumental in enterprises deciding to move out of the traditional in-house IT into the cloud. The SME's however can find it lucrative to obtain IT services from expert cloud service providers (Microsoft study, 2011).

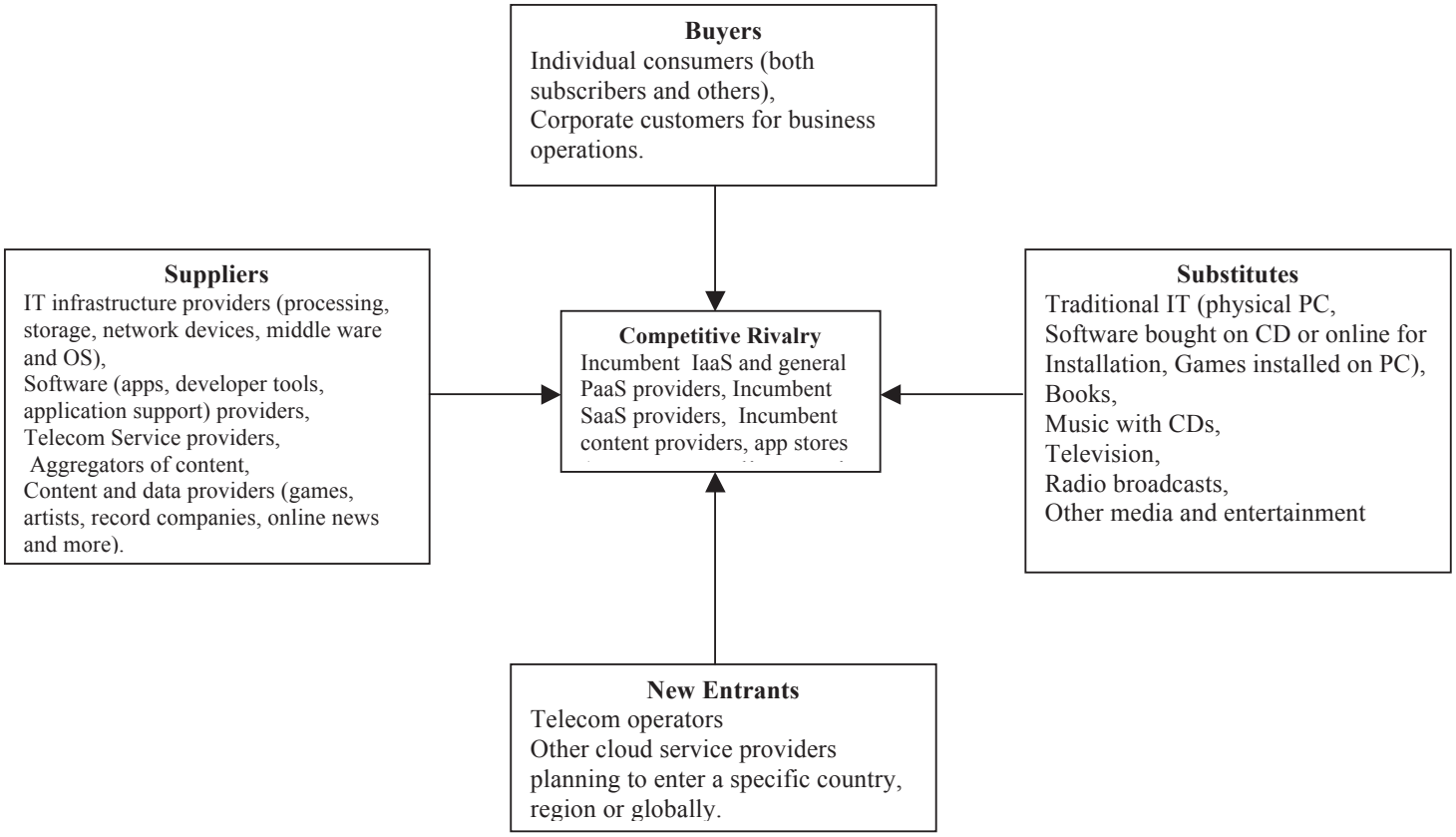


Figure 8: A generic model for Porters framework for cloud computing

Rivalry among competitors
The competition is intense with big OTT players like salesforce.com, Amazon, Google , Microsoft etc., offering cloud services.

Hypotheses testing

H1
We have showed how an enabler can creatively take advantage of opportunities by facilitating activities that are required in cloud value networks. This role can include and roughly be divide into networking activities and other activities mostly related to the support activities in value chain.
We described the need of a management system that supports cloud federation and how the idea can be extended to include a broker role for creating a cloud market place, where in a future scenario, excess of the commoditized services may be exchanged. For cloud services to work across operator boundaries, the role a broker which bundles available cloud services as a package before reselling to customers, therefore can be envisioned. This role, aggregator, brokers and resellers, has been pinpointed in the generic value chain created by Bany Mohammed, Altmann and Hwang (2009). As discussed by Ojala and Tyrväinen, the value networks change over time and these changes should be monitored and considered by participating companies (2011). Thus it is essential to consider the need of new players. The enabler role was also shown by exemplifying functions such as facilitator of activities like identity management and payment. Such activities are not directly related to network. The provided examples explain that these are mainly support activities in the cloud value chain and offer a variety of opportunities. This role can be compared to the integrators or platform provider in the generic value network depicted by Leimeister, Rided, Böhm and Krcmar (2010). By facilitating an infrastructure, an enabler makes it possible for the operations to go on. The enabler or facilitator role can be valuable because the actual services must be delivered seamlessly to customers. In fact this enabler role can be a gateway to external operations, which actually can open up for new sources of revenue. This was the motivation for our first hypothesis H1: An enabler role gives space for a variety of opportunities and innovations and must be considered by a communication provider in addition to providing technology and consulting services to operators".

H2
On the other hand this role and the described related activities, all demand new competencies, extensive interaction with external players and thus generally require partnership. Today telecom networks deliver services far behind voice calls and SMS. By introducing cloud the value created is transferred to the network in greater extend. Tatsushi believes that the degree of value ceated is associated with involved partners to create complementary assets (2011). Many activities and operations imposed by entry to cloud business require competencies external to operators and telecom vendors. The decision of entry to new business is the domain of corporate level strategy but as mentioned by Porter a business unit level differentiation is needed for success. On this level, core competencies advocated by Prahalad is required and, which we believe can be acquired by extensive cooperation on this level (1990). The characteristics of delivery of cloud in form of "as a service" model and a business model pay-per-use both occur in a value chain. Also end-to-end deliveries of services often require external embedded services or solutions. In a value network interaction between participants is required for delivery of quality of experience and actual revenue stream sometimes come from other participants than the consumer of services, indicating the relevance of partnership. In addition the role of partnership was outlined on existing practices like Ericsson and Akamai cooperation in MCA and a developer-provider relationship in a two-sided business

model. This explains the reasons and motivation for H2: “Partnership in different forms (acquisition, start up, etc.) is key strategies in successful cloud implementation”.

Operator segmentation (H3):

H3 is repeated here for convenience.
The forces and parameters that could matter in segmentation of operators could be:
Size (subscriber base (number of subscribers), revenue (sales volume))
Financial situation and Growth outlook (like access to capital)
Geography (local or global, operating in rural or urban areas)
Subscribers’ demographical characteristics (age, gender, income, education)
Business culture (Decision making, innovativeness, technology mindedness).

The contextual or environmental factors that could matter in segmentation of operators could be:
Level of competition (number of cloud providers and maturity of cloud market)
Politics (such as Restrictive or liberal government policy, regulations)
Important population habits if any (such as spending habits, technology adoption and use of social networks).

Size:
Comparing operators in different countries it was found that the very large and large operators (classified in terms of revenue as explained earlier in the Results sections) offered quite similar services (IaaS, SaaS, UCC, email, storage). The medium sized operators also were similar. They did not offer IaaS or SaaS. Instead they offered UCC and music/content based services targeting their individual subscribers. The large and very large operators were also the ones with the highest market shares in their respective countries. It can hence be deduced that the economic factors like revenue and subscriber base of the operator does play a role in the kind of XaaS offered.

Growth outlook:
Operators’ growth outlook is believed to have an impact on their deployment of cloud. In markets like India and China where the findings indicate very positive growth in subscriber base, the operators are aggressive in their cloud offerings. USA and Germany with more or less constant subscriber base, and aggressive cloud strategy, the operators’ growth outlook is in term of revenue, generated by moving to adjacent industries or creating new services.

Geography:
As mentioned by Porter in discussion about cluster, the geographical factors can play important role in forming industries in a country or region. He also says nations achieve competitive edge in a few of the industries because their home environment for that particular industry is the most dynamic and efficient. A strong demand for the products at home triggers innovation among local firms eventually leading to sustained competitive advantage. (Porter 1990, Pg.73).
The empirical findings indicate that in countries with higher degree of rural areas, the operators have not yet adopted broadband and G3 in great extent in those areas and PC penetration is lower than other countries. Unavailability of network resources like bandwidth is one of the shortcomings in these countries. In India like China the penetration of broadband and the PC in the population is a hindrance to the cloud industry.
On the other hand the emergence of cloud mobile phone in China, which is the real cloud mobile, may have relation to these facts.

We have pointed out that mobile phones are the primary computing device and means for accessing the Internet for a large proportion of population in emerging countries. Indian smartphone users are more active than their US counterparts. They access Internet from their smartphones more than the subscribers in the US. All above has consequences for cloud and mobile cloud computing. Cloud DC's in China are concentrated only in large cities and in India only in Tier 1 and Tier2 cities.
The operators that are active in countries other than their own take their cloud experience to other countries.

People's habits:
A number of researches indicate that people's habits and income level affect their choices. Social networking has become a key driver especially for young people. Content is an important factor in bringing more people online (ITU, p.129). An Australian research shows that life habits, including communication habits are important in our choices of communication method. Younger generation adopts mobile communication to a higher degree and many 18 to 24 year olds do not prefer a fixed-line phone in their residence (ACMA, 2012). Awareness of technology affects the way we use new products. An The research research shows that VoIP services were popular among 69% of the Australians surveyed.
Barnes & Huff state that "mobile Internet is highly compatible with the Japanese cultural values."
However, we recommend those areas for future research with methods mentioned above, in order to draw conclusions.

Politics and regulations:
As Porter mentioned changes in government regulations, a new developing industry segment, new technologies etc. can all trigger innovation.
As mentioned earlier the BSA scorecard finds the developed economies to be more ready to adopt cloud computing than the developing economies. The developed economies have amended or introduced laws to nurture cloud computing which is lacking in the developing economies. The full benefits of the cloud are only realized when the laws of the land support them. Government regulations can act as a barrier if it poses strict restrictions. An examples Germany and China were mentioned. German government requiring the data centers to be located within Germany. Chinese government is known to not promote free trade and encourage its own companies.
However the internal dynamics of companies in the context of factors of production, demand of market, presence or absence of related and supported industries and the company's strategy and competition, all interact with politics in every country. We have noted deviations from the general conclusions above as in the example of India, where the SME's do not have the finance or skills to manage security efficiently themselves. They feel better off relegating the task to the expert services offered by the cloud service provider. They are able to allocate resources to grow their business than worry about security (Microsoft study 2011).

Other forces:
Although we have presented a number of facts about demographical forces (like relation between income and age with mobile usage), we have previously mentioned that forces like demographics, financial situation and business culture need collecting extensive quantitative data and surveys, which makes it difficult to draw conclusions with certainty.
Regarding level of competition, it is hard to make any conclusion. In USA, which has the largest cloud market with a large number of players, for instance, operators are actively participating in cloud market.

It should also be mentioned that isolating the forces is a difficult task, because they are all interrelated and impact each other. Other parameters like availability of skilled labor, good infrastructure, knowledge resources and other specialized factors also impact choices of companies.

7. Conclusion

The research questions addressed by us are

Q1)

How can implementing cloud computing be a source of differentiation for telecom and mobile industry players including system providers and operators? How can system providers and operators monetize the cloud as a new source of revenue?

The sources of differentiation for operators and system providers compared to other cloud service providers identified by us in this thesis are the following:

Cloud acceleration guarantees end-to-end QoS. Overall delivery of content is cheaper in term of network utilization and QoE is enhanced with lower latencies. Setting priority for traffic in the network is made possible, which in combination with caching the traffic, result in enhanced user experience (QoE). Providing QoE is a source of differentiation, because user satisfaction is essential. This is a typical example of positioning by cost advantages and differentiation advocated by Porter (2001). Ericsson has already adopted this method.

The operators can expose network assets and interfaces to allow exploiting features like location presence and by OSS/BSS features and QoS, priority, user profiles and subscriber characteristics. This information can be embedded either in the 3rd party cloud services or their own providing linkage between the upstream and downstream revenue streams both from customers and third party. Exposing APIs alone is not sufficient because operators are constrained to their internal market, their own subscriber base. A broker role, in the form of an aggregator or facilitator is a role in the value chain that makes it possible for operator to play outside their own domain.

Developing an integrated cloud and network management suite enables provisioning of cloud services and configuration of network resources for automatic deployment of distributed cloud, depending on SLA's agreed with the customer. Distributed cloud was identified by one of our interviewees as a source of differentiation.

Providing telecom specific software as a service such as OSS/BSS and communication suite. Commoditized general purpose software is not a source to rely on, but pre-packaged, bundled combination of software such as communication suite with other software for businesses can target enterprises and SME's needs.

All the above mentioned differentiation strategies are classic examples of Core competencies as advocated by Prahalad (1990). The operators and system providers are leveraging their core competencies in delivering enhanced quality of experience to the end users.

The above listed sources of differentiation, when implemented will translate into revenues allowing the system providers and the operators to monetize from their cloud specific solutions. Platforms offered by the operators which expose network API's can be a good source of revenue for the operators. With this model the operators can earn double sided revenue both from the OTT's and content providers on one side and the customers on the other.

Q2)
How can cloud computing as a source of diversity be a business opportunity for telecom system providers and operators?

The differentiation that the operators and the system providers bring as described in Q1 above can be used to gain revenue and hence also transform as sources of business opportunities. Cloudifying of existing managed services solutions serves as a business opportunity. Other business opportunities could be providing consulting, mobile payments, developing products based on Rich communication suite(RCS) and VoLTE.

Business opportunities in automatic management and deployment of cloud services can be explored. If cloud services work across operator boundaries, the role of a cloud service provider, which bundles available cloud services as a package before reselling to customers can be envisioned.

Needs of SMEs can also be a driver. While Cisco sees SMEs as drivers of public clouds due to their less complex needs compared to large enterprises, we still believe that needs of SMEs are much more complex than individuals and in many cases demand a hybrid solution. However Cisco also believes that "Services tailored for SMBs" is the single biggest driver of provider choice (Taylor et.al. 2011). Regarding the potential of SMEs it has been a disagreement between interviewees (See Appendix for more details).

They can also consider buying out innovative cloud start-ups. Markides believes established companies can find other alternatives for growth, for example taking the existing business model internationally, while smaller tart-ups do not always have this possibility and in many cases try to find ways for business model innovation to succeed (2008).

8. Discussion and Scope of Future research

We have tried to find out different roles communication system providers can play in the cloud value chain by leveraging their core competencies. The system providers can position themselves in an enabler role, combining activities in the value chain to offer differentiating services. The system providers can extend their managed network services to operators by managing their cloud networks. They can move their operating and business support system to the cloud (as long as it does not concern critical real-time operation) and provide SaaS services on a pay per use or subscription model to the operators. They can offer special purpose and management software for the cloud resellers or brokers to bundle services together and sell them as a package. They can develop platforms to leverage the operator's networks by providing API's which application developers can use to utilize the networks more efficiently. The operators can thus bargain with the content providers for a share of revenue to use their networks, base on the two-sided model.

Acting in the role of an Enabler requires partnering with others in the value chain. Delivering end to end solutions require involvement of other players. We have pointed out this relationship through ALU-HP partnership, Ericsson-Akamai partnership, and acquisition of cloudswitch by Verizon etc.

We described that developing a management system (MS) is an initiative that can be expanded further to cover an enabler role, a broker, a way to support for market-oriented resource management for exchange and trading of services.

We also attempted a basic classification of operators in India, China, USA and Europe, which are vibrant cloud markets today, regarding their cloud deployments. This can help system providers analyze possible markets or customers to sell their solutions. It could also help them analyze the markets covered in this thesis. We also provided a generic model based on Porter's five forces for cloud.

However we would like to point out here that due to the time limitation imposed on us by the course we have only limited our research to a very few operators in a limited number of countries. The research can be extended to a number of countries and operators to validate our findings. The classification can be enhanced with more parameters and using surveys as method to further understand the drivers of operator characteristics in different parts of the world. Again due to limited time we have only restricted ourselves to a few enabler roles of system providers. There is definitely more scope to enhance this.

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List of interviews

Interviewee 1 Strategic Product Portfolio Alliances and Partnership Manager (Albert Wang 2012-05-16)
Interviewee 2 Senior Consultant, Cloud business development and customer engagement (Van Kon, 2012-05-27)
Interviewee 3 Technical manager in cloud area (Lu Luo, 2012-05-30)

10. Appendix

Appendix A: CASE STUDY PROTOCOL

0. Develop a good foundation on the topic of research.

Develop understanding of cloud computing:

Search internet and library for articles/books on cloud computing addressing topics like fundamentals/basics of cloud computing, advantages for a business in moving to the cloud, technology involved, standards if any, the companies offering existing cloud services, different cloud services offered and everything which helps develop an understanding to establish a foundation to do a good case study.

Understand the need for Equipment vendors to enter the cloud market:

First find out the sources of revenues for the operators and vendors today. If there is a problem of decoupling of sources of cost and revenue for operators, what are the challenges they face? With new services like VoIP and messaging based services becoming popular are the traditional sources of income for operators under threat? Should operators look to other sources of revenue? What are the likely outcomes of resolving these problem? Where can operators and/or vendors seek solutions like new opportunities? Is cloud a market they can enter? Find out what the experts have to say about the role of operators and vendors in cloud computing.

1. Background and develop research questions

a) Identify previous research on the topic

Search library and Internet with appropriate keywords and do a literature review.
Ask for help from the tutors by asking questions if required

b) Identify the main research question being addressed by this study

While reviewing the literature in a) search and identify questions worth studying, for example by paying attention to the parts being mentioned in “further study” in articles.
Discuss and finalize questions under focus with each other
Ask for help from the tutors by asking questions
Discuss the formulated questions with Ericsson

c) Identify any additional research questions that will be addressed

d) Create a draft outline of the report showing potential headings of various sections planned to be addressed.

2. Design

a) Criteria for case selection

The case must be an identifiable concrete phenomenon (as far as possible distinct from the context).
They must be in direct relation to the question of study and enlighten its main aspects.

b) Identify whether single-case or multiple-case and embedded or holistic designs will be used, and show the logical links between these and the research questions

Identify the components (units) that need attention according to the research question
Discuss them in the group and find key units
Match the result with the methodology (Yin)
Iteratively review and match the case(s) with the research question
Results: Choose embedded single case with two levels of analysis for the main case.
Iteratively review and match the single embedded case (all 3 cases) with the research question (use pattern matching technique).

c) Describe the object of study

Complete step 2a above with the required context of the case
iteratively review as changes occur
Results: cloud strategies, cloud implementations, operators in 4 regions (USA, China, India, Europe), Ericsson (in the cloud market), telecom industry, Ericsson's competitors and Internet and online players.
Telecom and cloud markets should be analyzed before analyzing other components. Factors / conditions for segmentation of operators need attention.

d) Develop propositions based on theory to give the case study a direction. Also develop sub questions when possible to break down the case to smaller manageable parts to lead to the more general research questions.

H1
Questions about enabler role:
What is an enabler role?
How does it create opportunities?
Can system providers in cooperation with operators pay more attention towards user centric services in realizing cloud?

H2
What makes partnership essential in cloud?
Is partnership a key strategic measure in successful cloud implementation?
Can partnering with other players in the value chain offer differentiating competitive advantage to the system providers?
What is the role of different forms of partnership (acquisition, start up, alliances, etc.)?

H3

How do operators differ in their cloud services ?
Is there anything common among operators functioning in different countries regarding their cloud services offered?
Is there a relationship between the size of the operator (revenue/subscriber base), their growth outlook, the geography of the market they are operating in and the cloud services offered?
Do operators having multinational presence take their cloud experience in the countries they operate?

The contextual or environmental factors that could impact operators and thus matter in segmentation of operators could be:
Level of competition (number of cloud providers and maturity of cloud market)
Politics (such as Restrictive or liberal government policy, regulations)
Important population habits if any (such as spending habits, technology adoption and use of social networks)

3. Develop Case Study Protocol
Develop a case study protocol
Discuss, review and finalize with other group members.

4. Case Study Procedures and Roles
a) Procedures governing field procedures

Identify people in various roles to interview
Contact people first by email and schedule an appointment for an interview
Prepare and formulate thoughts/case study questions carefully
Express the goals and intentions of the research clearly
Summarize field activity and report results to all group members

b) Roles of case study research team members

All group members jointly participate in developing theoretical framework, method, and analysis. Ideas have to be discussed iteratively. Writing texts for report should start early.
Division of workload for each submission prior to it.
All work like data collection can be divided between group members, where applicable.
Both the members write texts, which will be reviewed by other part.
Madhu edits and inserts the text to appropriate section.
Kejvan is responsible for contacts with Ericsson.

5. Data Collection
a) Identify the data to be collected

Cloud strategies
Cloud implementations
info about general situation and operators in 4 regions (USA, China, India, Europe)
Ericsson (in the cloud market)
telecom industry
Ericsson's competitors and partners (at least NokiaSiemens, Huawei, Alcatel-Lucent, ZTE. Even about Cisco, Juniper, Akamai and others).
Internet and online players (like Apple, Google, Amazon, etc. and paypal, ebay and alike). Even smaller players have to be included.
Data on operators in regions mentioned above in 2.d (H3)
Data on the companies in the value chain Ericsson and the operators could partner with.
Existing cloud offerings by operators like Verizon, AT&T, Deutsche Telekom, Bharti Airtel, China telecom, etc.

b) Define a data collection plan

Rely on qualitative data in first place
Search academic research and market research institutions for relevant data.
Follow references to get more evidence. Search internet with appropriate keywords.
Direct contact with Ericsson (e.g. survey).

c) Define how the data will be stored

Store copies of important web pages or their first page.
Store copies of articles from Internet if possible.

6. Analysis
a) Identify the criteria for interpreting case study findings

Address rival explanations with techniques like pattern matching and explanation building.
Match the data collected with the theory.

b) Identify which data elements are used to address which research question/sub question or proposition and how the data elements will be combined to answer the question

To be defined later

c) Consider the range of possible outcomes and identify alternative explanations of the outcomes, and identify any information that is needed to distinguish between these.

Is cloud an appropriate alternative for diversification and applicable for mobile environment? Then an analysis for both level of analysis has to show the solutions.
We need to describe possible scenarios for deploying a strategy.

d) The analysis should take place as the case study task progresses

e) Can findings be generalized to equipment vendors and Telecom industry?

7. Plan Validity
a) Construct validity: show that the correct operational measures are planned for the concepts being studied.

Use multiple sources of evidence by collecting data for classifying operators from different regions/countries.
Ask experts in Ericsson to review this report.

b) Internal validity:

Use pattern matching, explanation building and address rival explanations.

c) External validity:

If it is possible to come to same conclusions regarding the operator classification in all regions analyzed in this case study, i.e. if the proposed parameters will be a base for classification, then the case can be generalized. This is due to the exploratory character of this question. As a test we suggest future work on classifying operators in Latin America, Africa and other countries which are not part of this study. However, if the findings are not conclusive on the aspect of generalization of operator classification then only the following two procedures will be used.
Use theory framework
Match data against theory using analytical techniques

d) Reliability:
Use a case study protocol: repeatedly check the procedures of study to come to same conclusions.
Develop database of articles, journals referred to in the case.

8. Study Limitations
Specify residual validity issues including potential conflicts of interest (i.e. that are inherent in the problem, rather than arising from the plan).

Limitation to one company and distinct regions for operators covered. We have limited more extensive collection of data to operators in four regions and to distinct areas.

9. Reporting
Identify target audience, relationship to larger studies.
The report is primarily directed to an academic audience. Interested people in the telecom industry or cloud business may also find it interesting. Follow directions and conventions in writing academic papers and guidelines set by university tutors, such as using suggested templates etc. have been strictly adhered to.
The structure of the thesis is suggested to be according to these guidelines.

The report should be in narrative form and includes written and visual material.
Make early drafts and iteratively review before the final document is agreed upon.
Review and rewrite until done well. Display enough evidence for reader to reach own conclusion.

10. Schedule

Give time estimates for all of the major steps: Planning, Data Collection, Data Analysis, Reporting. Note Data Collection and Data Analysis are not expected to be sequential stages

Time plan

Activity	Deadline
Submission of an Outcast containing topic, title, problem formulation, objectives and timeline of the thesis	January 17th 2012
Submission of the revised version of the thesis topic	February 22nd 2012
Submission of the Thesis Proposal	March 8th 2012
Review of theory and Theory Special Proposal	March29th 2012
Submission of Method Special Proposal	April 19th 2012
Submission of Peer review version	May 2nd 2012
Collection of data (interviews, etc.), Analysis, Writing report for 1st draft - completed thesis	May 21st 2012
Final version	June 3rd 2012

11. Appendices

Put relevant information that can validate the research and extensive notes in the appendices if they are not important for the reader to follow the discussion.

Appendix B: Tables for collecting data

Table B 1: Demographics

	India	China	Europe	North America (USA)
Population	1.21 billion	1.338bn	501million (2010)	313,5 million
Gender ratio of population	940 females per 1000 males	938	970 females per 1000 males	1028 females
Rural population	72.2%	53%	N & W Europe : 17%; S & E Europe 33%	18%
Urban population	27.8%	47%	N & W Europe : 83%; S & E Europe 67%	82%
Educated population %	74.04% (82% males, 65.46% females) Average year of schooling of adults 5.1	Literacy rate 95.9% Average year of schooling of adults 6.4	Most of the EU has a high literacy rate close to 99% Average year of schooling of adults Between 7-12	Literacy rate 99% Average year of schooling of adults 12
Spendable income				Person $32140 Household 46326
Average age of population	More then 50% less then 25 and around 65% less then 35. Average age expected to be 29 by 2020.	Median 35.5	17% over the age of 65 .64% in the age of group 15 – 64.	Median 36,8 15-64 67% 65 and over 12.8%
Population technology adoption capability				
Spending culture				
Teledensity	76.86% (Dec 2011) Mobile subscribers : 833 million	mobile	Mobile penetration : 133% . 330 million mobile broadband subscriptions as of nov 2011	

Source: wikipedia

Table B 2: Classification of operators in India

	Airtel	Reliance	BSNL	Aircel
Revenue	USD 11.89 billion	USD 4.54 billion	USD 6.39 billion	
Market share (dec 2011)	19.65%	16.79	11	6.9%
Number of subscribers	181 million	144.78 million	92 million	63.25 million
Number of employees				
Do they offer cloud services/entering the cloud market?	Yes. Airtel is already offering cloud services.	Yes	Yes	Yes

Type of Cloud services offered	IaaS, colocation services, Managed services, Security as service (source: cloud.airtel.in)	IaaS,SaaS like email, ERP, PaaS, colocation services (reliance idc)		Music cloud, cloud acceleration through Virtela
Type of cloud services offered to SMB's	IaaS, colocation services, Managed services, Security as service (source: cloud.airtel.in)	IaaS,SaaS like email, ERP, PaaS, colocation services (reliance idc)	IaaS in partnership with Dimension data, co-location, managed hosting, managed video, secure email.	
Implementing mobile cloud or fixed cloud?	Fixed cloud	Fixed cloud	Fixed cloud	
Private/public cloud offering	Private and Public clouds			
Collaboration with others in the value chain, partnerships etc.	Ericsson, Aepona	Microsoft	-Dimension data which manages the data center providing IT solutions.	Virtela
Managed services offerings?				
Number of datacenters	5 (http://www.datacentermap.com/company/bharti-airtel-ltd_datacenters.html)	3	10	None of its own, runs datacenters through strategic partners.
Urban/Rural market presence	Urban market for existing cloud services. GSM is expanding into the rural markets and expects 55% of its new subscribers to come from the rural markets		Tier 1 and Tier 2 cities in India	Urban/semi-Urban
Differentiated services if any				
Average age of subscriber base				
Gender ratio of subscriber base(male:female)				
Number of data plan subscribers	131.38 million as of June 2011	69.27 million	63.69 million	
Outsourcing partners for network maintenance	Ericsson		Dimension data runs and maintains the datacenters for BSNL	

Source: http://cloud.airtel.in/portal
http://www.relianceidc.com/HTML/index.html
http://onecloud.in/pages/index.asp
http://www.lightreading.in/document.asp?doc_id=211535

Table B 3: Classification of operators in China

	China Telecom	China Mobile	China Unicom
Market share	14% (mobile)	Subscribers 66.5%	20% (mobile)
Revenue / sales volume		528 bn CNY (2011) 83.7 bn $US	33.8 billion yuan ($5.34 billion) only in 3G
Number of subscribers	Total 113.5 m 3G 25.6 m (2011)	Total 627.6 m 3G 40.3 m (2011)	Total 186.71(2011) 209.5 (2012) 3G 27.9 (2011)

ARPU	3G 80 CNY no Iphone offering	CNY 71, 2011	3G CNY 93.9 Mobile 43.7 (2012)
Do they offer cloud services/entering the cloud market?	Yes	Yes	Yes (already in commercial use)
Type of Cloud services offered	Private cloud Internet Data Centre (IDC) to Enterprise in China, Europe, Global, Remote (virtual) telephony system Network monitoring (NetCare),	IaaS in "Big Cloud", Major Cloud-RAN trials ongoing. Ongoing large DC in north China.	IaaS DCs for (Hosting, storage), PaaS (est, development environment), consulting for integration
Type of cloud services offered to SMB's	Data Centre, virtual telephony and network monitoring, as above.	IaaS	See above, clear enterprise orientation, Also DC for own use
Implementing mobile cloud or fixed cloud?			
Private/public cloud offering	See above		
Collaboration with others in the value chain, partnerships etc.	With US providers	Agreement with Microsoft to jointly work on cloud	
Managed services offerings?	Yes see link (1)		
Number of datacenters	Data Centres located in Beijing, Shanghai, Shenzhen, Hong Kong and Singapore, plus over 260 locations throughout mainland China	A number of DCs	First DC for commercial use in China
Urban/Rural market presence	527.02 m / 777.05 m	527.02 m / 777.05 m	527.02 m / 777.05 m
Differentiated services if any			
Average age of subscriber base	Age: 15-64 71% of population	Age: 15-64 71% of population	Age: 15-64 71% of population
Gender ratio of subscriber base(male:female)	Population 1,338 bn 676,50:634,50		

A trend observed in China is partnering between Internet players and handset makers to embed more cloud specific features and services in the mobile devices, creating a "mobile cloud handsets".
Tencent, Alibaba and Baidu, which are active in the field of communication, information, entertainment, e-commerce and other operations, are example of companies, performing similar activities.
Alibaba has announced an in-house developed, cloud based OS, "Aliyun OS". Aliyun is developed by its subsidiary Alibaba Cloud Computing ("AliCloud") and will initially run on a "Cloud-Smart Phone" from K-Touch. Aliyun OS will have support for cloud applications without need for downloading and installing apps. The support for Android will be added.

"Tencent, China's biggest Internet company, has partnered with Taiwanese handset maker HTC to embed its QQ instant messaging (IM) system into HTC's smartphones. Beyond IM services, Tencent will provide users with online storage, a browser interface, and micro-blogging services. Fellow Chinese Internet behemoths Alibaba and Baidu have presented similar ventures in partnership with handset manufacturers."
http://www.atkearney.com/index.php/Publications/the-mobile-ecosystem-in-asia-pacific.html

China Telecom's Cloud activities

1.

"Internet Data Centre Solution

Constructing an Internet infrastructure is a prohibitively expensive investment that demands stringent efforts on continual issues such as maintenance management, technical support, quality of use, security and a variety of related issues. In view of this, China Telecom proudly provides its Internet Data Centre (IDC) Solution, a simple and cost-effective solution that helps businesses eradicate these complex problems. Our comprehensive range of efficient, secure, and flexible IDC services includes EMEA IDC, China IDC, and Global IDC."

They promise "a wide range of Data Centre services from colocation, hosting to managed and professional services, together with diversified telecommunications connectivity." Data Centres located in Beijing, Shanghai, Shenzhen, Hong Kong and Singapore, plus over 260 locations throughout mainland China.

2.

"ContactWorld

China Telecom's ContactWorld uses a remote (virtual) telephony system to provide the links and call plan intelligence between your callers and your agents. ContactWorld typically takes just a few days to set up, there is no capital expenditure, and you only pay for what you use "on-demand". There is no hidden cost for maintenance or charges to change anything because you have outsourced the infrastructure to ContactWorld – and you can manage the call plans yourself over the web. Agents only need a telephone and a PC with an Internet connection: they can therefore work virtually from multiple centers or from home."

3.

NetCare

Network downtime can have immense impact on business operations, customer experience, and eventually revenues. Your network needs a proactive monitoring service that can identify resource problems before they affect your operations. China Telecom's NetCare provides end-to-end pro-active real-time network monitoring, fault alerts, notification and handling, as well as network management and performance analysis. With NetCare, you can check your network health anytime, anywhere around the world."

Source:
http://www.chinatelecomeurope.com/index.php?option=com_content&view=article&id=37&Itemid=41&lang=en

Classification of operators in Europe

Table B 4: Classification of operators in Germany

	Deutsche Telekom	Vodafone	O2
Revenue	€58.7 Billion	EUR 32.1 bilion (Europe wide)	EUR 4.826 billion (germany)
Market share (2010)	31%	33%	16.1%
Number of subscribers	35 million (end 2011) http://www.telekom.com/media/company/103372	37 million	
Number of employees	35403	37625	18379
Do they offer cloud services/entering the cloud market?	Yes	Yes	Yes
Type of Cloud services offered	Well established. Video conferencing, highly		Music streaming cloud based service.

	secure storage as service, email, SaaS, IaaS, app store		
Type of cloud services offered to SMB's	Complete cloud services for SMB's from IaaS to SaaS (CRM,ecommerce)	Locate service helps SMEs working in logistics to track their drivers without the need to invest in specialist hardware or software.	Business email, Saas
Implementing mobile cloud or fixed cloud?			
Private/public cloud offering	Private & Public clouds		
Managed services offerings?			
Number of datacenters	90 world over		
Outsourcing partners for network maintenance	NSN		visionapp

Source: http://www.telekom.com/media/media-kits/105418

Table B 5: Classification of operators in SE Asia

	Sing Tel (Singapore)	Maxis(Malaysia)
Revenue	SGD 16.87 billion	MYR 8.8 billion
Market share (2010)	46.4%	
Number of subscribers	3.2 million (Mar 2010)	14.225 million
Number of employees		
Do they offer cloud services/entering the cloud market?	Yes	Yes
Type of Cloud services offered	PaaS, innovative apps	IaaS services offered to schools.
Type of cloud services offered to SMB's	SaaS,IaaS,Oneoffice office suite, web based video conferencing	IaaS
Implementing mobile cloud or fixed cloud?		
Private/public cloud offering	Private and Public clouds	Private and Public clouds
Collaboration with others in the value chain, partnerships etc.	Google, Cisco	

Table B 6: Classification of operators in Turkey

Revenue	Turkcell	Avea
Market share (2010)	USD 5.5 billion	
Number of subscribers		
Number of employees	34.5 Million	12.5 Million
Do they offer cloud services/entering the cloud market?	Yes	Yes
Type of Cloud services offered		
Type of cloud services offered to SMB's	IaaS, SaaS, CaaS	Microsoft email exchange, Livemeeting, Microsoft sharepoint and other integrated communication tools to enable SME customers work using the mobile.
Implementing mobile cloud	Fixed cloud	Mobile cloud

or fixed cloud?		
Private/public cloud offering	Private/Public	Public
Collaboration with others in the value chain, partnerships etc.	Microsoft providing SW platform while HP is providing infrastructure.	Microsoft
Managed services offerings?		
Number of datacenters		
Urban/Rural market presence		
Differentiated services if any		

Table B 7: Classification of operators in North America (USA)

	AT&T	Verizon
Market capitalization		
Market share		
Revenue / sales volume	Total wireless revenue $ 22.0 bn Operating Revenues 126,723 bn	Wireless 70.2 bn Verizon Communication 110.9 bn
Number of subscribers	total wireless subscribers 131.6 m	Wireless connections 107.8 m incl. Retail 92.2 m customers Others 15.6 customers
ARPU	For postpaid subscribers monthly $63.69	
Number of employees	256420 (total)	193900 (total)
Do they offer cloud services/entering the cloud market?	cloud services	
Type of Cloud services offered	platform for computing, storage, security and mobile apps and PaaS	
Type of cloud services offered to SMB's	IaaS, PaaS: Computing, storage, development environment (PaaS). Health care app.	
Implementing mobile cloud or fixed cloud?	Both, most fixed?	
Private/public cloud offering		
Collaboration with others in the value chain, partnerships etc.		
Managed services offerings?	yes	yes
Number of datacenters		More than 200 in 22 countries
Urban/Rural market presence		
Differentiated services if any	Orientation: enterprise	Orientation: enterprise Storage based on encryption (cmpr Amazon)

The four largest US mobile operators are Verizon, AT&T, Sprint Nextel and T-Mobile USA.
All major US operators, either have already deployed LTE or announced their intensions in doing it.T-Mobile is late with its LTE deployment and has recently made contracts with Ericsson and Nokia Siemens for building its 4G network.

A trend observed in USA is that connectivity providers are attempting to compete not only with speed of the network, but also with the services they will offer upon the bits transferred.
These services are applications that take advantage of the new high networks. AT&T has planned its home automation and security-managed services. The system is a set of webcams, sensors and controllers connected to the network. Verizon will offer its customers a system for streaming life audio and video to friends and family. The latter is an example of cloud.

Table B 8: Classification of operators in Australia

	Telstra	Optus
Market capitalization		
Market share		
Revenue / sales volume	A$ 25.23 bn	Total 9,284 Mobile A$ 5.98 bn
Number of subscribers	8.4 million fixed line and 12.2 million mobile services,	More than 9m mobile Plus fix
ARPU		Blended A$ 47 (2010)
Number of employees	more than 39,000 around the world	Over 10300
Do they offer cloud services/entering the cloud market?	Yes	Yes
Type of Cloud services offered	SaaS, Trying content aggregating (OTT)	SaaS, IaaS (private and Business) Storage for consumers
Type of cloud services offered to SMB's	Web Conferencing, cloud based Cisco WebEx, Cisco Telepresence; SaaS (microsoft), integration Accenture	Google Apps for BusinessTM, Storage and computing, see below.
Implementing mobile cloud or fixed cloud?	Both	
Private/public cloud offering	Both	Both
Collaboration with others in the value chain, partnerships etc.	Accenture, Cisco and Microsoft	Google
Managed services offerings?		
Number of datacenters		
Urban/Rural market presence	Telstra operates on more than 53 locations, providing coverage to more than 99% of the Australian population	Optus has coverage for 97% of population
Differentiated services if any	SaaS. Pay-TV	

Information from Australian Bureau of Statistics (ASB)http://www.abs.gov.au/
Number of ISPs with more than 100,000 subscribers is 10 in Dec 2011.

Internet subscribers (via mobile broadband)by type of access connection
for ISPs with more than 1,000 subscribers

Access connections	Dec 2010	June 2011	Dec 2011
DSL	4458	4493	4553
Mobile Wireless	4230	4786	5491

Cable	-	881	900
All broadband connections	10446	10906	11596

Internet connections via a mobile handset, for ISPs with more than 1,000 subscribers

Total mobile handset subscribers	8197	9683	11000

”Mobile wireless internet connections continued to be the fastest growing internet technology in terms of actual subscriber numbers, increasing by 14.7% since June 2011, and was again the most prevalent internet technology in Australia.
Although Digital Subscriber Line (DSL) connections grew by 1.3% to 4.6 million in the six months ending December 2011, the percentage share of DSL continued to decline, accounting for 39% of access connections.” ASB http://www.abs.gov.au/
Overall, the number of internet subscribers in Australia climbed 6.3% to 11.6 million in the six months to December 2011, up from 10.9 million in June 2011.
In June 2011, number of Business and government Internet (broadband) subscribers was, while this number for households was 8942 (for ISPs with more than 1,000 subscribers; The total number of subscribers was 11596).

Mobile summary
Mobile wireless broadband connections (excluding mobile handsets) accounted for 47% of all internet connections as at 31 December 2011, according to the Australian Bureau of Statistics.
There were 5.5 million mobile wireless broadband connections (excluding mobile handsets), an increase of 14.7% compared with June 2011. Over the same time period, DSL connections increased by 1.3%, to 4.6 million.At the end of December 2011, there were 11 million mobile handset internet subscribers in Australia, an increase of 13.6% from June 2011.
There are more mobile subscriptions in Australia than people. This is a $17 bn industry in 2011. Mobile penetration is about 125%. (http://www.budde.com.au/). Around 60% of mobile subscribers access 3G.
The largest mobile operators are Telstra Mobile, Optus Mobile (owned by Singapore Telecommunication) and Vodafone/3 (Vodafone Hutchison Australia (VHA), owned by Vodafone and Hutchison).
Telstra is a private company originated from governmental Telecom Australia. In addition to being Australia's largest provider of fixed lines and mobile (both number of subscriptions and coverage), Telstra is a provider of TV, media and other services. The company has also activities in other Asia Pacific regions and Europe. In Australia it operates a HSPA (fast 3 G) mobile network called Next G, with coverage in large cities. It is currently rolling out an LTE (4G) network in cooperation with Ericsson, with coverage in the center of large cities.

Table B 9: Classification of operators in Europe - Continued

	TeliaSonera	Telia (Swede)n	
Market share			
Revenue / sales volume	Net sales SEK 104,354 m Mobility 51,032	Sweden 36,059 16,204	
Number of subscribers	63 m (whole concern)	6,3 m	
ARPU		196 SEK (21EUR)	
Number of employees	28412	8,732	

	mobility 7,771		
Do they offer cloud services/entering the cloud market?		data storage, telematics, unified messaging (IM,voice, video,etc.), virtual meeting service, Digital TV and spotify	
Type of Cloud services offered			
Type of cloud services offered to SMB's		data storage, telematics, unified mess- aging, telemeeting	
Implementing mobile cloud or fixed cloud?		Both	
Private/public cloud offering		Both	
Collaboration with others in the value chain, partnerships etc.		Cisco conferencing	

Appendix C: List of Abbreviations

2G	Second Generation Mobile
3G	Third Generation Mobile
4G	Fourth Generation Mobile
3GPP	3rd Generation Partnership Project
API	Application Programming Interface
ARPU	average revenue per user
BCS	Business Communication Suite
BSS	Business Support Systems
CPU	Central Processing Unit
DSL	Digital Subscriber Line
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications (originally Groupe Spécial Mobile)
GUI	Graphical User Interface
IM	Instant Messaging
IMS	IP Multimedia subsystem
IPv6	Internet Protocol Version 6
LTE	Long Term Evolution
M2M	machine-to-machine
OEM	Original Equipment Manufacturer
OSS	Operational Support Systems
OTT	Over-the-top
PSTN	Public Switched Telephone Network
QoE	Quality of experience
QoS	Quality of service
RAN	Radio Access Network
SMB	Small and Medium Business
SMEs	Small and Medium enterprises
SMS	Short Message Service
UC	Unified Communications
UMTS	Universal Mobile Telecommunications System
VoIP	Voice over Internet Protocol
WiFi	Wireless Fidelity

Appendix D: Definitions for data collection

Each country has own measures for determining enterprise categories

Enterprise categories, SME definition in **EU**

"**Staff headcount** and **financial ceilings** determining enterprise categories
1. The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.
2. Within the SME category, a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.
3. Within the SME category, a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million."

Source Euroststst http://epp.eurostat.ec.europa.eu/
available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003H0361:EN:NOT

For statistical purposes, **large enterprises** are those employing 250 or more people.
http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Large_enterprises

Enterprise categories in China

China has own standards for classification of different industries in categories
For electronic industry:
Branch: Communication equipment and TV broadcat
(unit = original value of the productive fixed assets in thousands yuan)
1 UDS = 6.30 CNY (May 2012)

Large I	LargeII	Medium I	Medium II	Small
100,000 and above	40,000-100,000 and below <	25,000-40,000 <	10,000-25,000 <	10,000 and below

China large II and below are SME, compared to European Medium and below.

Appendix E: Operator Segmentation

The BSA Global scorecard is an initiative from the Business Software Alliance to highlight the deficiencies and positives in the laws of a country and its demographics thus highlighting the readiness of cloud computing adoption in the country. The scorecard finds the developed economies to be more ready to adopt cloud computing than the developing economies. The developed economies have amended or introduced laws to nurture cloud computing which is lacking in the developing economies. The full benefits of the cloud are only realized when the laws of the land support them. The scorecard suggests the developing economies to model their laws against the developed economies to improve their cloud readiness. The following table has created using the BSA scorecard as the reference.

Table E 1: Political and Regulatory factors that affect the adoption of cloud services in countries

Factors	Germany	USA	Singapore	India	China
Laws against cyber crime	Yes	Yes	Yes	No	Yes
Laws to protect intellectual property	Yes	Yes	Yes	Yes, needs amendment	Yes, but inadequate
Laws to protect data privacy	Yes	Yes but has deficiencies	No but Planning	No	Yes, but inadequate
Is there a regulatory authority available to enforce the laws?	Yes	Yes, but No central authority	No	No	No
Laws to facilitate e-commerce	Yes	Yes	Yes	Yes	Yes
Regulations on the strict security requirements of data centers?	Yes, data centers allowed to store data outside EU only if security by that country is guaranteed by law	Only state of California has a strict regulation.	No	No	No
Is the Cloud service provider liable for capital punishment if he fails to meet the committed data security measures promised?	Yes	No. But consumer law can take effect here empowering the customer to claim compensation of damage caused.	No. But is required to inform the customer of a breach in data security.	No. But has to compensate the affected customer.	Yes.
Presence of a standardization body	Yes	Yes	Yes	Yes	Yes
Does the country promote free trade?	Yes	Yes	Yes	Yes	No. Requires local technologies to be used.
Is there a national broadband policy	75% of the households with a download speed of 50Mbps	100 million homes to have access to broadband ,	Every home, school and office to have 100Gbps download/50Mbps	75 million broadband connections expected by 2012 and 160 million by 2014. A	45% of its population to be provided broadband

available?	by 2015. 600,000 rural households to be provided broadband connectivity. All households in EU to have atleast 30Mbps download speeds by 2020 and 100Mbps in 50% households by 2025.	100Mbps/50Mbps by 2020. By 2020 all households to have 4Mbps/1Mbps connectivity. Most extensive and fastest wireless network by 2020.	Upload) speeds by 2015.	national broadband optical fiber network connecting towns with a population greater than 500 is planned. The plan envisages 10Mbps download speed per household in 63 large cities. 4Mbps download speed per household in 352 cities 2Mbps download speed per household in towns and villages	access by 2014.

Source: http://portal.bsa.org/cloudscorecard2012/

Table E 2: Demographical data:

	Germany	USA	Singapore	India	China
Population (million	82	311	5	1200	1300
Urban Population (% 2010)	74%	82%	100%	30%	45%
Number of households (millions)	39	120.5	1.1	220.5	380
Population density	234	34	7252	394	143
Per capita GDP (USD 2010)	40,631	47,284	43,117	1,265	4,382
Personal computers (%households, 2010)	86%	76%	84%	6%	35%
Internet users (2010 in millions)	67	245	3.5	91.84	460
Population % of Internet Users	82%	79%	70%	8%	34%
Fixed broadband subscriptions as % of households	66%	68%	112%	5%	9%
Fixed broadband subscriptions as % population	32%	26%	25%	1%	27%
Mobile subscriptions (2010 in millions))	104	279	7.3	752	859
Mobile broadband subscriptions per 100 inhabitants	36%	54%	70%	1%	2%

Source: http://portal.bsa.org/cloudscorecard2012/

Explanation of terms in the table E3 below:

Communications and Instant Messaging (IM): Offering web based video conferencing services, Instant messaging services, Telematics, telepresence etc.

Reseller of cloud services/broker: Are cloud service providers who have partnered with other service providers and offer cloud services through the partner data centers.

Content: Content provided like video, mobile tv etc.

Table E 3: Cloud services offered by operators today

Operator	Classification based on revenue	Public/Private	Iaas	SaaS	PaaS	Appstore	Storage	Communications and IM	Reseller of cloud services	Music Cloud	Content	Partnership / Collaboration	Active In cloud	Number of data centers
Airtel	Large	Private	X	X		X	X	X	X		X	X	High	6
Reliance	Large	Private	X	X		X	X	X			X	X	High	9
BSNL	Large	Public	X									X	Moderate	6
Aircel	Medium	Private							X	X		X	Low	None
China Telecom	Large	Public	X	X				X				X	High	Many across china and singapore
China Mobile	Large	Public	X									X	Moderate	Many in china
China Unicom	Large	Public	X	X	X		X					X	High	
Deustche Telekom	Very Large	Public	X	X		X	X	X				X	High	90
O2	Large	Private		X						X		X	Moderate	
Telefonica	Very Large	Private	X	X				X					High	
SingTel	Large	Public	X	X		X	X	X				X	High	Many across Asia
Maxis	Large	Private	X									X	High	
Turkcell	Large	Private	X	X			X	X				X	High	
Avea	Medium	Private						X				X	Low	
AT&T	Very Large	Private	X	X	X	X	X	X					High	Many
Verizon	Very Large	Private	X	X			X						High	Many
Telstra	Large	Private		X				X			X	X	High	
Optus	Large	Private	X	X		X	X					X	High	
TeliaSonera	Large	Private	X				X	X				X	High	
Telia	Medium	Private						X		X	X		Moderate	

Table E 4: Evaluating potential of operators in cloud

Operator	Type of cloud investor (aggressive/moderate/low)	Multinational presence	Capital availability for cloud investment	Potential customer for new cloud service models
Airtel	Aggressive	Yes	High	Yes
Reliance	Aggressive	Yes	High	Yes
BSNL	Moderate	No	Moderate	May be (if less capital intensive)
Aircel	Low-Moderate	Yes	Moderate	Most likely (if less capital intensive and caters to the subscriber base)
China Telecom	Aggressive	No	High	Yes
China Unicom	Aggressive	No	High	Yes
China Mobile	Aggressive	No	High	Yes

Deustche Telekom	Aggressive	Yes	High	Yes
O2	Moderate	Yes	High	Yes
Telefonica	Aggressive	Yes		Yes
SingTel	Aggressive	Yes	High	Yes
Maxis	Aggressive	Yes	High	Yes
Turkcell	Aggressive	Yes	High	Yes
Avea	Moderate	No	Moderate	Most likely (if less capital intensive and caters to the subscriber base)
AT&T	Aggressive	Yes	High	Yes
Verizon	Aggressive	Yes	High	Yes
Telstra	Semi.Aggressive	Yes	High	Yes
Optus	Semi-Aggressive	Yes	High	Yes
TeliaSonera	Semi-Aggressive	Yes	High	Yes
Telia	High Moderate	No	High	Most likely (if it caters to the subscriber base)

Appendix F: Interviewees and Interview questions

Interviewee 1 Strategic Product Portfolio Alliances and Partnership Manager (Albert Wang)
Interviewee 2 Senior Consultant, Cloud business development and customer engagement(Van Kon)
Interviewee 3 Technical manager in cloud area (Lu Luo)

Interview Questions:

1.What do you think is important about Ericsson's cloud strategy for entry into the cloud computing market? (Added value? Is it early or late to enter?) What trade-offs has been done?
Data Centers and SaaS are omitted largely in Ericsson's solutions).

How much do you think, the operators know about Ericsson's strategies and offerings in the cloud?
What cloud services do you think different customers are willing to adopt? (IaaS/PaaS/IaaS, (any XaaS) Public/Private cloud?)

2.How does Ericsson differentiate itself from competitors in the cloud market ?
(MCA, BSS, OSS, …)

(Do you think Ericsson should provide mobile payments? Or other enabling services? i.e. try to be active in other fields than selling to operators?)

How do you think Ericsson can differentiate itself with its cloud offerings compared to:
a) Competitors like NSN, ALU, Huawei etc?
b) Other players?

3. What are the main challenges in implementing clouds?
(Marketing challenges? Organizational challenges? Competencies - see next question)?
- Do you think the operators, your customers, have greater bargaining power in negotiating prices?
- How competitive is the system provider space? Is competition based on price?
What about your providers?

4. What partnership opportunities / activities do you think are important?

Has Ericsson carved out a separate business unit to address the cloud industry? Is the unit lean and able to work in an agile fashion and make quick decisions to address the rapidly evolving cloud ecosystem?
(See question 6)

5. Do you think medium sized businesses, in large, can afford the Private cloud model?

6. Does Ericsson's cloud service require operators to deploy Ericsson mobile communication infrastructure? In other words will the cloud solution provided by your company only work on existing Ericsson deployments? I ask this question because to expose the network through API's the control of the underlying infrastructure is also required.

7. Can you comment on your positioning strategy? Have you considered any trade-offs as part of your strategy? (like accessing only a particular market, or target only certain customers (like operators only)

Appendix G: Indian mobile user survey

76% of the smartphone users in India are active on social networking using their smartphones compared to 54% in the US while 81% Indians access their emails through their smartphones.

59% Indian males access the Internet through smartphones versus 48% by females. Additionally,
78 per cent of smartphone users search from their device
77% like listening to music on their smart device
35% read newspapers, book and magazines or watch
40% of smartphone owners do not feel secure to purchase online through their smart device and prefer PC/ laptop for the same.

The above market survey is indeed encouraging for the cloud service operators to offer mobile cloud services targeting the individual subscriber (approximately 10 million) and mostly concentrated in the urban area.

Source: http://www.themobileindian.com/news/6377_Indian-smartphone-users-more-active-than-US-counterparts:-Survey

European and UK mobile user survey:
Broadband subscriber market analysis conducted in Europe and UK revealed the following:

UK
Total mobile subscribers: 47.5 million
Mobile internet penetration: 12.7 million (27%)
The email services offered by mobile operators were used by
UK: 29%
Among UK males in the age group of 35-44 mostly mobile phone users had a corporate contract.
They accessed sports news, general news, email for work purposes, downloaded music,
watched mobile tv/video.

In Europe:
Total mobile subscribers: 224 million
Mobile internet penetration: 49.3 million (22%)

The email services offered by mobile operators were used by
Europe: 21%

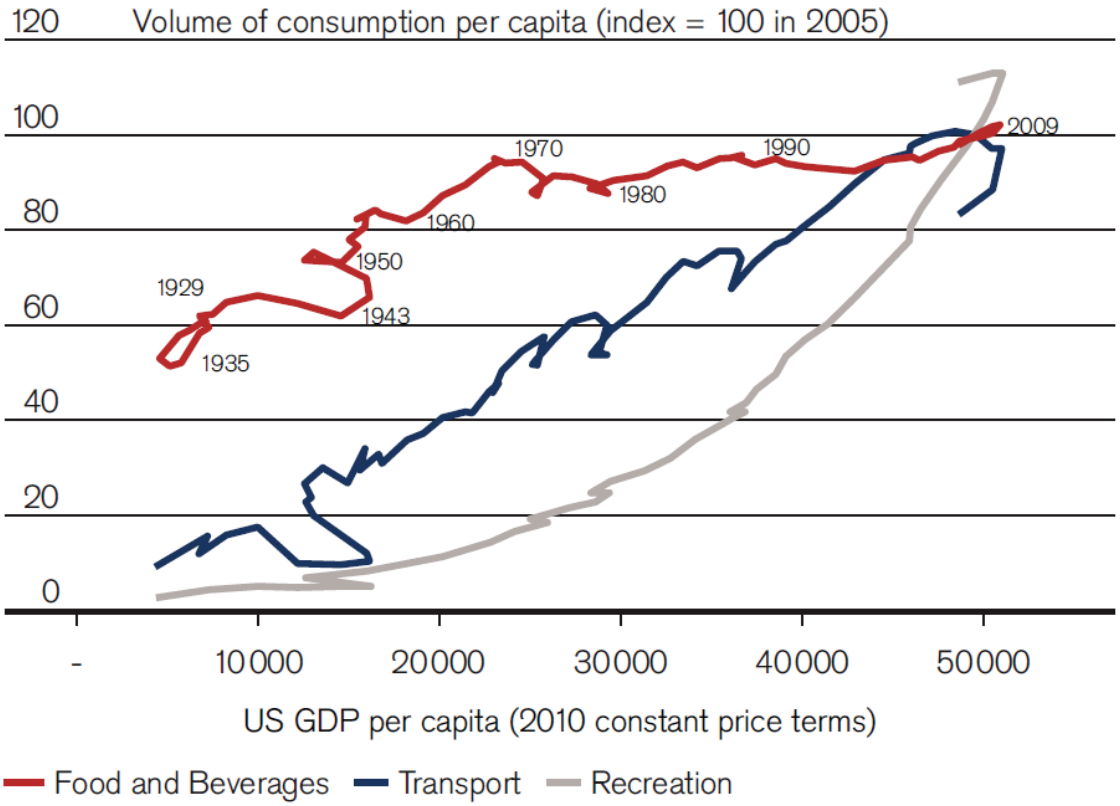
In Germany, 22% of online population see social networking as a top 3 primary online activity.
Average age of social gamers = 27.4 which totals to >3.3 million social gamers (52% females, 48% Males). People in the age group of 13 – 49yrs are active gamer.

Source:
http://www.newzoo.com/ENG/1554-Germany.html
http://www.iab.net/media/file/Going_Mobile_-_Issue_22.pdf

Appendix H

US GDP per capita and volume of consumption of food and beverages, transport and recreation, USD

Source: BEA, IMF, Credit Suisse



Source: https://www.credit-suisse.com/news/doc/media_releases/consumer_survey_0701_small.pdf

This graph shows that as the income level increases the recreational spending (like spending on mobile phones, luxury, branded items etc.) increases exponentially compared to the basic necessities (Credit Suisse, 2011)

Appendix I: Summary of Interviews (Answers from each interviewee are given in different colors):

Q: what is important for Ericsson in cloud strategy?

Focus on managed services.
Transport data from Cloud to end user through Ericsson network in an effective way.
1) solid cloud products and solutions, 2) the differentiators to other cloud player's products and solutions.

Two of interviewees believe that it's late for Ericsson to enter XaaS market and two also say that we should not enter because of competencies required as an IT-infrastructure company.

Q: How much do you think, the operators know about Ericsson's strategies in cloud?

All three say that they do not know much about it.
Operators has a perception that Ericsson is not a Cloud player. They think Ericsson is strong, in i.e. B/OSS in private Cloud to improve the operation efficiency.
Many operators still don't know about Ericsson's cloud strategies and offers. For some operators, Ericsson is not considered as a cloud player.

Q: How does Ericsson differentiate itself from competitors in the cloud market ?

Ericsson is not offering a blade server and will not compete with commoditized server manufacturers…the role of an optimizer who helps the customer by its know-how and enhances the distributed character of cloud by enhancing Ericsson's capabilities. An example being managed services.
Network capability in enabling Cloud function and excellent competence in B/OSS.
Network enabled cloud is a very good differentiator from competitors but we didn't share the detail products and solutions. MCA, OSS, BSS. Currently, Ericsson cloud offers are still not so interesting to the operators. Ericsson even does not have any commercial data-center-related products. Ericsson should move faster to develop the new products or acquire other cloud companies to strengthen the offers. For the differentiators, the distributed cloud and unified cloud management is a good idea.

Q: What are the main challenges in implementing clouds?

Defining where the actual revenue is coming from is the challenge (for telecom)
Lack of marketing message on Cloud and it is because we have no sound Cloud story to tell. But we have a few good best practices cases being built in some Eurpoean Cloud projects.
The organizational challenge may be the main challenges for operator and Ericsson itself. Both operator and Ericsson Org are still portfolio-driven but the cloud is business-driven.

Q: What partnership opportunities / activities do you think are important?

-
Alliance or partnership with 3pp cloud players is very important.
Partnership with the network vendors is very important.

Q: Separate business unit to address the cloud industry?

Cloud … still has no special organizational unit with dedicated leader today, but there is a program for cloud.
I found the decision from BU regarding Cloud development is still slow and fluffy.
The current cloud decision is a bit of slow. Comparing with the agile IT cloud player.

Q: Do you think medium sized businesses, in large, can afford the Private cloud model?

SME can afford cloud. In most cases it is about a hybrid cloud. Business model has still to be worked out.

Not necessary for medium sized businesses to have a private Cloud.

I think so. Normally, such companies already have a lot of servers. So consolidating the servers into the private cloud will still save a lot of cost.