TIVIT

TIETO- JA VIESTINTÄTEOLLISUUDEN TUTKIMUS TIVIT OY

CLOUD SOFTWARE PROGRAM

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(Task D3.1)

First Taste of Cloud Software Business

Preliminary report on definition of cloud software business, on transition from software project business and license business, and on value propositions and risks of cloud software business.

Consortia Internal Draft v. 1.3
(To Be Public)

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1 Description and Summary

Background	*The emerging domain of cloud computing does not have commonly accepted terminology and definitions. Information about the business context is explained with conflicting terms.*
Industry Domain	*The firms with software business related to the cloud.*
Business Context	*Cloud business in general.*
Current Status of the Cloud SW Challenge	*What are the definitions of key concepts of cloud software business?* *How to transition from software project business and license business to cloud software business?* *What are the value propositions and risks of cloud software business?*
Summary	*Cloud computing enables services having five characteristics: on-demand, network access, resource pooling, rapid elasticity, and measured service.* *From the technological point of view cloud computing means separating the User Interface, Application Execution, and Hardware. From the industry structure point of view this has led to a new horizontalization of software industry to services layers: Software-as-a-Service, Platform-as-a-Service; and Infrastructure-as-a-Service. Besides these, also the client software layer belongs to the ecosystem. From the Finnish point of view, the role of mobile communications in the development needs also special attention.* *Currently, cloud services have global yearly volume of $50-60 B, which is about 2 percent of global ICT industry. IT industry cloud services had global volume of $17.4 M in 2009, which was about 2 percent of global IT services and software business.* *In transition to the cloud, the success of software company is dependent on whether it can recognize a sustainable position in the new industry structure and whether in can reach the position.* *The major new strategic risks related to cloud are the reduced lock-in of customers, and longer investment payback periods. The major new operational risk is the increased dependency on suppliers.*

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2 Introduction

By Pasi Tyrväinen

This is the preliminary report about cloud software business addressing three questions of the business

1. definition of cloud software business,
2. transition from software project business and license business to cloud software business, and
3. value propositions and risks of cloud software business.

Chapter 3 provides first answers to these questions. It presents the definition of cloud software business at an overall level, the generic value propositions and risks, elaborates the largest IT related part, Software-as-a-Service (SaaS), and outlines the industry transformation.

Further analysis takes place on three levels of observation (Figure 2.1). Chapter 4 describes the expected industry structure and macro level market drivers. Chapter 5 outlines the market volumes. Chapters 6-11 elaborate analysis of the industry structure by opening the views of users, application providers, integrators, infrastructure providers, mobile cloud providers and data providers. At this early stage, some of these views have been analyzed in depth while others just provide a starting point for further analysis.

Unit of Analysis	Models and concepts	Indicators and data Methods
SW Industries (horizontal and vertical, primary and secondary..)	Horizontalization, Vertical (dis-)integration, **Architecture** / Dominant design, Standards, **Technology adoption**, Market concentration, **Markets,** Market segments, **Global change drivers**	Market statistics: primary industry revenues, segments Scenario analysis
Ecosystems	**Functions**: Infra, application, payload, integration, service provisioning, implementation, **Relationships, Roles**, Value networks/-chains, Dominant positions, Lead firms, Lead customers,	Role and relationship descriptions Case studies
Firms	**Business model** elements: Value proposition, Revenue model, Cost structure, Resources, Transaction costs, Assets, Partner network, Distribution channel, **Key customers**, Customer relationships, Customer segments	Financial data: revenue split, spending shares, markets addressed OSKARI data

Figure 2.1. Three layers used for analysis of cloud software business (Cloud Software, 2010)

Chapter 12 discusses shortly ecosystems. Chapter 13 analyses the domain at a firm level emphasising business models of the firms. Chapter 14 describes research methods and data collection relevant at each level of analysis. Chapter 15 summarizes the report.

3 Cloud Software

By Jussi Autere, Eetu Luoma, Pasi Tyrväinen, and Aku Valtakoski,

3.1 Enabling Technologies

Cloud computing techniques and Software-as-a-Service applications have enabled economical use of remote, shared computing resources and applications. This has enabled enterprises to outsource IT hardware management to cloud computing centers. Software and infrastructure providers have been able to offer users services, which used to be beyond their reach due to high purchase and installation costs of traditional software delivery models, when software was installed to user computer.

From the structural point of view, Cloud Computing has meant separating the User Interface, Application Execution, and Hardware that runs applications to own layers and offering a great flexibility in connecting these layers. The use of virtualized hardware enables shifting application processes based on load and use of the Internet provides access to remote applications. The three configurations of the layers that an included in Cloud Computing are presented in Figure 1.

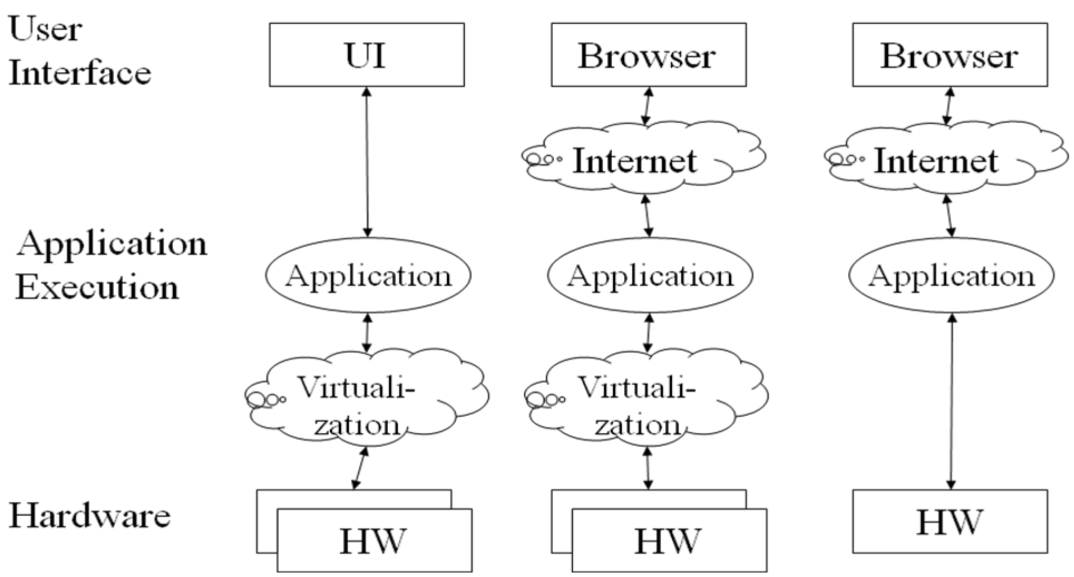

Figure 3.1. Three Cloud Computing configurations

Two leftmost configurations in Figure 3.1 can be used in-house (Private Cloud) while two rightmost configurations are used for providing Software-as-a-Service (SaaS in Public Cloud).

3.2 Definitions

A widely cited and commonly agreed definition on Cloud Computing identifies five essential cloud computing characteristics, three service models, and four deployment models[1].

Characteristics:

On-demand self-service: Computing resources (processing capacity, storage, virtual machines and services on top of them), can be acquired and used at anytime without the need for human interaction with cloud service providers.

Network access: The computing resources can be accessed over a network, using heterogeneous devices such as laptops or mobiles phones.

Resource pooling: Cloud service providers pool their resources, which may then be shared by multiple users. This is referred to as multi-tenancy where for example a physical server may host several virtual machines belonging to different users.

Rapid elasticity: The computing resources can be dynamically re-configured to adjust to scale, allowing for optimum resource utilization (Vaquero et al., 2008). A user can quickly acquire more resources from the cloud by scaling out. They can scale back in by releasing those resources once they are no longer required.

Measured service: Resource usage is metered using appropriate metrics. Usage is therefore typically charged by a pay-per-use model[2].

Service models:

Software-as-a-Service (SaaS): SaaS is the most visible layer to the end-users of the cloud. Normally, the users access the SaaS services provided by this layer through browser over the Internet. From software business perspective, SaaS differs from bespoke software and software product business models in that both the software development, deployment and operating are outsourced to a software vendor. Salesforce Customer Relationships Management (CRM) system and Google Apps are two examples of SaaS.

Platform-as-a-Service (PaaS): PaaS deliver a computing platform and/or solution stack as a service, often consuming cloud infrastructure and sustaining cloud applications. PaaS therefore incorporates run-time environments, databases, middleware and programming environment. Developers utilize the PaaS provisioning to implementing their applications for and deploying them on the cloud. The PaaS providers supply the developers with a set of APIs to facilitate the interaction between the infrastructure (i.e. the computing resources) and the applications, as well as to accelerate the deployment and support the scalability needed of those cloud applications. One of the examples of systems in this category is Google App Engine, which provides a python runtime environment and APIs for applications to interact with Google cloud runtime environment.

PaaS layer also includes common services for provisioning, assuring and charging services. The study by McKinsey & Company provides a good overall architectural

[1] Mell & Grance, 2009
[2] Vaquero et al., 2008

description on the platforms[3]. The study separates the SaaS application and general hardware infrastructure (physical data centres, remote infrastructure management) from the platform.

Infrastructure-as-a-Service (IaaS): IaaS delivers computer infrastructure, typically a platform virtualization environment as a service. The infrastructure layer provides fundamental resources to other higher-level layers, which in turn can be used to construct new platforms or applications. Cloud services offered in this layer can be categorized into: computational resources, data storage, and communications. Compared to the PaaS model, the IaaS model is a low level of abstraction that allows users to access the underlying infrastructure through the use of virtual machines. Amazon Elastic Compute Cloud is a well-known example of such provisioning. Data storage services allow users to store their data at remote disks and access them anytime from any place. Examples of commercial Data storage services are Amazon S3 and EMC Storage Managed Service. As the need for a guaranteed QoS for network communication grows for cloud systems, communication becomes a vital component of the cloud infrastructure. Consequently, cloud systems are obliged to provide some communication capability that is service-oriented, configurable, schedulable, predictable, and reliable.

In architectural description by Youseff, Butrico and Da Silva (2008), there are two further layers in addition to SaaS, PaaS and IaaS. *Software Kernel* layer provides the basic software management for the physical servers that compose the cloud. Software kernels at this level can be implemented as an OS kernel, hypervisor, virtual machine monitor and/or clustering middleware. The bottom layer of the cloud stack is the actual *physical hardware* and switches that form the backbone of the cloud.

Further, a *cloud client* consists of computer hardware and/or computer software that relies on cloud computing for application delivery, or that is specifically designed for delivery of cloud services. Examples include phones and other devices like Nexus One, operating systems like Android and browsers like Google Chrome.

Deployment models:

Private cloud: Private cloud refers to a proprietary network or data center that uses cloud computing technologies, and that is used exclusively by one organisation. Operating may be provided internally or by a third-party vendor. Motivation to use private cloud arises from use of virtualization techniques to improve utilization rate of existing hardware assets, and to avoid security concerns related to public clouds.

Public cloud: A public cloud can be used (for a compensation) by the general public. Examples of public clouds include Amazon Elastic Compute Cloud (EC2), IBM's Blue Cloud, Sun Cloud, Google AppEngine and Windows Azure Services Platform.

Community cloud: A community cloud is shared by many organizations, and is usually configured for their specific requirements. This option is more expensive than using public cloud but may offer a higher level of privacy, security and/or policy compliance.

[3] Dubey et al., 2008

Hybrid cloud: Hybrid cloud is a mixture of the other deployment models, allowing independent administration of individual clouds but applications and data would be allowed to move across the hybrid cloud.

Cloud software

For the purpose of this document, we define Cloud Software to share the five characteristics of NIST definition, to have multiple deployment models, and to implement the services in IaaS, PaaS and SaaS layers as well as in Cloud Clients. Table 1 below summarizes the types of basic types of software for the four layers.

Software type	Description
Client	GUI, runtime environment, operating system
SaaS	Application software, e.g. office automation tools, business, media and communication applications
PaaS	Runtime environment, database, middleware, programming tools, and operations support systems
IaaS	Operating system, hypervisor, telecommunications control software

Figure 3.2. Cloud Software types implementing services for the four layers

3.3 Transformation

The Cloud Software approach re-organizes the relations between the participants in value creation. Figure 3.2 and Figure 3.3 provide an illustrative example of the change in case, where a software vendor is providing their customers an application product on top of typical PC software platform.

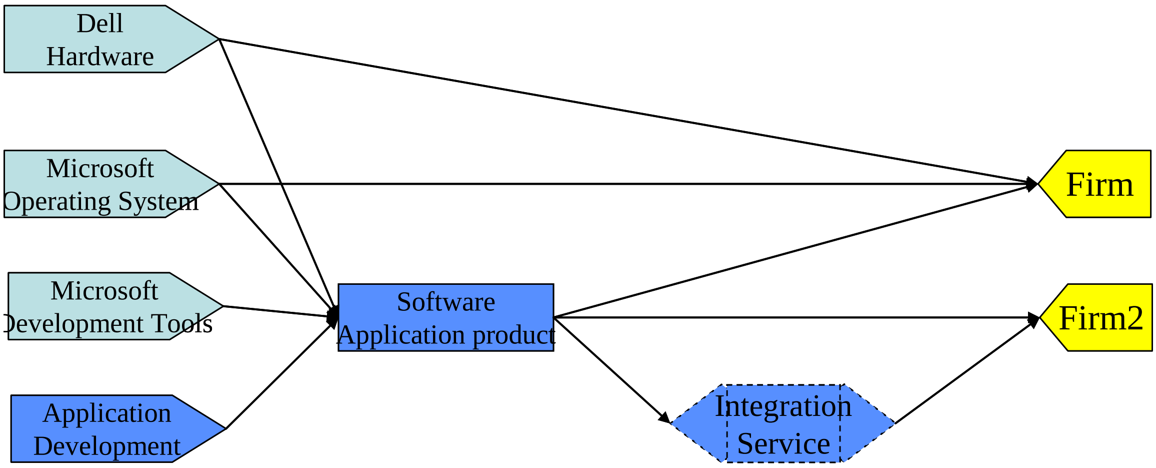

Figure 3.3. Organization of value creation in traditional packaged software

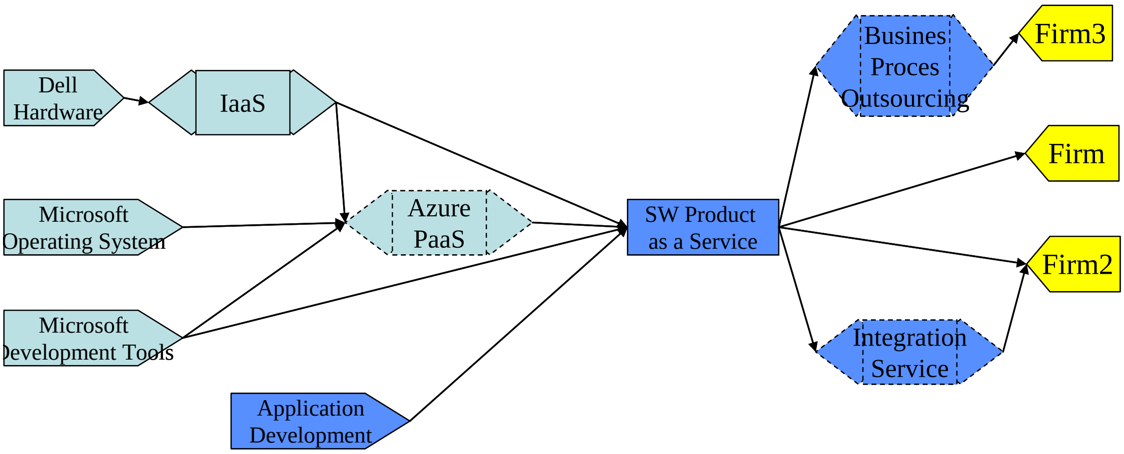

Figure 3.4. Organization of value creation of software in cloud environment

The dark blue symbols in the middle of the figures represent activities of the software vendor providing “Software Application Product” to two customer Firms (on the right) based on the in-house “Application Development” and components purchased from three vendors (on the left). In the SaaS offering the “SW Product as a Service” is not directly related to hardware rather than is executed on Infrastructure-as-a-Service. The SaaS service is also hiding the component vendors from the customer Firms, which do not have any connection to the hardware or software component vendors used to deliver the service.

The software offerings and the infrastructure offerings are separated into architectural layers and operated by different firms with different principles of operation. This horizontalization of the industry enables the infrastructure providers to utilize economies of scale and compete on prices while the application providers operate in narrower market segments and focus more on customer intimacy, user experience, business process services and other added value services. Transformation of application provider business is elaborated in Chapter 7.2.

4 Cloud Software Industry

4.1 Expected Industry Structure

By Pasi Tyrväinen

Figure 4.1 represents the dominant architecture and functional roles of firms in the expected future cloud software industry structure (Cloud Software, 2010). The view of the architecture has been developed in the Cloud Software expert workshops in the spring of 2010. A **cloud service** provided by a SaaS service provider is the core offering in this structure to the end users (denoted by yellow vertical arrows). SaaS services are sold not only to enterprises the as most software products and services are provided, but increasingly also to individual customers, who may pay with their attention instead of using money. Services can be provided directly via the Internet by the service provider or via an appstore, telecom operator, or some other channel packaging or bundling selected services to a selected customer segment. In addition intermediaries can use using SaaS services as a part of their offering along with their human services (e.g., marketing campaign services using Google AdWords service).

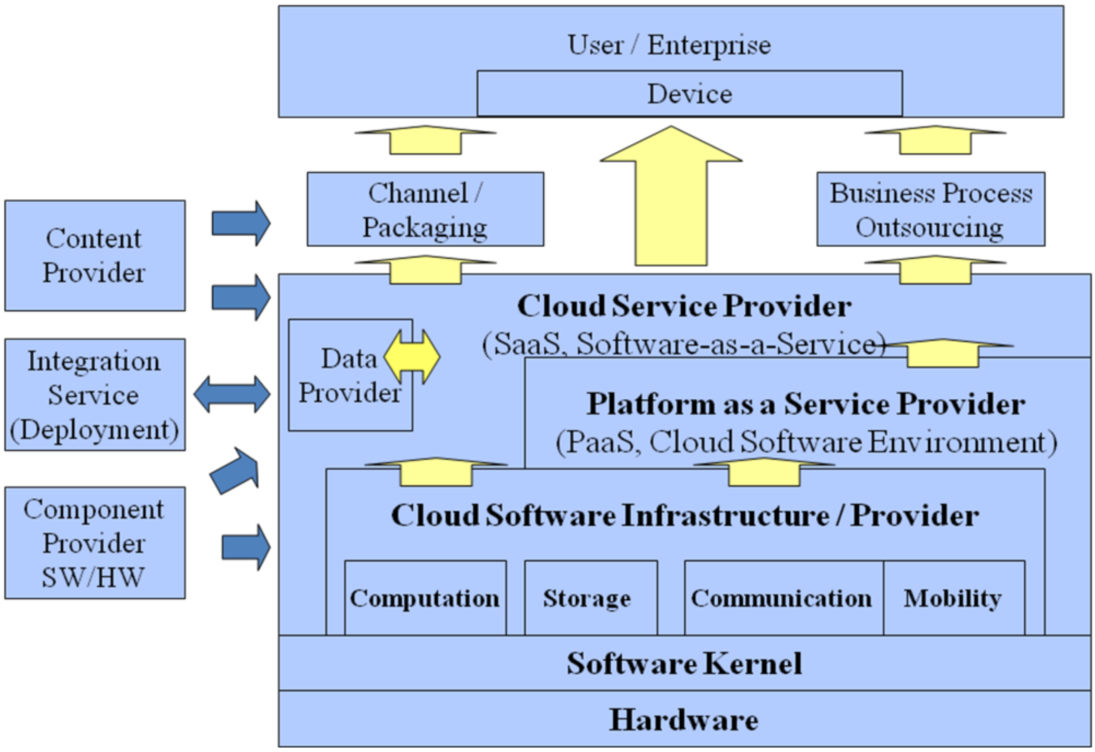

Figure 4.1. The expected Cloud Software Industry Structure (Cloud Software, 2010)

The large block in Figure 4.1 represents the infrastructure and service providers divided according to the cloud ontology of architectural layers (Youseff, et al 2008) while the functional roles of software and other component providers are presented on the left (e.g. Messerschmitt and Szyperski, 2001).

SaaS service provider (see Chapter 7) can purchase the software implementing the service from a software **component provider**, implementation and **integration services** needed from an IT consulting firm (Chapter 8) as well as content used as a part of the service from a content provider. In many cases, the firm implementing a specific SaaS service also operates the service acting as a SaaS service provider for one or more services.

In social media applications the cloud service provider often includes a role of **data provider** (see Chapter 11). That is, the service provider can e.g. collect data about user interests based on their search terms, categorize users into market segments, and sell market space to these highly specialized segments (as Google does). Data provider can also collect user recommendations about services, products, and trustworthiness of other users to internal databases. It can make use of this data in other services along with content provided by users as well as content provided by professional content providers.

The application service provider can make use of computing infrastructure available through the network of and **infrastructure provider** (Chapter 9) and even application development tools provided as a services by a **platform provider**. Most of the contemporary infrastructures ignore the opportunities of mobile platforms and networks. Chapter 10 views these often forgotten fields in detail. The demand side of services by individuals and enterprises is viewed in Chapter 6 describing **user view** after the macro level drivers and market volumes. The user view of client business includes also the often forgotten part of software business related to cloud: software in client devices that is needed to use the cloud services.

4.2 Macro Level Drivers

By Bronan McCabe

The macro environment represents the highest level layer of any economic system around a company. It consists of broad environmental factors that to some extent have an impact on most organisations. Within it, there's the industry layer which consists of companies producing similar products and services, it is from here that competitive rivalry forces are derived. Inside the industry layer, there is the organisational itself and the impact it has on the environment around it. (e.g. Bain, 1954; Chandler, 1962)

The objective behind the research was to gather the greatest amount of data in the shortest time, with as little bias as possible. The intent was to try to establish those trends that were impacting the market and where possible, to identify where there were breaks to existing trends in the market dynamic.

The political, economic, social and technological (PEST) analysis (Aguilar, 1967) framework was utilised in order to collect and categorise the driving forces. The primary data collection process consisted of 12 semi-structured interviews and in order to overcome any bias, the interviewees were selected from a cross section of companies and individuals; and the self selection methodology was applied. The sample consisted of expert employees from within VTT, i.e. those that were working on the Cloud Software programme. Also interviewed was a wide selection of individuals from the consortium partnership companies and again, these represented a wide cross section from software providers to network operators. Lastly, a group of individuals from outside this community were also represented, these were companies that are heavily involved in cloud type business activities and ranged from venture capitalists to movie makers. Secondary data including 14 journals and 8 books were also used to assist with source data.

The process utilised produced a rich source and in total over a hundred and sixty different driving factors were identified. Many of these factors tend to coalesce around certain themes, but that said, in many cases those same themes traverse across different aspects of the PEST framework. For this reason, it was decided to keep the factors independent, in doing so they can be considered in isolation which provides an opportunity for more detailed analysis at a later point.

In an effort to uncover that detail, 23 political factors have been identified. A good example of one is the legal ownership of content once it has been placed into the cloud. This is a point that is causing much consternation among interviewees, as it is not dependent upon the laws of the geographic region of the globe in which the contributor lives, but is dependent upon the laws of the region in which the data resides. Given the liquidity of data movements within the cloud environment, which can also take place in an instant, it may be extremely difficult for that contributor to retrieve rightful ownership of their data; and this is possibly one of the most potent arguments used by protagonists against the movement toward cloud initiatives.

There were also 74 economic factors identified and it would be difficult to ignore the five hundred percent growth rates that have been seen in mobile data traffic. In recent press articles Cisco, Qualcomm and Ericsson all announced that the usage of data across the mobile network had doubled every year over the past two years, adding that the volume of data traffic was now greater than the volume of voice traffic over the worldwide mobile network. Not that alone, they all forecast an expectation that data traffic would continue to double every year until 2014. This could be viewed by many as posturing, with the aim of gaining additional business from network operators for investment in network infrastructure. But that said, there can be no denying the considerable increase in mobile data traffic due to a significant change in the habits of mobile users.

The last point leads neatly to the 41 social factors that were identified. One of the points mentioned by interviewees was the growing burden of information overload. Many cited having a multitude of SMS, instant messaging, voice mail, email and now a growing number of social network accounts, all to take care of. Not to mention the subscriptions to blog sites such as Twitter and the like, that all makes keeping oneself organised and up to date a constant battle.

Lastly, there were 32 technical factors identified. There were a wide cross section of responses in this genre, but one that seemed to raise a reasonable amount of excitement was the growing movement towards machine to machine transactions. It was felt that this could not only change the landscape in terms of cost and efficiency, but also had the potential, when combined with context awareness to help bridge the gap between the real and the virtual worlds we currently occupy, by potentially providing vital context awareness links.

Though all the afore mentioned factors play an important role in the impact they have on the environment, the most startling revelation, was the fact that so many of all the factors identified, nearly half, were economic. It is also conceded that at the time of writing the detail of these factors have not been ranked and rated as to the level of impact they have on the environment and this is seen as a limitation of the investigation. It is intended to be carried out in a subsequent investigation. Thus far the evidence suggests that there are a significant number of factors impacting the cloud environment and a predominant number of those are all driven from an economic perspective.

4.3 Cloud Asset Valuation and Pricing

By Veikko Seppänen

One important environmental is the price level of cloud businesses – expectations from the customers' side are, simplifying, towards cheaper or even "free" services. In general, software business earnings seem to involve two megatrends, decreasing of the cost per offering and increase of the number of customers per offering.

Investigation and analysis of the cloud business models and especially earning logic is in an early phase in the Cloud Software program. There are alternatives views than can be followed (e.g. Matsuura, 2003). One of the streams involves price setting based on valuation of business assets. This has been studied by Elektrobit (EB), especially from the viewpoint of technology assets, but keeping in mind that other kinds of assets are also very likely to be created and reused for cloud business needs. Since this work has only been started and will be focused and continued during the next sprints, the following is just a short introduction and summary of some of the main topics to be addressed.

Assets in the context of this chapter refer to intellectual property that can be identified and defined for business needs and that are reusable in more than one business case (). Their role in business changes from nil to a full-scale asset portfolio based on the business strategy. Assets may have several roles in business like supporting items, business enablers, business case drivers, and strategic resources for a business or a portfolio of businesses (Malinen & Haahtela, 2007).

Asset valuation is a process to define the economical worth of an asset in a given time period. The three main approaches to it are cost-based, market-based and income-based (see e.g. Berk & Demarzo, 2006; Kamiyama, 2005; Razgaitis, 2003). Asset pricing can be based on asset valuation, with a note that the price is always a market-driven concept, i.e. a result of specific business negotiations. Simplifying, the necessary steps for creating means for defining asset values and prices are as follows: ad-hoc pricing, one business case payback, two or more business cases payback, basic asset lifecycle based cash-flow analysis, discounted cash-flow (DCF) analysis, sensitivity and risk-based analysis (e.g. Monte Carlo) and option based analysis (decision options during asset lifecycle). DCF can be used as a basis for defining the future income from asset reuse and the Monte Carlo Method to evaluate the sensitivity and risks of the results

(Oracle, 2007). Careful input parameter selection is, however, needed to get the best results, as well as knowledge to interpret those regarding figures and distributions of asset values. The methods are based on likelihoods and guesstimates, but all in all they are better than purely intuitive ad hoc methods or no methods at all.

It is expected that a strategic approach to asset valuation and pricing for business opportunity planning is needed in a changing business environment, where competition is based on customers rather than on resources. The approach demands advanced enough financial models to estimate and calculate the value available from the reuse of technology assets.

Although the initial view concerns technology assets, similar principles can be applied to other business assets: competences, customer relationships, supplier partnerships, stakeholder-provided resources, etc. Asset valuation and pricing thinking helps to consider the economic worth of a business case, a company or a network as a whole.

5 Market Volumes

By Jussi Autere

The estimates on the size of cloud business globally vary currently significantly depending on the market research company involved and the definitions used. It is not certain that this situation will change even in the future. Cloud software or SaaS services do not construct a separate industry, but SaaS and cloud based solutions are used for the same purposes as traditional software and systems using them. Especially in the enterprise software industry the applications and services based on cloud technologies are replacing the previous generation of locally installed software.

Because cloud software business is embedded in the larger information and communications technology (ICT) industry, one has to understand the size and structure of the whole ICT market to be able to understand the role cloud software plays.

5.1 Consumption Side View

The analysis of the whole market starts from the user or consumption side. In this preliminary version of the report we concentrate on the business customer side. To get the full picture on the markets of ICT sector, one has also to understand consumer markets, but this part of the analysis will be done in later reports.

Based on the data from two market research companies, we have estimated the IT spending of midsized Finnish companies. The estimations are presented in Figure 5.1.

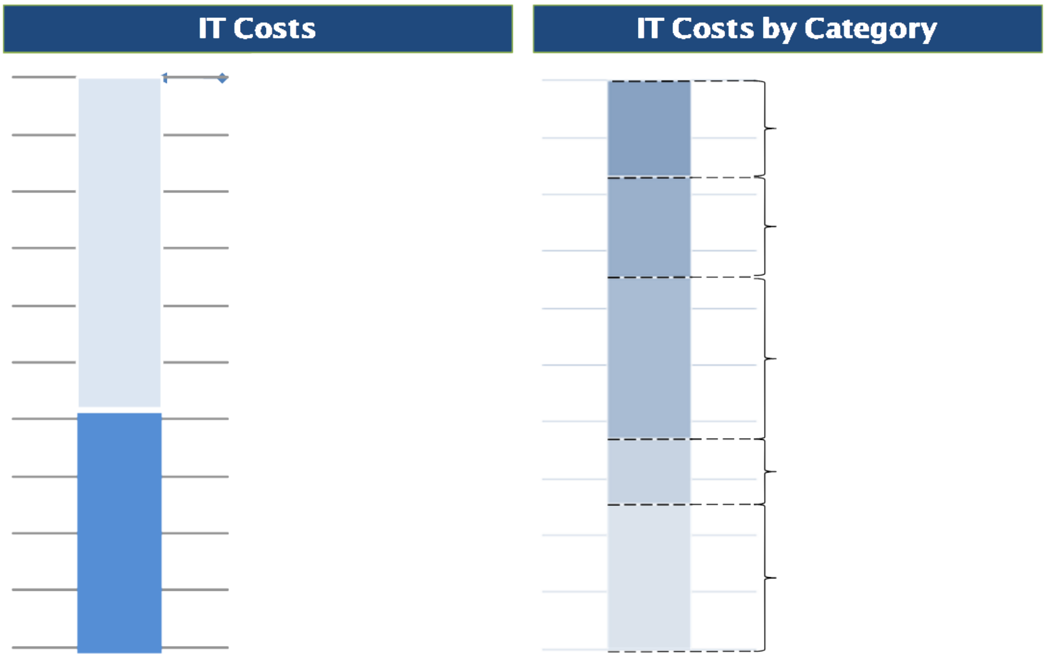

Figure 5.1. IT Costs of companies with 200-2000 employees in Finland (Tietotekniikan liitto, 2009; Mäntysaari, 2009)

IT spending is a significant portion of all the costs of enterprises. It is already to a large degree outsourced. Services are already the largest item in IT spending categories. Thus moving to services based models in delivering infrastructure and software is not a big change in operational practices of companies. It may even make their purchasing and management practices simpler.

To get better understanding, where the business potential lies, one can also analyse, what business functions larger companies have outsourced. One such analysis is presented in Table 5.1.

IT and BP outsourcing rates of Finnish companies[a]

	~2006	~2009E
Application Dev	86%	88%
Logistics/distribution	75%	78%
Application maintenance	73%	84%
IT Infrastructure	68%	85%
Production	64%	49%
R & D	38%	40%
Payroll management	29%	50%
HR functions	21%	28%
Financial management	17%	36%
Purchasing functions	13%	17%
Customer service	8%	18%

Figure 5.2. Trends in Large Company Purchasing Practices (Lumijärvi, 2007)

a) Upper management from companies employing over 400 people. The decline in production outsourcing percentages is present also in the original source. We assume it to be a typo.

As can be seen from the figure, functions related to application development and maintenance have already been mainly outsourced. Also this information indicates that the move to cloud services does not constitute a major change in the processes of buyers. There is no indication of potential for big changes in business models, if basic functionality of the services is the same as with traditional software or infrastructure.

The situation is different, if a wider view on the business processes of buyers is taken. It seems that companies are increasingly outsourcing whole business processes and functions. This may indicate major new business possibilities for new business models for companies with software based competencies, if they can build their offering to include also the business process that is using the software. An example of this development is that a company that has capabilities in statistical software development sells customer satisfaction survey service instead of software to analyse customer responses. Business processes include also activities that are not traditionally included in IT, This means that there is room for growth over the 4.5 percent of revenues currently allocated to IT budget.

The third view on IT spending is based on analysing which industry sectors are buying IT services and products. The distribution of IT Services spending between major industries is presented in Table 5.2.

In $ million								
Vertical	**E2008**	**F2009**	**F2010**	**F2011**	**F2012**	**F2013**	**F2014**	**CAGR (09-14)**
Energy and Utilities	24 595	25 598	26 773	28 063	29 406	30 825	32 244	4,7%
Financial Services	128 556	134 531	142 094	153 515	169 017	182 489	195 960	7,8%
Healthcare	24 153	25 263	26 573	28 036	29 590	31 263	32 935	5,4%
Life Sciences	10 044	10 344	10 714	11 125	11 539	11 981	12 423	3,7%
Manufacturing	94 145	97 335	102 183	107 572	113 244	119 370	125 497	5,2%
Media and Entertainment	7 728	7 990	8 374	8 819	9 278	9 787	10 295	5,2%
Other	9 874	10 166	10 593	11 085	11 606	12 142	12 678	4,5%
Public Sector	110 811	116 296	122 755	129 906	137 666	146 325	154 984	5,9%
Retail, Wholesale and Distribution	50 677	52 164	53 919	56 163	59 313	62 211	65 108	4,5%
Telecommunications	48 921	50 860	53 151	56 222	60 218	64 360	68 502	6,1%
Travel, Transportation, Logistics and Hospitality	28 693	29 501	30 606	32 039	33 717	35 256	36 795	4,5%
Grand Total	**538 198**	**560 049**	**587 737**	**622 544**	**664 593**	**706 008**	**747 422**	**5,9%**

Figure 5.3. Consumption of IT Services (Applications and Infrastructure) globally (Datamonitor, 2009)

As the distribution of IT Services spending reveals, the financial industry is the largest, and even the fastest growing market for IT Services. IT systems have already become the production machinery of financial services. From the Finnish point of view, it is worth noticing that manufacturing is the third largest IT customer industry. There are multiple successful global companies originating from Finland in this sector that could serve as pilot customers to Finnish SaaS and cloud software industry.

5.2 Total Volumes

To be able to understand the role that cloud software and cloud services can have, one has understand the size of the whole ICT business and of which sector it consists of. The distribution of the total revenues of 2.3 B€ between telecommunications and information technology industries (ICT) is presented in Table 5.3.

Sector	Size	Y-toY growth to 2010
Total	2 300 B€	1.9%
Telecommunications	1 400 B€	2.9%
IT	894 B€	0.4%
IT Services and SW	625 B€	1.0%
SW Industry (Datamonitor)	212 B€ (2009)	

Figure 5.4. Global ICT Market Size, Breakdown and Growth Estimates (EITO, 2010)

As the table tells, over 60 percent of the global ICT markets consist of telecommunications and only below 40 percent of IT. IT is currently dominated by IT Services. According to TeliaSonera experts (Cloud Software, 2010), about half of the telecommunications market consists of services bought by consumers or SME buyers acting like consumers. In IT business, the share of consumer business is not material, and the industry is dominated by business-to-business logic. The two different industry business logics generate two different approaches to cloud based business models in practitioners: IT industry sees cloud transformation as a move from applications and professional services delivered to customer premises to more cost-efficient delivery of the services over the Internet. Telecommunications industry sees cloud as a platform for new value added services that customers use on the Web.

The IT Services and software industry can be further broken down to main segments by vendor function. The results are presented in Table 5.4.

Sector	E2008	F2009	F2010	F2011	F2012	F2013	F2014	CAGR (09-14)
Application Development	109 656	113 677	118 713	124 621	131 827	139 611	147 396	5,3%
Application Integration	98 942	102 278	106 397	111 255	117 170	125 515	133 861	5,5%
Application Management	47 053	48 878	51 436	54 758	59 083	61 825	64 566	5,7%
Application Testing	17 724	19 125	20 850	22 890	25 368	27 869	30 370	9,7%
Desktop Management	66 408	68 113	70 267	72 749	75 641	78 239	80 836	3,5%
Storage	16 615	16 979	17 449	17 997	18 613	19 547	20 481	3,8%
Networks and Communication	76 654	78 716	81 739	85 770	90 637	93 150	95 663	4,0%
Security and Privacy	48 902	54 622	61 425	69 630	79 457	89 796	100 135	12,9%
Application Hosting and Datacenter Services	56 244	57 661	59 460	62 875	66 797	70 455	74 114	5,1%
Services total	**538 198**	**560 049**	**587 737**	**622 544**	**664 593**	**706 008**	**747 422**	**5,9%**
IT Applications	37 128	40 846	44 962	49 522	54 577	-	-	10,1%
Total Size of Software Industry*	303 800	323 547	-	-	-	-	-	6,5%

*Overlaps with IT services

Figure 5.5. IT Service breakdown (in M$) globally (Datamonitor, 2009; Datamonitor, 2009)

As one can see from the Table, the IT industry has already transformed to a services industry, as could also be seen from the Figure 5.1. It is interesting to notice that on application level, the markets for project based application development is larger than the markets for standardized product like, application software by an order of magnitude. The main volume of software industry, selling software licenses and related offering, is in infrastructure, platform and other types of software, not in applications. It is also worth noticing that security and privacy is the fastest growing IT services area. This can be seen as a sign of the increasing use of open networks, especially the Internet, to which the critical corporate applications are nowadays connected and must be protected against the threats.

5.3 Cloud and SaaS

After analysing and understanding the big picture, we can then take a closer on current status of cloud. All the market research companies agree on one thing: the cloud computing and cloud services market is growing fast, 20 percent a year or faster (EITO, 2010; IDC, 2009; Pring et al., 2009;). But the views of the size of the markets differ significantly. IDC (2009) estimates the size of the market to have been $17.4 billion in 2009, whereas Gartner (Pring et al., 2009) estimates that to be $56.3 billion. The reason for the big difference is that IDC looks only at the services following IT business logic, it counts only IT services that the customer pay directly or as part of a larger business process service package. Gartner includes also the services with indirect income, like services based on advertising revenue. Thus Gartner includes also the services that the telecommunications industry originating people see as part of cloud. The biggest difference between IDC and Gartner figures are because of Google's AdWords service that alone had about $ 24 Billion of revenue in 2009. Table 5.5 shows our estimates on the size class of different cloud services based on multiple market research sources.

Sector	Size in 2009	Yearly growth
Cloud Services Total including ad and business process revenue	$50-60 B	20-25%
Ad based services	$30-35 B	20%
Other Business Process Services	$10-15 B	20%
IT Cloud Services	$10-18 B	20-30%
SaaS	$5-9 B	20-25%
IaaS	$3-8 B	25-30%
PaaS	$1-2 B	?

Figure 5.6. Summary View on Cloud Business

If one compares the numbers to the total size of ICT business or IT services business, one can immediately notice that cloud is still a minor part of the total business. The total cloud business is below three percent of the whole ICT business and IT industry cloud services are about two percent of total IT business. But it is interesting to notice that SaaS business is already over ten percent of the size of application business. This indicates that transformation to cloud has been application driven, and now the development is moving to infrastructure and platforms.

The Figure 5 tells the same story about IT cloud growth. It is currently driven by infrastructure services. Even though SaaS services are also growing, they are growing slower than IaaS.

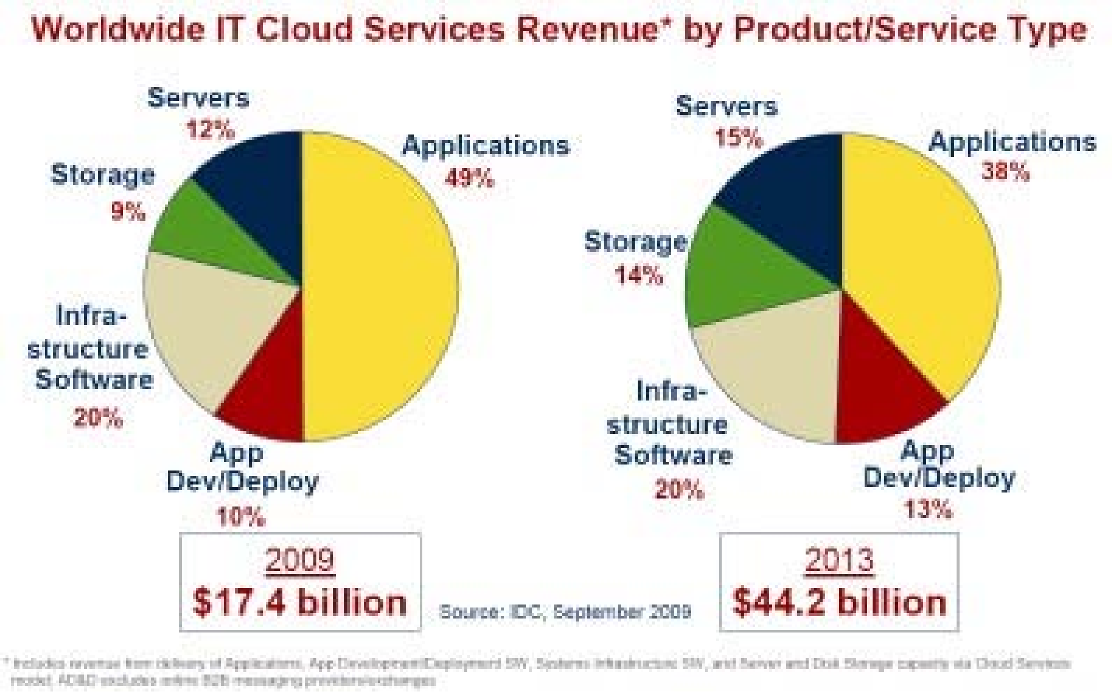

Figure 5.7. IT Cloud Growth Driven by IaaS (IDC, 2009)

Still, the final question is which application areas are most popular in the core cloud area of SaaS. As Figure 5.3 shows, customer relationship management has been the strong area of SaaS. The success of Salesforce may be behind this.

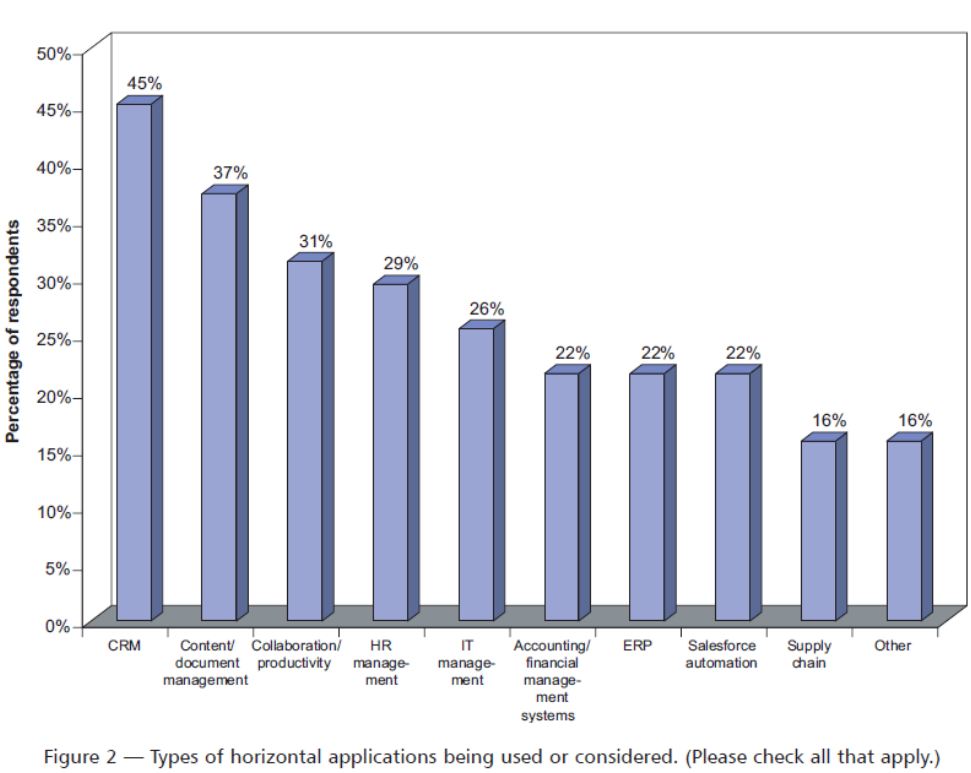

Figure 5.8. Structure of SaaS Business (Kaplan, 2007)

5.4 The Finnish Situation

In general, the situation in adaptation to cloud services in Finland is similar to other European countries. Europe has been following the leading US markets with 12-18 month delay (West & Koenig, 2007). The benefit of being follower is that Europeans have avoided the worst disappointments. There are also a population of European SaaS vendors that exploits the specialties of European markets and the willingness of Europeans to buy from local vendors. This phenomenon is clearly visible, e.g. in Finland, where the leading SaaS providers include multiple Finnish vendors (Ollikainen, 2009).

According to a report produced by European Commission (Schubert et al., 2010), the European role in cloud development is to enhance and expand the cloud systems originating from the USA. The European experts see the European communications carriers as a strength compared to the US situation. In the USA, carriers have only the role of bit movers, whereas European carriers can offer also value added and expertise. In a longer run, this means is a possibility for Europe to become the leader in highly scalable cloud systems and services, but this demands research and product development competencies. Other European business possibilities are (Schubert et al., 2010):

(1) Provisioning and further development of Cloud infrastructures, where in particular telecommunication companies are expected to provide offerings;
(2) Provisioning and advancing cloud platforms, which the telecommunication industry might see as a business opportunity, as well as large IT companies with business in Europe and even large non-IT businesses with hardware not fully utilized.
(3) Enhanced service provisioning and development of meta-services: Europe could and should develop a ‘free market for IT services’ to match those for movement

of goods, services, capital, and skills. Again telecommunication industry could supplement their services as ISPs with extended cloud capabilities;

(4) provision of consultancy to assist businesses to migrate to, and utilize effectively, clouds. This implies also provision of a toolset to assist in analysis and migration.

In Finland, the concept cloud became popular only in 2009, when, e.g. Elisa (2009) could still announce that it will bring cloud services to Finnish markets. During the last 1.5 years, the attention cloud has been getting has been high. The *Cloud Software Program* is one clear example of this.

In 2009, Finns recognized also the big possibility of cloud development for Finland—climate. Thanks to the cold climate of Finland, the operating costs of datacenters are lower here than in the majority of European countries. Less energy is needed to cool down the centers (Jaeger et al., 2009). As an example how this possibility generates business is the decision of Google to build a datacenter in Finland (Tietoviikko, 2009).

Software Business Laboratory of Helsinki University of Technology analyzed the Finnish situation in moving to cloud in its annual software company survey (Rönkkö et al., 2009). Because the survey was aimed at companies regarding themselves as software companies, a large percentage of companies providing services on Web were left out, because the did not consider themselves as software companies. IaaS companies were left out from the survey practically totally. Therefore, the survey concentrated only on SaaS part of the cloud business.

In the survey, it was measured how close a company was to a "pure" SaaS company by five Likert scale questions describing the offering of the company:

- It is used through Web browser (e. g. Lehtonen, 2009)
- It is not tailored separately to each customer
- It does not include a component that needs to be installed in client computer or site
- It does not demand integration or installation work
- The pricing of it based on the real usage of it

Based on the responses, the companies were divided in four clusters. Their relative shares are presented in Figure 5.4.

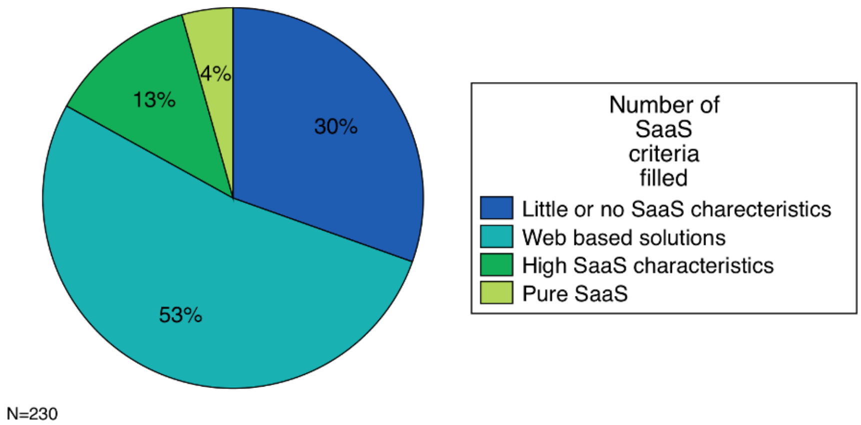

Figure 5.9. The clustering of Finnish software companies based on how SaaS intensive they are

Pure SaaS companies have given the highest score to all questions. Their share of revenues was even smaller than their share of number of companies. The high SaaS companies have given the highest score to all but one of the responses. The Web based solutions group consists of companies with 2-3 responses on positive end of the scale. Mainly the group consists of companies offering tailoring solutions that are hosted by the vendor. This is the most common model currently in the Finnish industry: the established companies in the business have adapted parts of the SaaS model but are stuck to their old products and technologies.

Table 5.6. presents the average characteristics of the three types of companies.

Characteristic	Little SaaS	Web-based solutions	High SaaS	Pure SaaS
Firm Age (years)	12	11	11	8
Total Revenue (M€)	9.6	2.2	1.5	1.2
Personnel	63	22	18	15
Revenue Growth % (median)	10.5	13.8	11.7	29.6
Profitability % (median)	10	7	4.2	4.4
International Revenue %	12.5	20	12.5	45

Figure 5.10. The characteristics of software companies based on their degree of SaaS adaptation

Pure SaaS companies on average are the youngest of the company types. The younger the company, the more probably it is following SaaS practices. This is natural, as younger companies can start building their offering without legacy burden. They currently select SaaS model because it offers more advantages. Companies following SaaS model have also lower revenues and less employees than other companies. This is partly due to their lower age.

Companies with high SaaS degree are growing faster and more international than other companies. This has been achieved partly on the expenses of profitability. They have chosen growth over profitability. SaaS companies seem to have understood the truly global nature of their markets and have started to enter the global marketplace. Still, one has to remember that age and size explain partly the differences in growth speed, smaller and younger companies have it easier to achieve high relative growth rates. If these variables were controlled, the difference in growth rates loses its significance. The controls do not remove the connection between high internationalization and SaaS.

Altogether, the Finnish SaaS industry consists of small, new and growth oriented enterprises. Compared to the total volume of the software or IT services business, the SaaS industry is still small, and no big success stories have emerged.

5.5 Chinese Cloud Computing market

According to rough estimates by Gartner, Chinese business software market will make revenues of $6.2 billion in year 2010, contributing to only three percent of the world's total. A survey by Accenture (2010), including input from 103 IT executives in China, found that only 43 percent of businesses and government organizations are testing or using cloud computing in at least a limited way, and 88 percent will be in two years. However, it is likely that very few will move beyond testing, investigating and private clouds. Whereas 65 percent of US organization are adopting software services, currently only 13 percent of Chinese organizations are using software services. In platform services the adoption figures are 54 percent (US) and 8 percent (China), and in infrastructure services 56 percent (US) and 19 percent (China). Currently, the average spending on Cloud Computing in China as percentage of IT budget is 6.3 percent.

The main reasons for slower adoption are security concerns, missing regulation, and limited in-depth knowledge of cloud computing among Chinese executives. Chinese are expecting government to set the rules for the business, especially regards to cloud security and reliability. Further, the fundamental technical requirements for effective cloud computing are not fully in place in China. While broadband technology is widespread in China, speeds remain low compared to other nations. And compared to foreign companies, Chinese organizations are slower to adopt server virtualization. Chinese organizations that are interested in cloud services have fewer choices than in other countries. Few domestic firms have ventured into cloud computing, and their offerings are primarily focusing on SaaS.

Despite the slow adoption, major research activities are being initiated in mainland China and Taiwan. For instance, Taiwan has launched a Cloud Computing program, including 15 projects and almost 800 million dollars investment for the next five years. Also, large data centers are been built and upgraded by the service providers in PRC and Taiwan, for internal use and for customers. Communication service providers are piloting technologies, and platforms are being developed for application and mobile application developers.

6 User View

by Jussi Autere, Mirja Pulkkinen and Aku Valtakoski

Cloud computing as a term first appeared at the end of the last millennium. NetCentric tried to file an application for registering cloud computing as a trademark (USPTO, 1998). The term started to become more frequently used at the beginning of the 2000s to describe the phenomenon of general decentralization of ICT services. Finally, in 2007-2008, the term became commonly used, when IBM and Google, together with a group of universities stated a broad research program towards the subject (Lohr, 2007).

Even though the proliferation of cloud technologies use has been so far quite slow, cloud computing as a phenomenon is currently entering a phase of rapid growth which is likely to last for 2-3 years. After this growth phase it will become a part of mainstream information technology (Plummer, 2009). The novelty value of cloud technologies is thus vanishing rapidly; in other words, the potential competitive advantage related to their use is disappearing, and the technology is becoming ”business as usual”.

The application of cloud computing technologies has given rise to great expectations in start-up firms and in the pilot projects of large enterprises. Experts are already willing to say that cloud computing has produced undeniable commercial successes and it will become very significant to the ICT industry during the next ten years (Schubert et al., 2010). On the other hand, other experts think that the technology is not yet ready to help large enterprises in their key challenges (McKinsey, 2009). In addition, pursuing cloud computing technologies can divert the attention of IT departments of technologies that could bring significant benefits faster, such as aggressive virtualization of computing resources. However, many of these more specific technologies are related to cloud computing technologies or they are, broadly understood, a part of them (McKinsey, 2009).

During workshop discussions with Software Business Lab researchers and a group of Finnish software firms and infrastructure service providers in the beginning of 2010, it was noted that the following conclusions help to analyze the significance of cloud computing:

- From the customers’ point of view there is no separate SaaS market. Customers are looking for solutions which suit their industry and functional requirements. However, SaaS can be a superior method of delivering these solutions in comparison to traditional methods.
- The scalability of a SaaS solution depends at least in the short term on the PaaS or IaaS solution providers. However, the SaaS provider can take advantage of the customer mindset that scaling solutions increases costs significantly. In the long run, the SaaS software architecture has to become widely compatible with the PaaS and IaaS services. In other words, the SaaS provider has to ”design for scalability”.
- The pricing logic or licensing model are rarely critical success factors for SaaS providers. Much more important are contractual responsibilities, liabilities and

service level agreements (SLAs). This is particularly important when the SaaS provider uses IaaS and PaaS services from its partners.

- The SaaS business model requires much more transparency about how the provided service works and how it has been implemented than in the traditional license-based business model.
- All SaaS offerings are not simple and standardized mass services. Enterprise customers are often ready to pay for software customizations and associated professional services that will provide them direct business benefits. In addition, a software services is only rarely sufficient to meet all enterprise users' needs. Often these offerings are related to some business process that customers might be interested to outsource to the SaaS provider.

6.1 SWOT analysis of SaaS provision

6.1.1 Strengths

The sales of SaaS offerings raised the most interest and comments during the workshops. Sales methods analysis can be started with assessing the benefits, i.e. the strengths of SaaS offering. From the user organizations' point of view, SaaS solutions have the following benefits in comparison to traditional software products (Schubert, 2010; Plummer, 2009):

- Purchases can be financed from operational costs (OPEX) instead of investments
- Functionality has been optimized for basic features that users need, not for all possible features and options
- SaaS minimizes the heterogeneity of software platforms
- SaaS minimizes overhead from running a specific infrastructure and own system maintenance
- Lower total cost of ownership (TCO) in the middle to long term time perspective
- Faster system implementation
- The opportunity to change processes and procedures more efficiently
- The service scales very well, and in best cases nearly limitlessly
- By using SaaS solutions, a firm's dependence on single own device, communication connection or software is reduced, and thus in error situations the ability to assume activities is enhanced.

6.1.2 Weaknesses

However, SaaS business model does also have some problems that need to be communicated to the customer during sales process and whose impact on the customer needs to be decreased (Gartner, 2009):

- Parts of the solution's functionality is always ”under construction”, without any guarantee when it will be available. In addition, the customer is not really able to influence the development schedule of required functionality.
- Software has no asset value, and thus the costs embedded in it cannot be managed in the traditional sense
- Using SaaS solutions is easy, and may make the management of application portfolio more challenging

- Version management is handed over to the SaaS provider, and upgrade to a new software version is often forced
- Tools for expanding and integrating the solution to other systems are often limited
- Provider management difficulties, including service quality and compliance management
- Concerns about information security
- Uncertainty about overall cost of use on the long run
- Difficulties in integration with customers' own locally managed applications and other SaaS applications
- Uncertainty about the sufficient speed of data connections

6.1.3 Opportunities

Several SaaS related value propositions can be found (see Table 6.1). These can be translated to business opportunities of not only the SaaS provider, but also their clients.

A win-win for both the SaaS provider and their client is an upgrading of business processes (reaching at minimum the industry standard level process efficiency by adopting a SaaS system for a business function). The SaaS providers are likely to be after the big bite, large corporations as customers. However, the SMEs may be more interested and the providers could do better adjusting to this type of demand. SaaS is the great opportunity of SMEs in persisting in the global, 24/7 world by enabling them to use corporate level information systems, e.g. CRM and customer care applications.

Table 6.1 Value propositions of Software as a Service (Luoma et al. 2009)

SaaS benefit / value proposition	Reference studies
SaaS requires less resources for installation and maintenance	Greschler & Mangan (2002a), Japan Research Institute (2009), Jacobs (2005), Ammerman (2007), Hayes (2008)
SaaS enables prompt deployment	Greschler & Mangan (2002a), Rovio (2008), Ammerman (2007)
SaaS offers flexibility in case of changing requirements	Greschler & Mangan (2002a), Japan Research Institute (2009)
SaaS scales based on the actual volume	Antila 2008, Jacobs (2005), and the workshop discussions
SaaS has lower costs on hardware and platforms	Greschler & Mangan (2002a), Antila 2008, Japan Research Institute (2009), Jacobs (2005), Hayes 2008
SaaS has more predictable software cost	Jacobs (2005)
SaaS customers are not locked into single license	Jacobs (2005)
SaaS has global reach of services	Hayes (2008), Rovio (2008), Antila (2008), Ammerman (2007)
SaaS offers better service through SLA (compared to EULAs)	Ammerman (2007)
SaaS requires less dedicated IT personnel	Greschler & Mangan (2002a), Rovio (2008), Jacobs (2005), Ammerman (2007), and the workshop discussions
SaaS has lower up-front costs	Greschler & Mangan (2002a), Japan Research Institute (2009), Jacobs (2005)
SaaS impacts as an expense in the income statement rather than in the balance sheet	Rovio (2008), Antila (2008)
SaaS enables customers to use of the latest update and version of the software	Greschler & Mangan (2002a), McCabe (2004), Antila (2008), Ammerman (2007)
SaaS enables benchmarking of processes	Greschler & Mangan (2002a), York 2008, and the workshop discussions
SaaS enables acquiring best practises with low costs	The workshop discussions
SaaS reduces the need for customer training	The workshop discussions
SaaS is provided with backup service and security features from the provider	Greschler & Mangan (2002a), McCabe (2004)
SaaS enables focusing on core competence	Ammerman (2007), Greschler & Mangan (2002a)
SaaS has lower TCO	Greschler & Mangan (2002a), Rovio (2008), Jacobs (2005), Japan Research Institute (2009), and the workshop discussions
SaaS enables reduces dependency on a platform or an equipment	Greschler & Mangan (2002a), McCabe (2004)

6.1.4 Risks

Many of the customers' concerns related to SaaS offerings are often unwarranted. Therefore, proper communication and assessing the customer's needs will make sales process easier in these situations. As indicated by Plummer (2009), most of customers who buy SaaS offerings are either beginners or pragmatists. The beginners are looking for simple basic solutions for point-like needs; in other words, for needs where the practical significance of these concerns is low. These needs can thus be used to establish a foothold in customer organizations. By contrast, pragmatists above all often replace traditional solutions used by isolated business units by SaaS solutions. In this case, the concerns of these business units can be dealt with one at a time.

Customers with concerns in multiple areas are still rare as real buyers, and thus do not determine the success of a software provider. In other words, all SaaS providers do not need to answer all potential customer concerns.

6.1.5 Sales of SaaS offering

During workgroup discussions, the following sales arguments were developed to capture the benefits of SaaS model:

- Ease, effortlessness and reliability
- Scaling of price according to actual use
- Allows focusing on core competences, IT does not require as much attention from actual business
- Delivery speed
- The right decision makers
  - Collaboration between technological and business employees in organizations
- Reduction in investment risk
  - Total costs are known in advance
  - No need for a large initial investment
- Savings in time and money
  - Upgrades, trainings, data security are included on the solution
  - Allows focusing on own core business

In workshops, we also determined practical tools that can be used in sales of SaaS offerings. These include:

- Solutions that improve usability and a very polished user interface. Since the purchase of SaaS software is often determined by the actual users of the software, in comparison to traditional licensed software. This implies that SaaS software should be easy to use also from the sales point of view – good usability will make sales easier.
- Software demonstration and presentation that concretely shows how the software works and its benefits.
- Things that positively affect the buyer's view of the provider, such as web site and screen shots

- Emphasizing security by providing an information security description and document, as well as system documentation and auditing proofs

Suomalainen asiantuntijayritysten toiminnanohjauksen SaaS-palvelua tekevä Severa on esimerkki yrityksestä, joka on tehnyt palvelun käyttöönoton mahdollisimman helpoksi. Yritys tarjoaa maksuttoman 30 päivän koekäyttöajan palvelulle ilman käyttörajoituksia. Näin asiakkaat pääsevät käytännössä toteamaan helpon käyttöönoton ja hyvän käytettävyyden tuotealueella, joilla niiden viestiminen uskottavasti on muuten hankalaa.

- Segmentation and reference customers, which allow the provider to define own global ”niche”; these reference customers should be acquired even for free.
- A return on investment (ROI) calculator for customers
- Comparing SaaS solutions to earlier, traditional IT projects
- Displaying the level of service quality, for example through transparent and robust SLA commitments

In addition to the abovementioned challenges, the common practice of selling solutions directly to business units without the involvement of the IT management creates problems in the sales of SaaS offerings. Bypassing the IT department is likely to cause resistance for change in IT management, which must be mitigated by the SaaS provider. This can be done, for example, by providing arguments to IT department using a ROI calculator, by providing a role in the SaaS solution for IT management by providing one single manageable instance instead of uncontrolled use by business units. If IT management is unwilling or untenable to co-operate, it may be wise to emphasize the IT cost savings enabled by SaaS offerings.

In the pursue of revenue growth, but especially in internationalization, the ability to scale the sales organization is of great importance to a SaaS software firm. One potential method for managing this scaling cost efficiently is to use partner networks. These partners can deal with the sales, distribution and potential customer-specific services required by SaaS offerings.

However, at the beginning of its lifecycle, when the offering is not yet fully productized, the straightforward method of using partners is unlikely to work well. In this case, the software firm must use direct sales and deliver required services by itself. This is necessary since services are often in a key role when acquiring the first reference customers for the SaaS offering. At a later phase, when the product has been standardized and is sellable through a scalable organization, it is often rational to cease own service business to improve scalability, and to let partners provide the services required by customers.

When the channel sales model has started to work, the next challenge for the SaaS software firm is to remain in touch with its customers through the sales channels. However, this is often easier for SaaS firms than for traditional software firms, because there’s always at least a technical connection with the customers. This enables direct communication with customers, and also the analysis of customer behavior at the software level.

6.2 Enterprises

The transition to use virtualized services actually provides the same benefits for large organizations as the use of cloud infrastructure services (McKinsey, 2009). If an organization already buys its data center services from an outside provider, there is in fact no great difference in comparison to cloud computing. In this case, the transition to ”real” cloud computing, where generic services are bought on demand does not require a great change, once the cloud based services become sufficiently cost efficient.

Challenges related to the transition to cloud computing solutions in large organizations include (McKinsey, 2009):

- For large enterprises, the current cloud services are not yet cost efficient enough in comparison to traditional data center services. This is particularly evident as the organization grows in size.
- The technical problems in large organizations arise from the need to change the architecture of current applications when they are moved to cloud. The other technical challenge is information security. In addition, the reliability of cloud services may not yet reach the level of own or outsourced data center services levels.
- On practical level, the implementation of cloud computing services is problematic since business unit and end user expectations may be increased due to cloud computing. Successful cloud computing implementation thus requires effective expectation management.
- The need for IT departments and service providers to adapt new procedures is an organizatorial challenge for cloud computing.

The challenges of implementing cloud services universally in large organizations have lead to their adaptation being limited to independent business units and end users without IT management decision. The IT department is also often unknowledgeable about the purchase of these solutions. For example, in the Market Vision SaaS survey on Finnish large enterprises (Market Vision, 2010), neither international nor Finnish SaaS providers’ applications were listed by IT managers as top applications used in the organization.

The Market Vision study surveyed above all the views of IT managers from large and middle-sized firms on SaaS solution use. They may be completely unaware of the web services bought directly by business units. For example, Digium, reputedly the largest SaaS provider in Finland, was missing from the IT managers’ list. This suggests that decisions concerning the purchase and use of marketing research services provided by Digium are made mainly outside the IT department. In addition, the commonly used Salesforce solution provides further evidence for this view of SaaS purchasing behavior in large organizations. In most cases, the IT management is likely to be unaware what cloud software is used in the organization. In this sense the situation is similar to 1980s, and the way PCs were adopted by large organizations. Back then, new technology diffusion took place through the needs of individual employees, when managers ordered PCs for their personal use.

However, the situation is quickly changing for SaaS markets. According to Gartner (Plummer, 2009) SaaS solutions are rapidly becoming a serious option for the IT requirements of all sizes of firms. Most software providers already have some kind of SaaS alternative for their traditional licensed software. Since SaaS software is currently spreading in firms in an uncontrolled manner, the IT departments should take control of the situation and start to manage the use of SaaS software in their organizations.

6.3 Individuals

User Experience, (ISO 9241-210: "a person's perceptions and responses that result from the use or anticipated use of a product, system or service"). is a relatively new concept to join efforts with different approaches to better design of devices, software and services. It combines Human Computer Interaction (HCI) with Information Architecture (IA) design and more traditional Usability, (including Usefulness) and UI design with interaction design and other human factors engineering. The multiplicity of phenomena together summing to UX can be illustrated as in Figure 6.3.1.

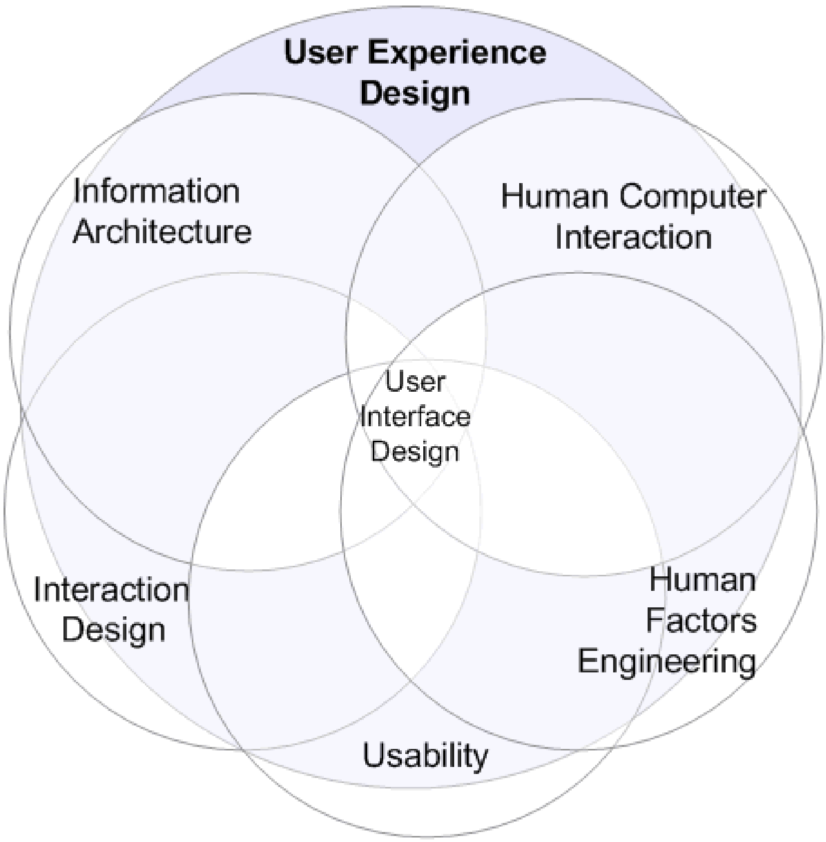

Figure 6.3.1 Components of User Experience (from Montparnas User Experience Blog, by Kimmy Paluch 2006)

Success of cloud services especially in the B2C or end-user market strongly depends on the overall experience of the consumer in using the service. Social platforms have currently caught the attention. However, there are other possible areas in personal information management where cloud services have an opportunity. Factors like information storage and retrieval functionalities as well as ubiquitous availability might become more important after the first enthusiasm with social platforms and diverse messaging functionalities is over. Studies on UX could support the software developers to create persistently successful cloud services both thinking the end-user in a corporate setting, and the private cloud service usage.

The role of user experience is very important for adoption of SaaS solutions as it impacts the behavior of individuals adopting SaaS solutions more than CIOs responsible for acquiring traditional enterprise systems. However, results of the Cloud Software UX team have not yet been integrated to this preliminary report in this early phase of the project.

6.4 The Future of ICT Industry

Even though the servitization of all service and application layers of information technology is slow, and part of end user service is embedded in a device, the evolution of the entire ICT industry towards service production seems inevitable. Software business, internet and telecom provision, as well as device manufacturing are becoming service delivered to create an end user service.

Figure 6.4.1 shows one potential structure for the future ICT industry, suggested by many experts. In this model, the industry would be divided to three layers: the current SaaS layer and the before mentioned IaaS layer. In addition, the model also has a separate PaaS layer which refers to more generic software platform type of services. However, this PaaS layer is clearly the least well developed of the three layers.

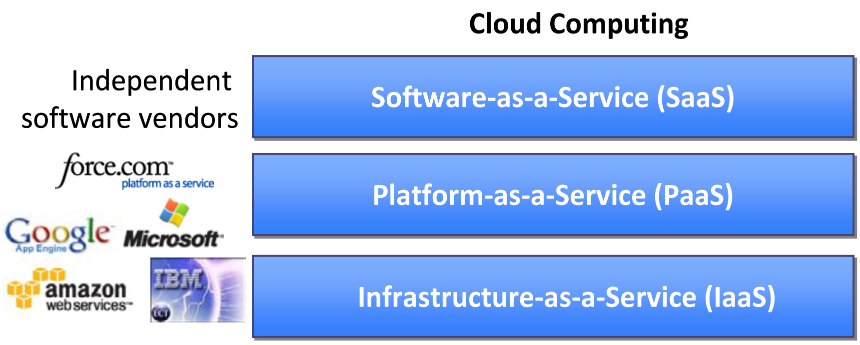

Figure 6.4.1: The three layers of cloud computing

In addition to this basic model, we may analyze another potential future scenario for the ICT industry structure. In Figure 6.4.2, we have depicted another, more detailed vision of the future.

The most significant difference between these two models is that the latter model clearly delineates end user devices and user interfaces as technological layers apart from actual applications. By contrast, the IaaS and PaaS layers of the first model are integrated into one generic software services layer. The detailed model also includes a more technical data center layer beneath these software services that provides only commoditified processor and memory capacity.

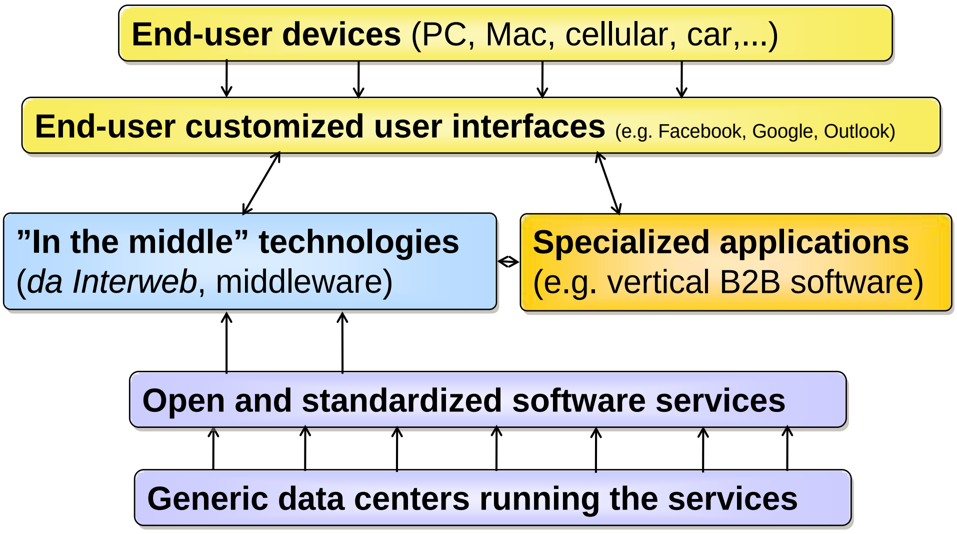

Figure 6.4.2: One possible future model for ICT industry structure

It is enlightening to analyze cloud services also from the perspective of the buyers of these services. Based on interviews with a small number of IT managers large Finnish enterprise firms, and service providers, we may synthesize the view of future IT services structure by cloud service buyers in Figure 6.4.3. According to this customer view, ICT services are divided to three levels: IT infrastructure services, application services and user environment services.

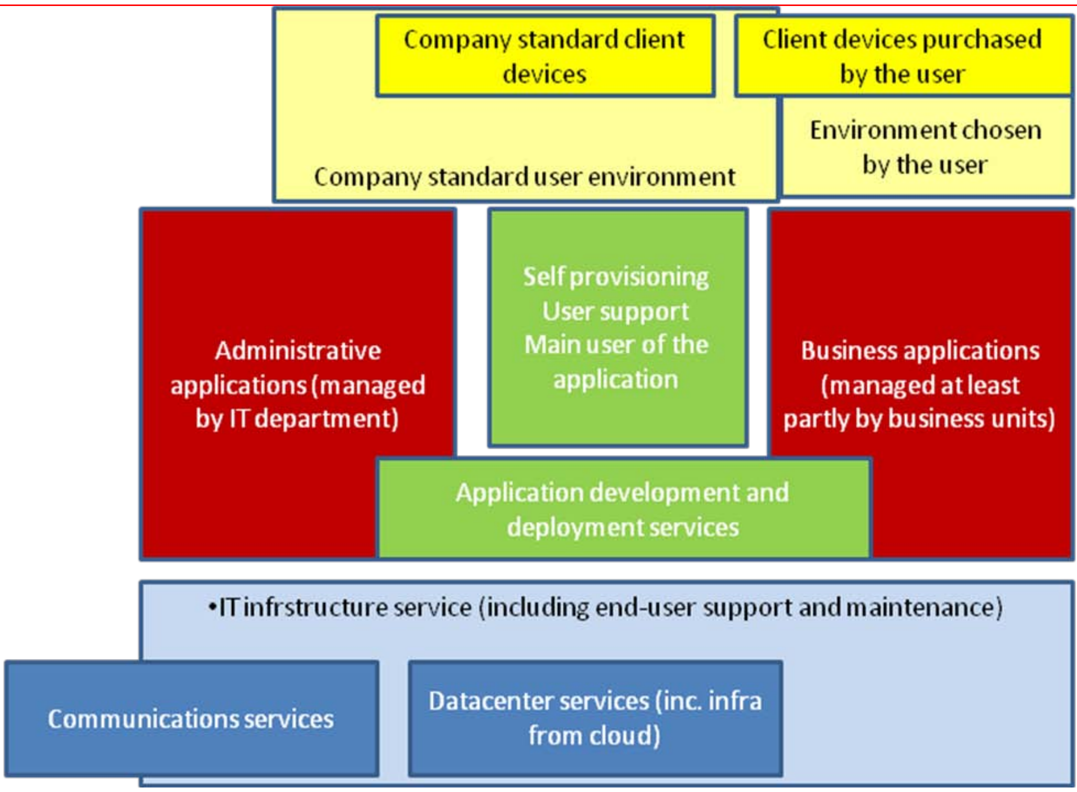

Figure 6.4.3: Customers' perspective on future IT architecture

In comparison to the earlier views on future ICT industry structure from the provider's side, which identified IaaS, PaaS and SaaS services, the above figure is both complementary but also provides some new insights.

First of all, from the customer organizations' point of view, IT infrastructure is becoming an integrated entity that is purchased as a service. This service includes both service software provision and the support and maintenance for all basic applications. From the customers' perspective it is indifferent how the service provider produces these services, as long as the service quality meets contractual levels. In other words, more basic IaaS and data center services are merged to part of the overall IT infrastructure service. In other words, the infrastructure service provider can place the required data center according to its own business logic, for example in Ireland while providing its maintenance from South Africa. Another conclusion from this insight is that most of telecommunication services are also included to this overall infrastructure service offering.

Secondly, from customers' perspective the application service above infrastructure services are clearly divided into three distinctive groups: applications managed by IT department, applications purchased and managed independently by business units, and applications which allow both IT management and business units to manage the services used by the employees.

This third type of applications includes different service login and account management services, application administrative user and provisioning activities, the aggregation of services for each employee, as well as applications which help employees to find and use the desired services. In addition, these applications include tools that the firms' process managers can use to support end users in doing their tasks in the application environment.

Applications managed directly by business units are the area where SaaS solutions are most rapidly becoming common. From the view point of business units and functions, the SaaS model is an easy way to get required applications quickly into use: the application can be tested quickly and efficiently, and to be implemented in small scale without a heavy process. By contrast, change in the applications managed by IT departments is often much slower.

An interesting phenomenon is taking place at the interface of infrastructure and application services. The administrative routines in many firms are quite similar, and the applications used to support them are relatively generic, such as Microsoft Office or e-mail applications. Examples of such routines include invoice and travel expenses management, development conversations and employee imitative management. The implementation of these type of applications has great potential for the exploitation of cloud technologies. It may be that such administrative routine supporting software become a part of the infrastructure services in the way of Microsoft Office maintenance and implementation. Even though they may be traditionally classified as SaaS services, their role commercially is closer to IaaS.

The highest layer consists of end user environments. In this area, two major changes in user logic are taking place. First of all, a strengthening trend is that each employee chooses the devices and use environments which he or she uses for working. The traditional model where the firm provides tools required by the employee is transforming into a model where the laptop computer and smart phone are part of the employee's personality and used to access the services provided by the firm. Well-advised firms actually support this type of arrangement by providing clear procedures; if the use of customized own devices is prohibited, the customers may start to develop their own tweaks to use the services with their devices in the way they want.

Another change in the user environment layer is the merging of client devices as part of an integrated user experience service. Users are no longer interested what phone he or she has, but whether it can access iTunes services or iPhone applications, or whether the device can handle a Microsoft Outlook like user interface.

In the above customer perspective on future IT services it is worth to notice the absence of a separate PaaS layer. This is no wonder, as end user organizations want to buy ready services and applications, and not develop them in-house. In addition, the problem of PaaS is that popular services tend to become parts of the infrastructure services, and on the other hand special services and development tools are not mass service business. Therefore, a separate PaaS layer is likely to be more important to software providers than end users.

The last insight from the customers' view is that the transition towards services models has been the quickest in the user interface layer. Consumer mass software have become nearly fully services, with the exceptions of operating systems and office applications. Thus, end users are starting to consider the characteristics of cloud services, such as flexible choice of service, tool centricity instead of technology centricity and social media features as self-evident. In addition, many new employees have started to request such characteristics from the systems they use in work (Plummer, 2009). In other words, the development of cloud services has thus far been strongly based on consumer and mass user environments.

7 SW Application Provider

by Jussi Autere and Aku Valtakoski

7.1 SWOT Analysis of Application Provider's Business

In McKinsey's (2009) conceptual model SaaS is not directly cloud itself, but rather a service provided through cloud; in other words, it is a cloud service.

The cloud computing paradigm includes a significant amount of new business opportunities and threats. Many analysts and ICT industry players envision that using cloud computing in information technology will cause a revolution similar to the introduction of the Internet and electronic commerce (Buyya et al., 2009). The potential business benefits of cloud technology are considered to include at least the following (McKinsey, 2009):

- Much lower costs
- Faster time-to-market
- Good opportunities to find new sources of value

7.1.1 Strengths

Even though the use of cloud computing is likely to have great business potential, many of the previously suggested visions have lead to unrealistic expectations of its economic significance (McKinsey, 2009). According to McKinsey, cloud computing is nearing on the peak of Gartner's hype cycle. Despite all the hype about colud computing, it is still advisable that actors in the ICT industry are familiar with concepts related to cloud computing and understand how these concepts can affect their business opportunities in the future.

The use of clouds is already rational to many small and middle-sized firms, because cloud technologies enable the buying of standardized basic IT services easily and cost efficiently, without the need for large in-house ICT investments. By contrast, in large enterprises the adoption of cloud technology is slowed by technological, processual and financial barriers (McKinsey, 2009). Users, technology vendors and service providers can, however, adopt a number of measures to ensure that cloud technologies are used successfully – and also to prevent the cloud computing revolution to be stuck in the inevitable disappointment phase (McKinsey, 2009).

The technologies required by providers of cloud and SaaS services are a much broader entity than providing the same applications from a virtualized data centers or buying the services using the ASP model. In particular, in on-demand based service models pricing, usage monitoring and invoicing plays a crucial role. Efficient invoicing requires its own technology. In addition, firms need good knowledge of service provisioning, service providing and distribution throughout the Internet, as well as the capability to produce backups and authentication to customers wherever and however they want it.

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Logic of SaaS business models and investments

There are several reasons for transitioning to a SaaS business model. The most important reasons are *transition to continuous revenue generation, scalability gains and continuous customer relationship.*

In SaaS business model revenues and cash flow are generated continuously from monthly or yearly payments instead of large one-off deals. The fact that revenue is generated continuously implies that the firm has better visibility to the future and improved capability to forecast the future. These factors suggest that firms are better able to plan their activities more reliably, and possibility to make cost savings and financing opportunities, once the scale of the business is sufficiently large. On the other hand, the firm does not generate as much sales up-front than in licensing business model. The financing of the software firm needs to be very solid that the ”death valley” phase can be successfully passed. This valley can be longer in SaaS model.

Correctly planned SaaS service achieves economies of scale. In other words, the marginal production costs are lower than in traditional license-based business. Put differently, the more customers the SaaS software firm has, the lower the average costs per customer becomes. These scale benefits stem from the lack of customer-specific delivery project, there is no need to maintain and support every customer system separately. Due to economies of scale, the customer-specific production costs are lowered as the number of customer grows, while in alternative software business models the production costs remain the same.

The SaaS software firm may leverage these lower marginal costs either in the form of better sales margins or by pricing its offering more aggressively. In the base case the difference in production costs is so large that the entire revenue model can be changed: instead of customers paying monthly for the service, revenues can accrue from advertising, transactions or from the possibility of lowering a larger, for example partner, solution offering.

One important factor affecting the profitability of SaaS software firms is high customer retention: the longer each customer uses the services, the more profitable they are. This logic should guide SaaS firms to take care of their existing customers better than in some traditional software firms, where customers were often left to their own devices after the initial sale. A secondary benefit from keeping existing customers satisfied is that it also improves the firm’s understanding of its customers, better customer satisfaction, and potentially see and react to changes in the competitive environment.

SaaS-toimintamallin myötä innovatiiviselle yritykselle tarjoutuu mahdollisuus sovittaa oma hinnoittelunsa asiakkaan liiketoimintamallin tarpeiden mukaisesti. Suomalainen älytekstiviestipalveluita SaaS-tyyppisenä palveluna (joskin ilman web-käyttöliittymää) toimittava BookIT Oy on kehittänyt lehtikustantajien tarpeisiin oman hinnoittelumallin: BookIT ei veloita ohjelmistonsa käytöstä lisenssimaksuja, ei kuukausimaksuja eikä tekstiviestien käytön mukaan, vaan tuloksen mukaan. Kun kustantaja käyttää BookITin palvelua tilauksen uusintojen tarjoamiseen määräaikaistilaajilleen, BookIT saa maksun jokaisesta uusitusta tilauksesta. Näin BookITin hinnoittelu vastaa puhelinmyyntiyrityksen hinnoittelua.

The potential benefits of SaaS business models also indicate which factors lead to failures of such business. If customer retention is not on a high enough level, the expectations of continuous and foreseeable cash flow, as well as the ability to react due to satisfied customers are not realized. Therefore, the good usability and the use experience of the basic user are often crucial for the feasibility of the business model. If cost savings are not realized during business scaling, the expected profitability is not realized either. Typically the biggest challenge for cost control when scaling business is in sales: as the scale of the business increases the SaaS firm must be able to sell its offering in a way that requires less competence. In practice, this means either a large crowd of direct mass sales, strong market pull generated through marketing, or sales through channels. The inevitability of internationalization for Finnish software firms increases challenges in cost savings, since international sales increases sales costs.

7.1.2 Weaknesses

7.1.3 Opportunities

The most important business opportunity enabled by the new cloud computing architecture, cloud computing and SaaS models is that they lower the entry barrier for new entrants in software markets (Schubert, 2010). The introduction of a completely new services for all potential global users is today relatively cheap, typically requiring investments only in the range of tens of thousands of euros. This is also eased by the lack of need to separate investment in own technical infrastructure. The software service developer can concentrate on its core competence, and try out different new services without taking large risks in investing in product development (Schubert, 2010). SaaS firms only need to deal with challenges of service scaling after the interest and business feasibility of the service have been demonstrated. Even then, the scalability can be seen as a ”happy problem” that actually indicates that the business has passed through its most risky period of development.

Taking the perspective of how Finnish software firms can succeed in the future ICT industry, we can discern at least the following more detailed opportunities in the transition to cloud computing (Autere, 2010):

- *Integrated solutions.* This means combining software and the expertise needed to use it as one integrated offering that the customer can buy as a end-to-end solution. Examples of these type of solutions include payroll, financial management, market and customer behavior analysis services, as well as online games.
- *Data center and provisioning software.* It is likely that Finland will be the location for at least some data centers that serve the European markets. Examples of service providers likely to do this include Google, CSC, Nokia and Ericsson. In the case such centers are realized, Finnish software firms have a home market advantage in developing and delivering tools and solutions to improve the efficiency of such data centers. This could mean different virtualization and optimization software, diverting computing capacity automatically to the cheapest possible location or shutting down unused capacity to reduce energy usage. According to the European Commission, cloud provides business opportunities for telecommunication operators, for example in the form of service provisioning. These opportunities are likely to be available for Finnish operators as well. Specific software is needed in this kind of business, including user account management, administrative user functionality and invoicing.
- *Agile software development methods*. Finnish software development capabilities based on agile development methods and rapid prototyping can be leveraged in quickly developing new services. Cloud computing enables software services to be developed using a model where a prototype is developed quickly. Using this prototype the business potential and functionality of the services are tested in a real use situation. This are is related to SaaS software, and on the other hands to software used by consumers and business units of larger organizations.
- *SME firm software.* Finnish firms are, on the average, quite small in size. In this SME market the SaaS business model may enable cost efficiency. Previously customer specific installations and support can potentially be replaced by a single centralized software, reducing costs and complexity. From the SME customer perspective this allows a cost efficient way of buying the required enterprise software, and lowers the requirement for technical competences in the customer organization. In addition, language and cultural barriers, as well as legislation and regulation are likely to form an advantage for software firms serving the local SME market.
- *Mobile devices*. The traditional strong part of the Finnish ICT industry, mobile technology and software embedded mobile devices can still be used in the future. When mobile devices are turned into client services, where the device and Internet-based service form an uniform whole, the parties building these solutions are likely to buy required technical competences from firms who have already provided services for developing embedded software for mobile devices. In addition to Nokia, expertise on embedded software is likely to be valuable to those players who have little prior experience on end user device software.
- *Consumer markets*. Cloud computing allows the development of applications for relatively small customer segments in a cost efficient way. When combined with rapidly expanding consumer markets, such as Facebook, Google/Android and iTunes/iPhone, these consumer markets present opportunities for Finnish software firms interested in these markets. By using these ready consumer networks software firms can distribute their products extremely fast through

global distribution channels. In principle, this enables rapid growth without large investments in distribution channels.

In summary, cloud computing does offer new business opportunities for Finnish software firms. However, it is important to note that many of these opportunities differ considerably in their business logic from the existing traditional software business models. Those firms currently competing in software industry thus need to embrace themselves for change in time and choose their new position within the future ICT industry structure. In general, the significance of non-software development competences is likely to increase in the future. These competences include consumer marketing and industry-specific expertise. Business based solely on software competences is likely to become increasingly challenging in the future.

In addition to business opportunities, the transition to cloud computing also forms a number of identifiable threats to Finnish software firms. In the following, we discuss some of these threats:

7.1.4 Risks

Even though SaaS as a continuous and type of business is more predictable than traditional license sales, starting and developing business and making product development investments is in fact riskier than in traditional software business. The degree of productization required from SaaS solutions is often considerably higher than for licensed software. In addition, revenue from a customer is not generated immediately after the first sales, but only during 2-4 years. Therefore the time from making investment to capturing revenue from it is lengthened. This makes reducing risks related to the investment more crucial than ever. Some specific risks that need to be considered are

- **Technological uncertainty,** that means uncertainty about the feasibility of the software service in the first place, and whether it will be competitive with the chosen technology. Because uncertainties in the SaaS business model in general are greater than those in traditional software business, the logic of investments directs SaaS investments towards services that contain little or limited technological uncertainty. Projects and investments that contain large technological risks should probably be implemented with traditional business models.
- **Market uncertainty,** that means uncertainty about whether there actually are users for the services that would buy it at a high enough price. This risk is in fact unchanged from traditional software business, but if investment payback time is stretched, predicting how markets evolve will become more difficult. Therefore SaaS investments are made in areas where the market is relatively stable or where rapidly developed prototypes of the services can be quickly sold to a more narrowly defined customer segment.
- **Operative uncertainty,** by which we mean uncertainty about the sufficient competences and process of the software organization to deliver the offering. In this area the SaaS business model often reduces risks at the beginning of business development, as the delivery of the solution becomes more simple. However, in the long run the SaaS model contains challenges: as the systems

evolve, they typically become more complex. This is in contradiction with the basic nature of SaaS software solutions. Furthermore, business using the SaaS model is based more on the partner network management skills than the traditional software business.

The main driving force behind the progress cloud computing is the search for cost savings through centralization of computing resources (Schubert, 2010). Because of this, cloud computing fundamentally is likely to lead to consolidation, where the position of the dominant players will become even more dominant. An increasing part of ICT products and services for both enterprise and consumer customers are acquired in a standardized way from global markets. These markets are dominated by large international actors due to economies of scale. In this world dominated by players such as Microsoft, Orcale, Google and Apple the role of Finnish software industry, consisting mainly of very small firms, is likely to become crushed between these large actors. Because of this, at least the following risks for existing Finnish software firms can be identified (Autere, 2010):

- **Change in vertical software markets.** The role of small, customer-driven vertical software firms is likely to diminish, as customers' ICT needs are increasingly served through standardized cloud services. In this case, solutions based on pure software engineering know-how are inevitably too expensive and also technologically lagging from standardized cloud software. However, this development enables concentration on the development of true industry specific expertise which might provide competitive advantage for software firms. On the other hand, this change also dictates a change towards more professional services type of firm (cf. Total Solutions in opportunities)
- **Lowered demand for software development services.** The business opportunities for firms based on the sales of software development services are likely to be diminished. Due to adoption of cloud computing services, customer IT environments are likely to become increasingly standardized. This implies that need for customer-specific routine software engineering is becoming increasingly rare, as less and less implementation, configuration and integration is needed in customer environments. However, software competences required for system integration will become higher. As software applications are bought from the Internet, this does not reduce the challenges related to integrate enterprise software – quite contrary. This indicates that increasing business opportunities may be related to system integration in the future.
- **Risks of the Nokia ecosystem.** There considerable risks related to the future success of Nokia. If Nokia is unsuccessful in building solutions by combining Internet based user environments and end user devices, the position of Finnish software firms who provide software development subcontracting services to Nokia is likely to become worse. In addition, if Nokia is unable to portray a credible vision of future success, the opportunities of Finnish software firms to act as experts in mobile technologies will be put it to question. This may have a negative impact on the competitiveness of the Finnish software industry.

All in all, the most significant risk for existing Finnish software firms in relation to the threats posed by the proliferation of cloud computing, as in all changes in competitive environment, is being stuck in the past. Cloud computing *will* change the structure of ICT industry. Sticking to the current business models is thus not an option in long run. The common theme in the above threats is exactly the inevitability of change: the previously used and tried business models will become obsolete. Hence, Finnish software firms need to carefully evaluate to which larger software ecosystem they belong to and whether they want to pursue product-based business that contains larger risks or whether they want to develop their firm towards professional services.

Specific risks of SaaS business

The risks related to SaaS business model mentioned in public discussion are fore mostly related to customers' concerns about service reliability and data security. Additional concerns are questions about the ownership of the data recorded in the service and customer's access to the data in problem and changes in provider, as well as how to measure and invoice the usage of the service reliably. All these customer concerns can be summarized with one word: *trust.* If the buyer does not have enough trust in the service provider, the above concerns turn into risks that prohibit the purchase and use of the service in the eyes of the buyer. If sufficient trust exists, these concerns can instead be forgotten.

The real risks in the business of SaaS service providers are elsewhere. During SaaS workshops the following most significant risks were identified on the strategic level:

- SaaS model reduces customer's dependence on one specific service provider, as changing the provider becomes easier and customer has not made as big investments as in the past license-based software. This risk can be mitigated through different contractual and pricing models, as well as differentiating features of the service.
- The transition to SaaS services will change the competitive environment also for those actors who do not themselves move towards SaaS. Due to standardization and simplification of solutions international competition is possible also in markets that previously were relatively protected local markets.
- The payback time for product development investments becomes longer, since the software vendor needs to wait, in addition to the usual death valley of product development, from year to up to three years before getting the same sales from the customers as previously was available immediately through license sales. This risk can be reduced by embracing agile product development models instead of older waterfall models. Instead of making the product complete once and for all, the first version of the software may have weaker scalability and simplified functionality. This can reduce market-related risks in a quicker fashion. This requires that software engineers need to relearn their processes to a great extent, which poses a challenge for the software firm's HR function and training.
- The risks related to technological architecture decisions mad during product development become inevitably more significant, as the payback time from product development investments becomes longer. In addition, the SaaS provider needs to provide the service based on its software and also look after for customers who are committed to older functionality. This gain lengthens the time during which poorly chosen technologies need to be supported and maintained.

- In some cases, the SaaS provider may disrupt the business of a professional services provider. The SaaS software may require the customer organization to adopt a specific process model that the service provider may be unwilling to support. Combining the SaaS solution to a business process outsourcing service may make professional service provider feel threatened

On the operative level, the most significant risks were considered to be the selection and effective management of partner network (PaaS, IaaS, hosting, communications, customer interface, integration). In particular, the risks and problems related to these partners are realized when something goes wrong: if responsibilities and service supply chain have not been properly defined, problems are not likely to be efficiently solved. Correctly chosen network partners support the SaaS provider's business, while wrong partners tend to steal the provider's business. Finnish software firms also still lack much knowledge and understanding about what should be done in-house and what competences should be maintained within the own firm.

The following table summarizes the discussed risks:

Risk type	Risk	Mitigation strategies
Strategic – Market risk	Customer's dependence on the vendor is decreased	1. Binding contract and pricing models 2. Original service features 3. Quick identification of customer needs
	(International) Competition is increased	1. Ensure the competitiveness of own service 2. Quick reaction to customer needs
	Process consultant or process service subcontractor changes from partner to competitor	1. Avoid solutions that are related to one specific process model 2. Combining process service and SaaS as one outsourcing service
Strategic – Technological risk	The payback time of product development investments becomes longer	3. Transition from waterfall model to agile development in product development 4. Prioritize projects with less technological risks
Operative	Dependence on networked partners increases	1. Clear division of roles and communication about them 2. Contractual binding of partners 3. Building partnerships based on mutual trust
	The running of the system is dependent on one critical point or person	1. Identifying critical points and persons in order to remove dependencies

Figure 7.1. Key risks with SaaS business model

Other significant operative risks that were identified are problem points that are potentially formed in systems. In worst case, these problem points may stall the use of the entire service. As systems evolve they often become more complex and their functions are often understood only a few people, in the worst case only one employee. The business of the SaaS vendor may thus become dependent on these technological gurus.

Other noteworthy risks are those related to legislation, for example where data can be stored and what kind of contract models work well. Furthermore, sometimes a challenge is that SaaS business models often impose strict restraints for customers within which it can customize its service. Customers that are used to wide customization of previously licensed software products are not necessary willing to adapt to these constraints.

7.2 Transformation to SaaS Provider

Many existing Finnish software firms are currently considering whether or not, and how they could transition to the SaaS business model from the traditional licensing based model. As discussed in the workshops, this is likely to require changes in multiple areas of the organization:

2. The customer segment for SaaS services is often different than previously licensed software. Typically, the change is towards smaller firms and units. This implies that SaaS solution should have a higher degree of productization and standardization.
3. On technological level changes are likely to be required to the current software so that it can be delivered as a service. Typically the most important change is the increased standardization and simplification of the software so that the service can be produced and maintained efficiently. Sometimes it may be preferable to start from scratch so that the problems of the previous business do not slow down the SaaS business.
4. In terms of the software vendor's basic operations models the most challenging change is the transition from a one-off deals of license sales towards longer term customer relationship based business. This may lead to conflict as there will be two different operating ways in the firm. The problem can be mitigated, for example, by making the SaaS business an independent business unit.
5. A change in required in marketing and sales from product sales to customer relationship management. A change may thus be required to the incentive models of sales personnel. However, this may not be enough, and sometimes new sales personnel may need to be recruited, in particular if the SaaS service is combined with professional or outsourcing service.
6. In production and maintenance the biggest change is the transition from office hours to model where customer requests need to be catered 24/7 throughout the year. To do this, more knowledge is required on the real operational challenges of customers to adapt to these patterns. Otherwise this 24-hour support may become too expensive for small start-up firms. Often the reasonable operational model also requires a change from the typical approach of doing it all in-house towards using partners to deliver services.

7.3 Whole Product

The SaaS model also changes the relationship between software vendor and user in a significant way (Plummer, 2009). In the traditional license sales and project delivery models vendors delivered technology to users who implemented this technology in their organization. By contrast, in the SaaS model service provider sells the service to the user who receives the service. This change means the moving focus from technology and its implementation towards what the service user receives and how good service level the vendor can offer. Good quality from the customer's point of view include the scalability and flexibility of the software in addition to it being available everywhere through Internet.

Key feature of the new business model is that the complexity and technical details related to service provision are hidden from users. This requires that the service user interface is clear and standardized. Behind this interface the service provider can use various ways to produce the service based on its own business logic and seek cost efficiency. In terms of offering and its positioning SaaS often means moving towards cost efficiency.

During workshops the following main components of a SaaS offering were identified:

- **Solution**, that includes the software and user rights, security, integration automation and software upgrades
- **Services**, which includes for example integration services, migration services, user support, technical support, implementation projects, technical consulting, training and business process outsourcing services.

When developing a SaaS software offering, the most important decisions include

- Matching the offering with customer type and organization size, as well as product and market life cycle. Similar to traditional software business, the software vendor needs to match its offering according to target customer segment. It is futile to offer a complex application to small enterprise customers. Furthermore, the optimal offering is likely to differ depending on the firms' lifecycle phase; in the beginning, it may be possible to deliver a customized system, but at some point the offering needs to be standardized. Moreover, in mature markets the significance of various professional and outsourcing services is emphasized.
- Pricing the offering
- Transparency of service production from the viewpoint of the customer. The SaaS vendor needs to provide a clear enough view of how and where the software service used by the customer are produced.
- Practices related to networked business models used for service development and production. In comparison to previous software business, SaaS firms are often more networked since they used partners both as providers of the service as well as resellers of their offering. This networked business poses its own challenges, and software vendors need to make sure that operative processes are clear and coordinated with partners to ensure the service quality of the overall offering.

- How to sell high availability and scaling computing capacity to customers and how to determine SLAs and service quality levels. Scalability in itself forms a business opportunity for software vendors: by productizing a suitable short-term extra computing capacity to customers, it can be sold as an additional service to customers while the actual service is provided by the technical service partner.
- Productizing the entire offering, not only software. In particular in those SaaS firms whose offering includes various professional services productizing the software is not enough to ensure the growth of the business. Software vendor must also productize these professional services so that their scaling is as easy as possible. In addition, productizing the overall solution should be remembered: what is the customer problem that the offered solution solves efficiently?
- The impact of local legislation on SaaS services. This may make it necessary to customize the service to a certain degree for specific markets, and is most prominent for vendors service public sector customers.
- Service localization and translations. SaaS firms who wish to internationalize need to recognize the need to service localization for international markets and take this into consideration in product development.
- Contracts and SLAs. Service contracts related to SaaS services are often more complex than those related to traditional software business, and the responsibility of the service provider are often much greater. Software vendor thus needs to ensure that it has the necessary competences to manage the legal issues related to creation of these contracts.

7.4 Partner Network Management

Managing partner network is an area of business whose significance to small firms in traditional software business has not been too large. Software firms have usually done everything in-house from software development to sales, and their operations have only rarely involved using subcontractors or other partners. If subcontracting has been used it has been done away from the customers' view. In customer deliveries, the software support has been possible to deliver from the software firm, as the problems related to the escalation of software problems from first line helpdesk to software vendor support has taken some time and the problems are rarely critical to the customers' operations.

By contrast, through SaaS models the management of partner networks is becoming a potentially significant source of competitive advantage, as well as source of risks and problems. Customer's operations may depend on the availability of the SaaS service. In this case, problems with used data centres, infrastructure and platform services, as well as data communication are easily visible to the customer.

In this new situation, two types of tools are required to manage partner networks: those based on trust and collaborative relationship, and those based on contracts.

The operations of partner networks are fundamentally based on trust between the different actors: the providers need to know each other, and there needs to exist a relationship which allows the SaaS service provider to trust these other providers to perform. On the other hand, this means that service providers should not be chosen solely based on pricing, but the provider needs to possess a demonstrated capability of providing requested services. In problem situations it often helps to have personal level relationships between partners. People are usually ready to do some extra for people they know.

In addition to pure trust, it is also important to establish a clear and communicated division of responsibilities. All parties should be clear about who is responsible for what and what kind of response times and other commitments partners have made. Having these written down in contracts reduces uncertainty and mutual complains in problem situations.

In SaaS business the software provider needs to commit to the availability and SLA requirements of at least largest customers. To actually provide these service levels, the SaaS vendor is often very much dependent on its service providers' ability to deliver according to contracts. Even though mutual trust is a good grounding for smooth operations, partners need to be contractually bound to be responsible for meeting their commitments, in particular if the SaaS vendor needs to bear payments in problem situations. However, sometimes the partners may not be wiling to commit to the same responsibilities as the SaaS vendor and no substitute partner can be found. In these cases, the situation needs to be acknowledged and if risk is taken, it should be based on a conscious, rational choice.

8 SW Integrator View

By Oleksiy Mazhelis

8.1 Integration Types

The transition to cloud services does not remove the need for software integration. Cloud software may need to communicate to other clouds and/or to on-premise legacy software systems. Besides, cloud software may be represented by a set of interacting layers – including infrastructure, platform, and applications – also demanding integration. Accordingly, several types of cloud software integration can be envisioned:

- Internal: vertical integration of applications, platforms, and infrastructure in private cloud
- Internal: private cloud and on-premise legacy software systems
- External: private cloud to public cloud
- External: in-house legacy software systems to public cloud
- (External: private cloud to external non-cloud applications – not considered)

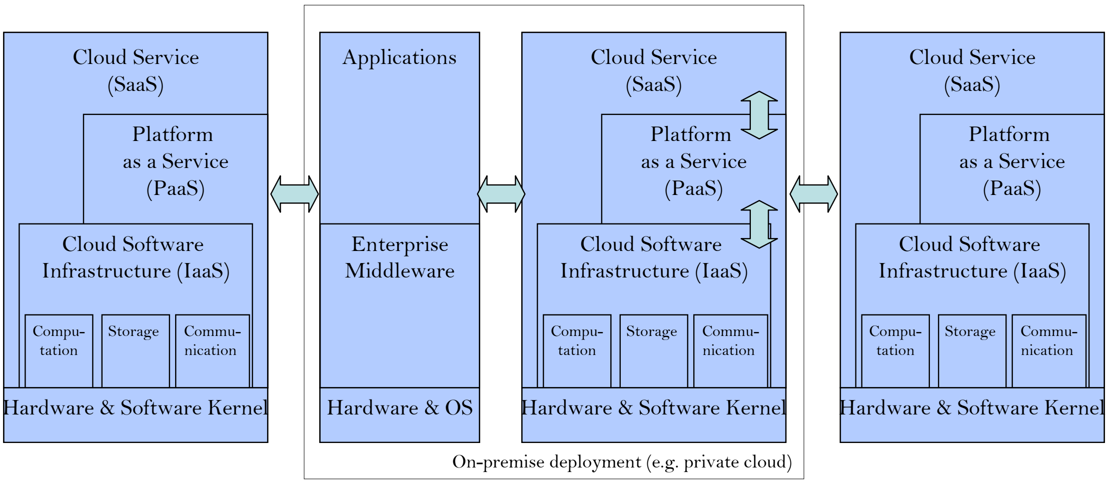

Figure 8.1. Illustration of different types of cloud software integration (the arrows)

Several alternatives to the integration in the cloud are available:

- Integration of independent SaaS services into mash-ups (SaaS-SaaS integration) – can be done either manually or with support of assisting tools e.g. Dapper, Openkapow, RoadRunner, or by using fully automated mash-up tools such as Yahoo Pipes, Intel Mash Maker, Microsoft Popfly, JackBe Presto (Benatallah et al., 2009).
- Platform (PaaS) integration (SaaS-On premise integration) – based on messaging middleware such as CORBA, DCOM, EJB (Dubey et al., 2008).
- Use of integration as a service (INTaaS) where the integration is carried out by using on-demand software residing in the cloud (Lheureux and Malinverno, 2008; Hai and Sakoda 2009).

As evidenced by the IDC Enterprise Panel (2009b) and more recent Forrester study (Herbert et al., 2010), such integration may be associated with challenges. In particular, the last four items in the IDC (see Figure 8.3) list emphasize integration-related issues. They are “lack of interoperability standards"; "bringing back in-house may be difficult", "hard to integrate with in-house IT"; and "not enough ability to customize". In other words, due to the lack of standards and openness (especially in the application platform area – e.g. http://opencloudmanifesto.org/), the customers see it difficult to integrate with cloud service(s) and perceive the risk of being locked into a particular cloud solution as high.

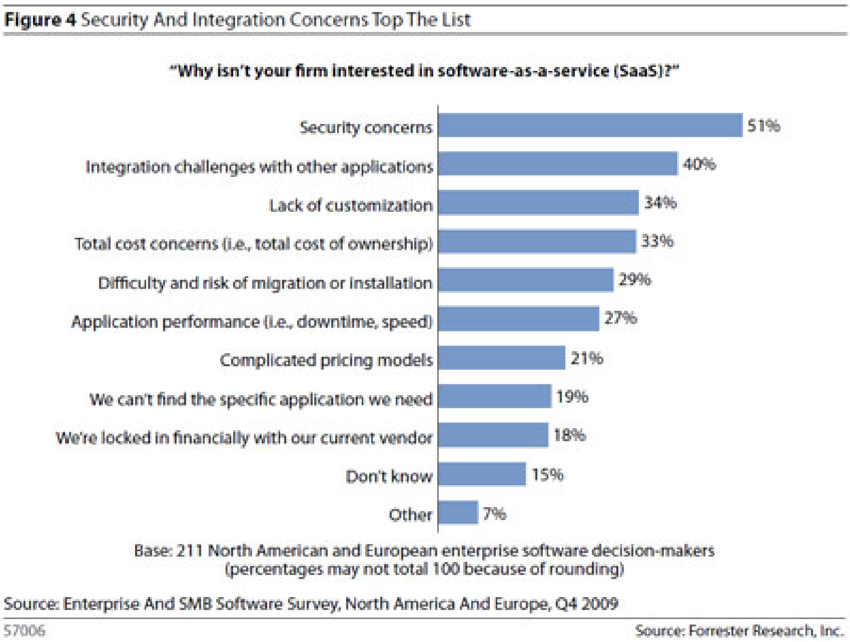

Figure 8.2. Integration considered as a challenge (Wailgum, 2010)

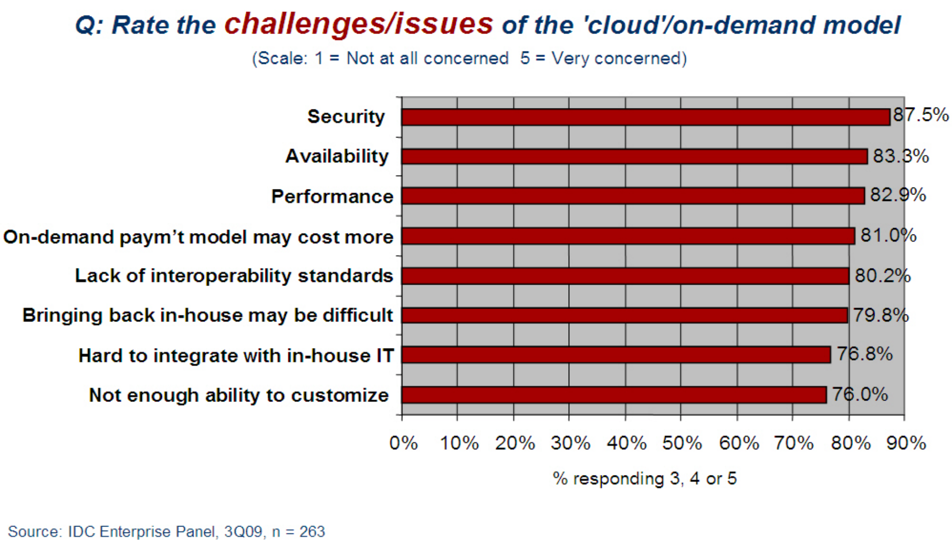

Figure 8.3. Challenges of the cloud (IDC, 2009)

In overcoming the above integration-related challenges, involvement of system integrators (SIs) plays a pivotal role. A number of heterogeneous cloud offerings are competing in the market, and a SI is in the position to combine the knowledge of these offerings. The SI can hence efficiently carry out the integration, whereas learning the offerings and doing the integration by the customers themselves is too difficult and inefficient (time- and cost-wise) due to steep learning curve (Raichura, 2010).

For this, customers have to trust the SIs in judging the strengths/weaknesses of offerings despite aggressive marketing by the cloud service providers. Some anecdotal evidence exists that the customers do trust the SIs seeing them as neutral party. As a result, eventually, the SI power in IT decision making is likely to increase, both when building private clouds and integrating internal systems to external clouds (Damodaran, 2010).

The sustainability of the integration (and hence SI) business depends on the heterogeneity of the cloud offerings and the lack of standard interfaces, plus the need to integrate with legacy IT systems. As pointed by John Madden, “The larger and more complex a customer’s IT infrastructure, the greater the SI’s revenue potential” (Madden, 2009). He maintains that, as the adoption of cloud services proliferates, there will be less and less demand for integrating internal IT systems; meanwhile, SIs still will play an important role in integrating on-premise IT systems and public clouds.

The integration can be as well provided as an on-demand service (Cunningham, 2010), whereby the development and operations of the integration software for both on-premise and cloud systems can be shifted to the cloud.

As compared with public clouds, private clouds are more likely to be used when a tight integration is demanded for critical applications (Lawson, 2009). Because of this, private clouds are expected to bring more revenues than public clouds for the solutions providers, – as a premium is paid for security, manageability and reliability offered by private clouds (Hickey, 2010).

8.2 Standardization efforts

A tool for system integration, but also a competing way of connecting systems is standardization. A lot of scattered standardization activities are ongoing at the moment. By now, no dominant standard, or even a common understanding of where and how to integrate (mash-ups vs. messaging) seems to have emerged. Some of the activities are listed in the tables below.

Organization	**Initiative**	Scope
VMWare	vCloud	API for managing cloud resources
RedHat	Delta Cloud	-- “ --
Zend, GoGrid, IBM, Microsoft, Nirvanix, Rackspace	SimpleCloud	Cloud storage API
Amazon (S3), Nirvanix, Microsoft (Azure), Diomede, Aspen	CloudLoop	-- “ --

Figure 8.4. Vendor initiatives

Organization	Scope
Open Grid Forum (OGF)	APIs for managing cloud resources
Distributed Management Task Force (DMTF)	-- " --
Storage Networking Industry Association (SNIA)	APIs for cloud storage
Open Cloud Consortium (OCC)	Interoperability
Cloud Computing Interoperability Forum (CCIF)	-- " --
Object Management Group (OMG)	Cloud resources modeling
TeleManagement Forum	SLA, provider-seller relationships
OASIS	Identity
Cloud Security Alliance (CSA)	Security
ETSI – TC Grid	Grid computing

Figure 8.5. Standardization bodies/forums

Some further organization involved in cloud related standardization activities include:

- ISO/IEC-JTC1; SC38: Distributed Application Platforms and Services (SOA, WS, Cloud)
- ITU-T: Cloud Computing Focus Group (FG Cloud)
- NIST: Cloud Computing Project; security while using the cloud
- W3C: activities on HTML-5
- IETF: Web-socket, Hypertext-Bidirectional (HyBi) WG
- GICTF: Global Inter-Cloud Technology Forum, Japan

8.3 Cloud Services Integration revenues

Overall, application integration is expected to be a steady growing business owing to the steady growing complexity of the systems being integrated. Following Table 8.3 shows that currently application integration is almost by an order of magnitude larger business than IT cloud services, and they will remain larger business also in the foreseeable future.

Global, in $M	E2008	F2009	F2010	F2011	F2012	F2013	F2014	CAGR (09-14)
Application Integration	98 942	102 278	106 397	111 255	117 170	125 515	133 861	5,5%

Figure 8.6. Application Integration: Market size (Datamonitor, 2009)

In developing markets, such as China, system integration service market exhibits more rapid growth exceeding 10 percent annually, which is divided roughly equally between application development and system integration.

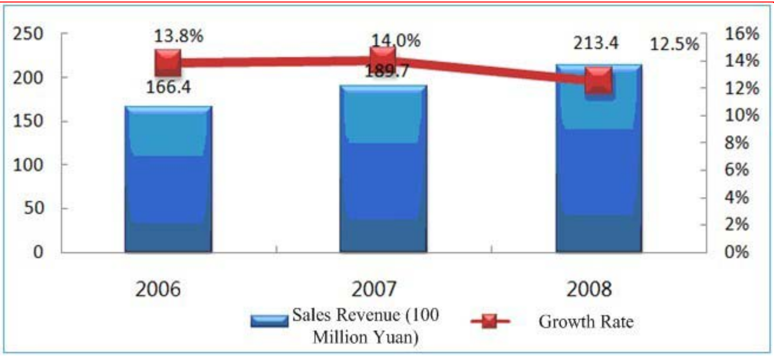

Figure 8.4. China's System Integration Service Market (CCID Consulting, 2009).

McKinsey&Company predicts that by 2012, the SaaS database, development, and integration market together will reach the volumes between $1.5 Billion and $3 Billion. Similarly, Gartner (Pring et al., 2009) predicts that the cloud integration services will reach $1.86 Billion by 2013, with 5 percent CAGR. In relation to the overall cloud services, though, the share of integration services will decline from 3 percent in 2008 to 1 percent in 2013. Apparently, this represents the lowest growth rate among the itemized services in the study, due to rather mature integration and middleware market (Deloitte, 2009).

Year	2008	2009	2010	2011	2012	2013	CAGR (%)
Market size ($ billions)	1.47	1.54	1.62	1.7	1.78	1.86	4.8

Figure 8.7. Cloud Integration Services: Market size (Pring, 2009; Deloitte, 2009)

In relation to the integration in traditional software business, the cloud integration business has significantly smaller volume. Indeed, the software integration revenues on average comprise over 18 percent of total software service revenues, whereas cloud integration revenues represent only 6 percent of the cloud services revenues excluding advertising revenues (see also Table 8.5).

Revenues, in B$	Overall	Cloud
Software services, total	560	23.3*
Integration	102	1.54
Ratio of integration / total SW services	1:5.5 (18%)	1:15 (6%)

* Revenues from advertisements are excluded

Figure 8.8. Total software integration vs. Cloud integration revenues (based on 2009 volumes)

It is important to note, however, that Gartner analysis and the comparison above excludes private clouds, where the integration services are likely to be significantly more demanded as compared to the public clouds. While the adoption of public cloud services gains momentum, the adoption of private cloud is also expected to grow. For the large enterprises (with revenues exceeding $1 Billion), the private clouds may be more cost-effective (Floyer 2010). As a result, 44 percent of respondents to IDC survey (Cohen et al., 2010) indicated they consider a private-cloud option, in agreement with Gartner's

(2009) prediction that through 2012, enterprises will rather invest in private than public clouds. For instance, the number of servers deployed in private clouds is estimated to grow from 122,615 in 2009 to 502,626 by 2014, and the corresponding private cloud server revenue could grow from $8.2 Billion in 2009 $11.8 Billion by 2014.

8.4 Players

Big "private cloud providers in 2010 and beyond" are likely to provide complementary professional software services including integration. These provides are (IDC, 2009a):

- Big IT "platform" suppliers: IBM, HP and Microsoft
- Dystems/service management software suppliers: VMware, CA, BMC, Symantec and Novell
- Major enterprise application suppliers: Oracle and SAP
- Others: Dell, Cisco in partnership with EMC,
- Potentially public cloud leaders: Google and Salesforce.com

A number of companies are focusing on the integration as their main business. Examples of these companies are:

- Supply-chain-related IaaS vendors (Pring et al., 2009): GXS, Sterling Commerce, Inovis
- New companies focusing on integrating internal IT systems and cloud systems (Medford, 2008): Bluewolf, Cast Iron Systems (bought by IBM in May 2010), Boomi, Jitterbit, Hubspan, Pervasive.
- SIs (Mooreland Partners, 2009): Appirio, Astadia, Bluewolf, Cloud Sherpas, Sada
- Data Management & Integration companies (Mooreland Partners, 2009): Akiba, SnapLogic, Xeround

9 Infrastructure Provider View

By Jussi Autere

This chapter is based on open-ended interviews on management of eight companies operating in the infrastructure services providing business (Interviews, 2010). The interviews analyzed their business models, earning logic, development trends and views on environment development regarding the offering and technology.

The interviews revealed that there are two totally different approaches to infrastructure providing in cloud (Interviews, 2010). Firstly, there are the providers of standardized atomic services: computational capacity, storage space, and communications. These pure IaaS providers have the cloud core characteristics: on-demand, network access, resource pooling, rapid elasticity, and measured service (Mell & Grance, 2009). Characteristics and components of IaaS services include (Bhardwaj et al., 2010):

- Utility computing service and billing model.
- Automation of administrative tasks.
- Dynamic scaling.
- Desktop virtualization.
- Policy-based services.
- Internet connectivity.

Secondly, there are existing providers of IT infrastructure service and datacenter based services. The existing datacenters see the virtualization a foundation of cloud and use other cloud technologies as different ways to make datacenters more scalable and flexible, especially through using virtualization technologies (Golden, 2008).

The existing providers of IT infrastructure services to companies have customer relationships as a critical asset and they integrate different infrastructure components to their customers (Interviews, 2010). These integrators can produce the atomic services themselves, but they can also purchase atomistic services from the cloud. Producing infra services in own embedded datacenters is still the dominant model with providers of outsourced infrastructure services, but development towards buying the datacenter based services from separate services provides currently ongoing (Weissmann, 2010).

The producing of atomistic services is also experiencing further division to two horizontal layers. As the increasing demand for datacenter facilities due has become evident, a separate industry, datacenter facilities providers has emerged (Weissmann, 2010). Modern producers of infra services use increasingly those providers instead of building and managing the facilities themselves. The facilities providing companies concentrate on purchasing and renovating the actual buildings, building and managing the electricity supplying systems (about half of the total costs of facilities), ventilation and cooling systems, physical access control, and physical security. This kind of facilities management has become a separate field of expertise from traditional office building management (Rubens, 2007). They would also be investing and managing communications fibers, but traditional business model bound incumbent telecom carriers have not been ready to accept this model, as they consider fiber and copper infrastructure to be part of their core strategic resources.

The driving force behind the development towards the separation of business models in physical infrastructure providing and ICT equipment producing ICT infrastructure services is their totally different investment logic (Tornianen et al., 2010). Active ICT equipment has a typical economic lifetime of five years and the equipment has almost no recycling value only after a couple of years. This means that the financing of such systems is strictly bound to the free cash flow generating capability of business models of the users of the systems. The financing possibilities are VC or private equity investments in businesses using the equipment or leasing or loan agreements, where the success potential of the user's business model is crucial in the financing decision. In facilities, the lifespan of the building investment is in the range of 30 years and the lifespan of electricity supply system and other active technology is about ten years. The value of the property remains the same independent of the user. If one user defaults, the same facility can be rented to another user. This gives possibilities to aggressive leveraging or attracts investors searching long term safe targets. In modern investment markets, especially after the financial crisis, investors prefer such targets that easy to categorize and the risk is transparent. Thus they would rather invest in either facility or datacenter operator, not in a combination of those two.

Another reason to separation of facilities and datacenter operating business is the operational efficiency in renovating datacenter facilities. The upgrading of electricity supplying and cooling systems happens multiple times during the lifespan of datacenter building. It is significantly more cost efficient and less disturbing to the services production to upgrade one building altogether at the same time, when there is no services production in the same physical facility, than to renovate parts of datacenter that provides production services (Mäenpää, 2010). When a datacenter operator manages its own facilities, it usually has not such a wide portfolio of spaces that it can close down one facility altogether in time. Specialized companies having a large portfolio of facilities can plan and allocate space more efficiently. Naturally, the largest players in the business, especially Google and Amazon, have sufficient own facility portfolio, but most other actors do not.

The horizontal structure towards which infrastructure services providing seems to be developing is presented in the Figure 9.1. The development towards the horizontalized structure is clear in IT services field. But in communications services, the pattern is not clear. In general, the carriers, especially network operators, both fixed line as well as mobile, regard the owning and managing physical facilities, including base station locations as part of their core assets. In general, they are also not facing the same financing related driving force to separate businesses with different investment life spans. They either have over supply of financial resources in their balances sheets, or can rise efficiently funding to a vertically integrated operation. Even providing communications solutions to enterprises that otherwise have centralized their infrastructure services providing to a very limited number of service integrators, they sell their services past these integrators (Interviews, 2010).

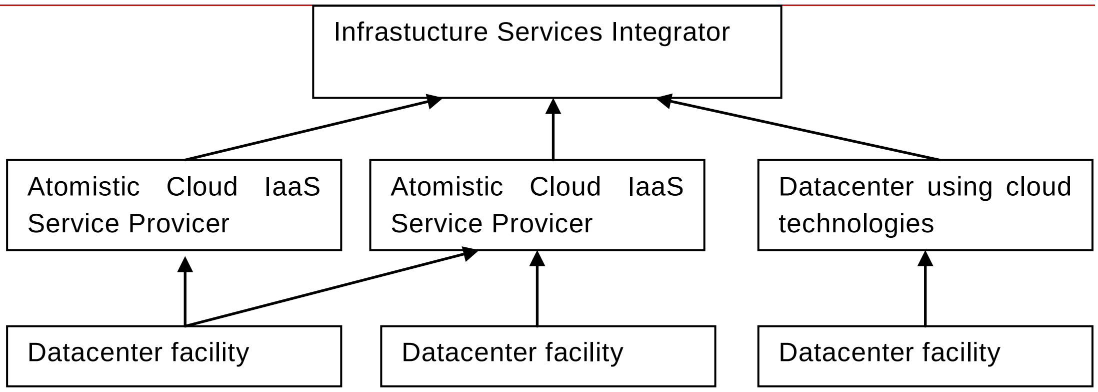

Figure 9.1. Structure towards which the infrastructure services are developing to

The infrastructure services are increasingly used not only for basic productivity tool platform, but also as the basis for application providing (Interviews, 2010). Application software is built by using infrastructure services, not by building them in development systems and installing them to dedicated servers (Autere et al., 2010). This means that the need is increasing to define and standardize interfaces that SaaS and PaaS providers can use to use infrastructure. At the same time the infra services horizontalization means that the traditional approach to serving application builders: provide them hosting collocation and physical access to their hosted servers, is decreasingly feasible (Autere et al., 2010). The services that software services provides can use from the infra provider must be limited and well defined. This means that the IT hardware layer must be virtualized to the software developers.

The dependency of software companies on infrastructure providers becomes a critical issue, as the traditional software license providers are replaced by companies providing time critical application services (Autere et al., 2010). Their capability to deliver services 24 hours a day, 7 days a week affects the operations of their clients. The clients demand services level agreements (SLA) from SaaS providers to make sure that their vendor will meet the delivery requirements. Software services production is based on services produced by infrastructure services providers. This means that application providers want to pass their SLA liabilities to infrastructure services providers in a formal way. Therefore infrastructure services providers are facing increasing demanding services level agreements. To be able to cope with this demand, the companies have to use systematic processes in key services producing areas, and not only to use, but they have to be able to prove that they are using them. This means increasing pressure to adopt formal IT process management standards like ITIL.

10 Mobile View

By Antero Juntunen and Yrjö Raivio

Mobile Cloud or Mobile Cloud Computing is a new term that does not have yet stable definition. Tivit's Flexible Services deliverable defines it as such: "Mobile cloud computing (MCC) can be defined as using cloud computing principles to deliver applications and services for mobile devices" (Juntunen, 2010). Basically Mobile Cloud can refer to – at least – three things (FinNode, 2010):

1. Access method from mobile to fixed cloud
2. Enabler for new services utilizing the benefits of mobile devices and a cloud
3. Adhoc cloud, where mobiles provide cloud services for each other

According to ABI Research, the number of global Mobile Cloud Computing subscribers will increase from the current number, 42.8 Million to 998 Million by year 2014 (ABIResearch, 2009). A total representative revenue opportunity would be then $20 Billion. ABI research continues that the main mobile cloud computing applications include document sharing, calendar and sales management applications. Similarly, Juniper Research predicts that the mobile cloud computing market will rise from just over $400 Million in 2009 to nearly $9.5 Billion in 2014 (Juniper Research, 2010).

Relating to the first option and partly also for the second, one of the most traditional proposals has been to utilize so called thin clients with cloud infrastructures. Processor power critical applications such as voice translation or image, voice and video recognition could be run in a network, instead of a mobile. Also for security and usability reasons, network storage is an interesting alternative for terminal storage. These questions form also an energy optimization formula, where computing can be taken in a terminal or a network depending on the case. The transmission cost must surely be taken into account. Thin clients can refer also to machine-to-machine (M2M) services that utilize Mobile Clouds. Number of M2M devices will increase rapidly in smart meters, security systems, sensors and healthcare applications. All these devices can be access on-demand the network capabilities offered by Mobile Cloud.

The second angle for Mobile Cloud Computing area will be found from telecom network capabilities that will be offered through cloud platforms to enhance the original cloud services. For an example, operators can offer messaging, payment and location services for the cloud services. This approach has been called Telco 2.0 (STL Partners, 2008), Network as a Service (NaaS) (Aepona, 2010) or Open Telco (Raivio et al., 2009). To be successful, operators need to build brokers or Cross-network Service Providers (CNSPs) to provide a coherent view on network resources. With cross-network availability of all network capabilities and of payment services, operators can create a similar market that has grown on text messages. This scenario is reviewed deeper in the following subchapters.

The third Mobile Cloud Computing definition refers to the idea that even mobiles themselves can offer cloud services to other mobiles. This idea is close to the old Mobile Peer-to-Peer (MP2P) approach where mobiles could – for an example – fetch MP3s from neighbouring wireless devices. Mobiles can form an adhoc cloud where the communication method can be built on short term radios, WLAN or cellular networks. These networks can also act in a hybrid mode where content is search from mobile and fixed clouds.

10.1 Open Telco

Until today most telecom operators have been very profitable, although the average revenue per subscriber (ARPU) has steadily declined (Breed, 2009; Hatton, 2003). Voice and data are the main revenue sources for most operators. On the mobile side, text messages have been the primary data application, while on the fixed area Internet connectivity has gained more and more position in the balance sheets. New service innovations have been rare.

Originally, telecommunication networks have been designed for closed communities, partly due to security but also due to control requirements. However, the situation is slowly changing: openness and open innovation are the new paradigms. Large internet service providers (ISP), such as Apple, Google, Amazon, Flickr and Yahoo have already utilized open innovation for a long time. It seems that there is an element of openness in the creation of new innovations in communications. Thus, one of the main reasons for the modest success may have been the closed strategy of telecommunications carriers. Also carriers can benefit from open innovation. Among others, one idea is to offer open interfaces to application developers. This approach sounds simple, but there are critical questions to be answered, before the success stories of Apple and Google can be duplicated into the telecom space. Technology, business models, privacy and user experience are examples of the challenges to be solved.

The open telecommunication APIs (Application Programming Interface) may provide new and interesting opportunities for the Finnish ICT industry. As a part of the cloud computing infrastructure and with a help of other APIs, open telecommunication APIs, such as location, messaging, payment and profile, can enable totally new business ideas, called mash-ups. New innovations can only be created in a close relationship with developer communities. It is essential to receive instant and direct feedback from developers and end users themselves. Both the API technologies and features must be tested through repeated experimentations (Gaynor, 2003). On technology and business wise, open APIs shorten service innovation cycle and create internationally competitive service products around the new cloud ecosystem.

The planned process of supporting the creation of new services inside the Cloud Software program is described in Figure 10.1.

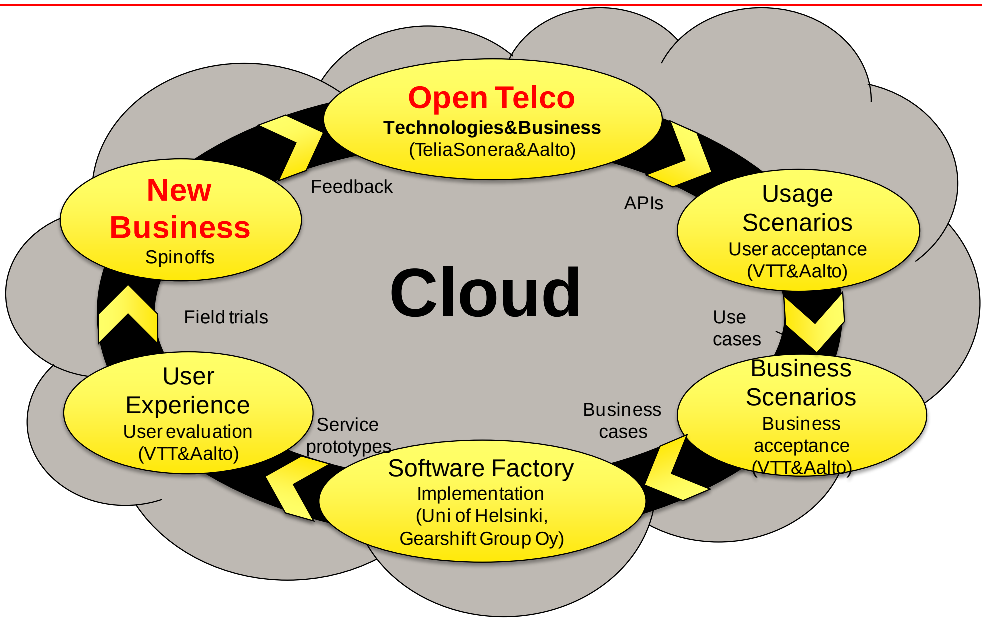

Figure 10.1. Open Telco process

On the Internet, open Web APIs have already been widely available for a long time. By the end of May 2010, the number of APIs exceeded over 2000 and different mashups over 4000 (Shuen, 2008). For the Internet-related businesses, open APIs are often an essential part of the core business. Open APIs are key functions of the Web 2.0 paradigm (Shuen, 2008), accelerating service creation and innovation, attracting developers and end users, creating stickiness, and adding additional features for the main business. As such, open APIs seldom bring any direct revenues, but their financial impacts are indirect.

In the telecommunication industry, the situation has been very different and open APIs have been rare. On the contrary, operators have preferred the walled garden approach, where data has been strictly available only for their own purposes. Certain operators have opted totally opposite alternative called an open model or a bit pipe. In this other extreme operator just offers the transport without any value added services. However, both these options have challenges. The walled garden model severely restricts the innovation. On the other hand, in an open model operator looses the control, and eventually, profitability will decline. The optimal solution can be sought from the compromise, a hybrid model. See Figure 10.2. Open Telco is one example of hybrid components that utilize operator assets through the optimal manner.

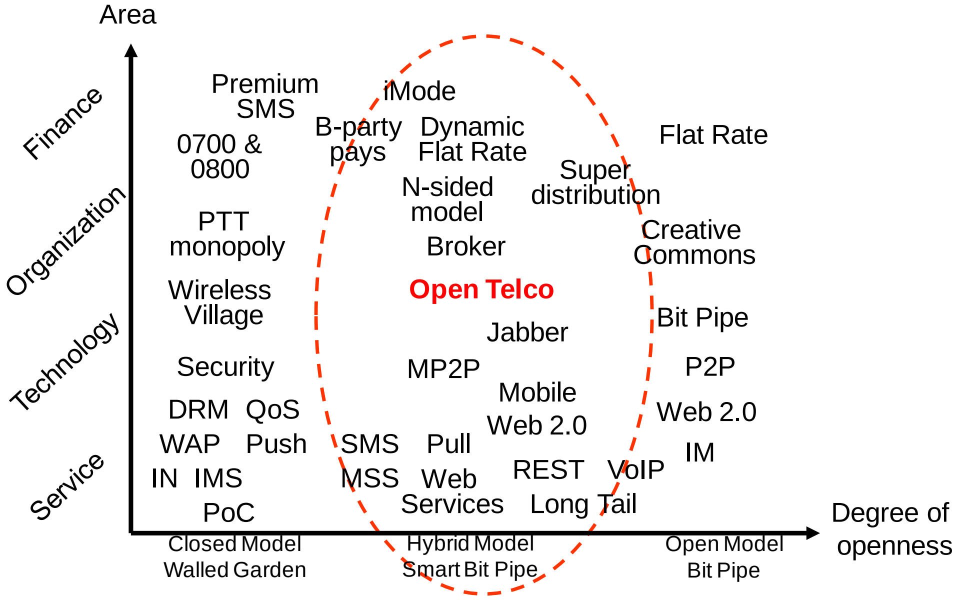

Figure 10.2. Hybrid model

Both the operators themselves (Lomas, 2008) and external observers (O'Reilly, 2007) have commented that operators should open their assets for the developers. As a result, many mobile operators have started developer trials to test out new possibilities on the openness arena. The most extensive trials can, for example, be found from BT Ribbit, Vodafone Betavine, O2 Litmus and Orange Partner. The most common APIs are related to messaging, but other APIs vary considerably. This fact creates a problem for developers, because a service developed for one operator will not work with another operator due to different APIs and processes. GSMA, the umbrella organization for GSM mobile operators, realized this challenge and started a standardization activity to harmonize the most common APIs (GSMA, 2010).

An obvious question is, why the operators have been so reluctant to open their assets and why they would open them now. There are various reasons, but strict regulation is clearly one of them. Privacy and telephony are extremely sensitive topics and operators have been reluctant to move in this direction. On the other hand, so far there has been no customer pressure for opening the APIs, but due to the internet competition, the situation is changing rapidly. A lack of common standards and procedures has also been mentioned as a show stopper. However, the main reason for the low operator interest has been the financial factor. The mobile operators especially have been and still are very profitable compared to the Internet competitors. Basic voice and text message services bring steady income without a need for major investments. When the market uncertainty (variance) is low, the relative benefit of different experiments is low. The positive financial momentum of open APIs is very difficult to prove. n parallel, building the successful developer community needs considerable amount of work, requiring skills which operators normally do not have.

Cloud business is in the focus of this deliverable. Cloud computing and openness is a natural combination. Clouds are available through the Internet, and thus the resources can be easily opened for any user. Cloud computing provides an interesting business ecosystem around open interfaces. In a multi-operator environment open interfaces are virtually available through the Internet, hiding physical addresses from the developers. This way Open Telco creates a global business environment that enables new business models for operators, content creators, developers, advertisers and end users. There are several standardization initiatives and trials ongoing for harmonizing the fragmented field. The report presents the latest development on the area, concentrating in GSMA's OneAPI initiative that is the leading project at the moment. However, unlike GSMA, this report will not exclude other telecommunication networks either.

10.2 Network as a Service

Aepona (2010) is calling Open Telco Mobile Cloud and Network as a Service (NaaS). Mobile Cloud includes a coherent Cross Network Service Provider (CNSP) that is also known as broker. Carrier (also known as operators) resources are available for service providers through CNSP as NaaS. Furthermore, service providers can offer their services for other PaaS (Platform as a Service) or SaaS (Software as a Service) companies as PaaS APIs. Finally, enterprises and end users are customers of the SaaS and PaaS providers. In certain cases enterprises and end users can also directly access the mobile cloud. The described architecture opens two new players on the ecosystem: operators offering NaaS services, and CNSPs proving a coherent access on operator resources by simultaneously creating the mobile cloud. See Figure 10.3 for more details.

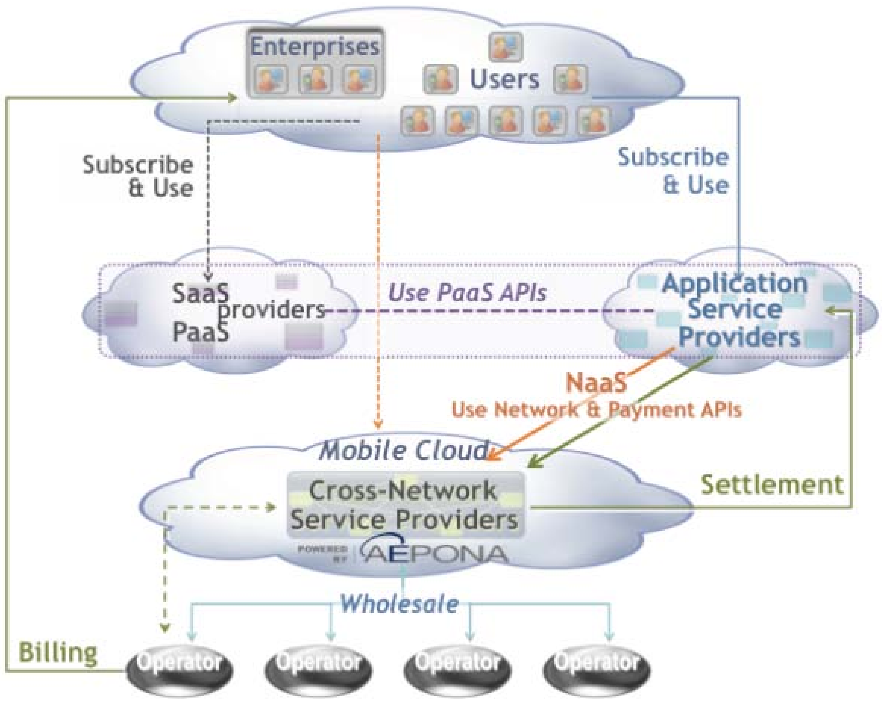

Figure 10.3. Mobile Cloud Computing ecosystem (Aepona, 2010)

Aepona (2010) claims that payment API will be one of the most interesting services for ASPs. Especially, the 'Bill-on Behalf-of' (BoBo) capability, making it possible to charge goods and services via phone accounts should attract ASPs. However, like in Finland, the regulation and requirements for generic money transfer can prevent innovative payment solutions. Payment services also create a comprehensive list of new requirements for operators, unless they outsource the service for a CNSP. Aepona (2010) lists the following requirements:

- Who pays (e.g. enterprise or user);
- Bulk payments versus pay per use;
- Different settlement terms (revenue share);
- Recurrent subscriptions;
- Advice of charge and mandating payments;
- Tax considerations;
- Refund policy
- Incentives

10.3 Pricing

Whether the type of connection is fixed-line or mobile Internet, ordinary users are often incapable of assessing how much bandwidth they are using. Subscription rates based on transferred megabytes make people very careful about how much they are using mobile Internet. In addition, there is always the fear of some application inadvertently using excessive amounts of network bandwidth causing a large phone bill for the user. Since carriers have introduced flat rate pricing models for their mobile Internet connections, the adoption of these connections has increased exponentially. We see that the flat rate pricing is a prerequisite for the future success of mobile cloud applications. However, in some regions flat rate pricing may have increased mobile broadband adoption a bit too much and caused congestion in the network traffic which is harmful for mobile cloud applications. There may be a need for additional pricing models such as the dynamic flat rate model which would offer consumers protection from too high phone bills but at the same time discourage excessive bandwidth hogs such as heavy P2P users. With dynamic flat rate, the monthly fee rises in a few steps if the user consumes too much bandwidth in a month, although the average cost per bit for the user decreases with the increasing usage.

High international roaming fees can be an obstacle to wider adaptation of mobile cloud applications. As mobile cloud applications can consume large amounts of network bandwidth, high data transfer tariffs prevent users from using these applications abroad in fear of excessive bills. If users cannot trust their applications to function abroad it will definitely have a negative effect on adoption of cloud applications. Especially companies whose employees travel a lot may think twice about the financial consequences before adopting mobile cloud services. Moreover, many of the most promising mobile applications would be especially useful to tourists or other travelers.

At least on a European level, there have been efforts to limit international roaming fees charged by the operators. In 2009, the European parliament voted to impose caps on retail SMS rates and data roaming fees inside Europe. Data rates were capped to 1 €/MB as of July 1st 2009 and falling to 0.5 €/MB as of July 1st 2011. These rates are still considerably higher than the flat rate prices that operators offer domestically but are a step towards the right direction (European Parliament, 2009). (Juntunen et al., 2010)

10.4 Value network

This chapter examines an example of a generic mobile cloud value network. The analysis is based on example of a generic structure (Figure 10.4) presented by Juntunen et al. (2010).

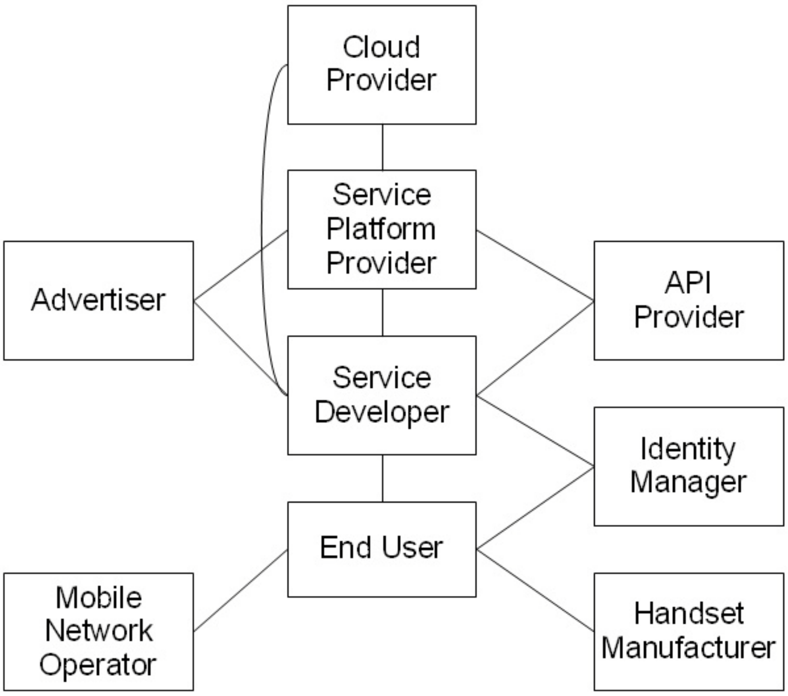

Figure 10.4. An example of a generic mobile cloud value network.

A *Service Platform Provider* is responsible for hosting the platform used for creating services, including the Service Composer and XIDE tools. It is also likely to play a broker role between different parties such as between the service developers and advertisers. Cloud Providers may provide the infrastructure used for hosting services, but they can also extend their services and function as Service Platform Providers.

API Providers consist of third-party services such as Google Maps, Flickr, or MNOs, the APIs of which can be used by Service Developers. API Providers may also function purely as data providers, allowing service developers to use their data in (mashup) services.

Mobile Network Operators (MNOs) provide, at minimum, the end user with access to cloud-based services. However, they can fulfill several other roles as well, such as providing open APIs to developers and functioning as Identity Managers or even as Service Platform Providers.

Identity Managers are responsible for externally managing issues such as authentication and authorization for other parties. Likely actors seeking to fulfill the role are banks, who provide the widely used TUPAS authentication service in Finland and MNOs, who are promoting their SIM card -based mobile authentication.

Service Developers use the Service Platform tools to create the services for end users, or service components used by other developers.

There are multiple possible revenue models for the actors (Juntunen et, al., 2010):

1. In the application store revenue model, a service platform provider allows service developers to create services or applications, but retains a considerable amount of control over these applications. The service platform provider controls the channel through which the applications are sold, mediates all finance transactions, and may restrict the types of applications that can be offered to the customers. In addition, the service platform provider is likely to receive a share of the revenues the service developers receive from selling the applications. A typical example of this business model is Apple's AppStore, the success of which has inspired numerous imitators, such as Nokia's Ovi Store, Microsoft's Windows Marketplace for Mobile, and Google's Android Market.
2. In the PaaS model, the service platform provider allows the service developers to sell their services without restrictions and only charges for providing the tools and hosting the platform necessary for developing and running these services.
3. In the broker revenue model, an actor such as a service platform provider acts as an intermediary, or broker, between two other actors functioning as buyers or sellers. For example, with AdSense, Google acts as a broker between the buyers and sellers of advertisement space.
4. The API provision revenue model involves an API Provider, who charges a fee from the developers using its APIs. One way of structuring this fee is by monitoring the API traffic and charging the developers based on their API usage.
5. Alternatively, API Providers may receive revenue through advertisement or affiliate revenue sharing. In the advertisement revenue sharing revenue model, the API Provider may control the advertisements used by the services utilizing its APIs and receives a share of the advertisement revenues. In the affiliate revenue sharing model, the service utilizing the API Provider's APIs directs traffic to the API Provider's site, increasing the API Provider's revenue. The API Provider then compensates this affiliate site with a portion of the revenues earned.
6. In handset and service bundling, the handset is sold as a bundle with certain cloud-based services. Thus, the handset manufacturer is able to increase the value of the handset to the end user by including desirable services in the bundle, whereas the service developers may find this a good way to gain visibility for their services as well as an easier method of monetizing their service.
7. Subscription and service bundling is similar to handset and service bundling, with the MNOs bundling certain services with a mobile subscription.

10.5 Brokering

Mobile Cloud value network can include also a broker for guaranteeing a coherent view on multi-operator network resources. Brokering can be called N- or two-sided business model. It differs from a traditional one-sided business model in that sense that revenues can be collected from various directions. Operators are used to one-sided business models, where money flows just from subscribers towards the service providers. In the broker model revenue streams are more complicated and can flow from and between various entities. The broker business model is shown in Figure 10.5.

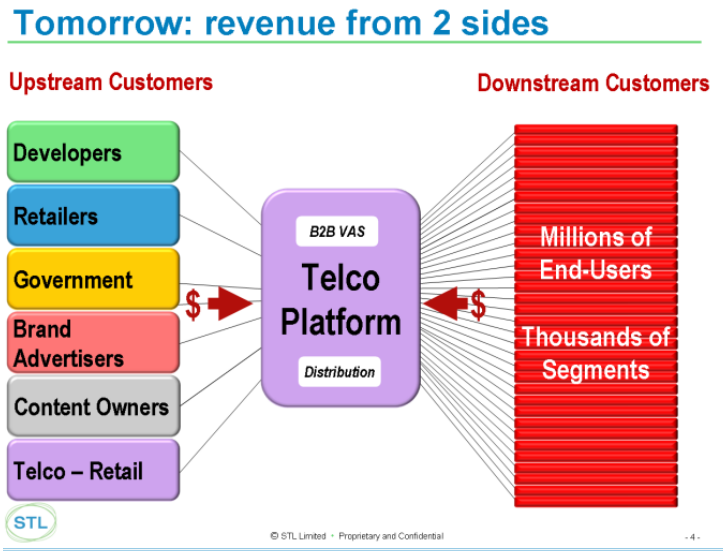

Figure 10.5. Two-sided business model (STL Partners, 2008)

The broker enables rich set of revenue models for any participant. The Web 2.0 domain has applied six different revenue models: Subscription, Advertising, Transaction, Volume, Licensing and Sponsorship. We could also add the seventh one, Free. It is very effectively used in conjunction with the subscription and advertising revenue models in various Web 2.0 services. This model can be called Freemium, combining the words Free and Premium. Free access is the key to accelerate the positive momentum of the network effect. It will sooner or later increase the demand for chargeable premium services. Mobile operators could easily invent very interesting advanced features for their premium customers.

The broker concept can create win-win case for all players. Operators can concentrate on their main businesses, e.g. connectivity and customer care. The broker will accelerate content creation, increase data traffic consumption and create new revenue stream possibilities. Operators´ network assets can be efficiently exploited and utilized to benefit operator customers. For internet players the broker offers one stop contact. It is enough that content creators make a business agreement with the broker, which offers operator network assets and advertising machinery for the content creator. However, the actual content can be delivered directly to the mobiles or with help of the broker. In any case, the broker should provide end users an easy access catalogue for all applications and services, by minimizing search efforts and accelerating service consumption. Harmonized APIs will make it simpler to develop new mashups, and also considerable amount of integration and testing work can be saved. The same story applies to advertisers, who will get a coherent view for their end customers, independently of the operator or geographic area.

Last but not least, the biggest winner is the end user. Consumers can welcome a large service set, participate in service creation and be part of the mobile community. Besides, new revenue models give end users new alternatives to compensate their communication costs. The broker can solve the privacy challenges and at the same time, guarantee that applications are safe to use. If compared to the current situation in the Internet, this scenario would be a huge improvement. See summary in Figure 10.6(Raivio, 2008).

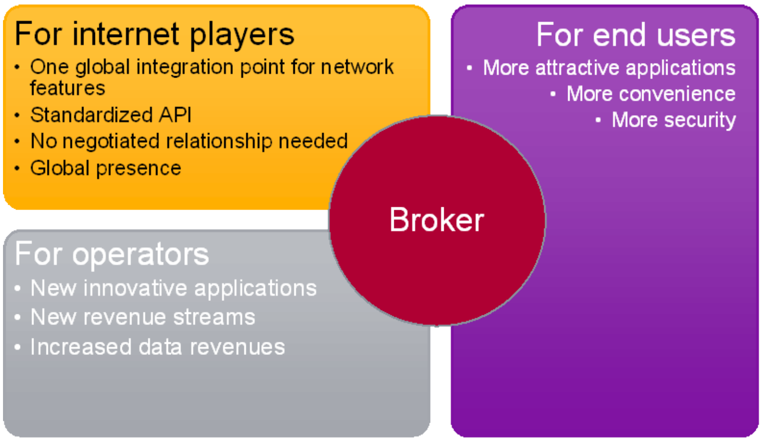

Figure 10.6. Value proposition (Raivio, 2008)

10.6 Summary

Mobile Cloud Computing is predicted to have a significant impact on the way mobile applications and services are developed, distributed, and consumed in the future. According to reports, the number of mobile cloud applications as well as the revenue provided by them will grow significantly during the next five years. This growth will come both from the development of new mobile cloud applications and from adapting existing mobile application to utilize the cloud infrastructure. In the future, mobile cloud applications are expected to be hosted predominantly in the cloud.

Key factors that should drive this adoption of mobile cloud services deal with the synergy cloud computing has with the mobile world: cloud computing can help minimize some of the shortcomings mobile devices have compared to the desktop devices. Most promisingly, cloud computing may help alleviate the constraints posed on mobile applications by the limited processing power, battery life, and storage capacity of the mobile devices. In addition, mobile cloud computing may help in overcoming the fragmentation of the mobile space by allowing developers to utilize common web technologies. Furthermore, because these web technologies are commonly used in the desktop world, mobile cloud computing may provide a much larger developer base with programming access to the mobile devices, thus helping ensure the growth of mobile applications and services.

Despite the promise of mobile cloud computing, some factors are likely to have a restraining influence on the diffusion of mobile cloud services. Perhaps the most significant of these involves the limitations of the mobile networks compared to fixed networks. Because mobile cloud services depend on the transfer of data between the cloud infrastructure and mobile devices, the data transfer bandwidth is likely to become a bottleneck limiting the functionality of these services. This could be especially problematic as many mobile networks are already struggling with the abundance of mobile data traffic. Moreover, the geographical coverage of mobile networks is still lacking even in developed countries, which can lead to a situation where users cannot access mobile cloud services because of their current location. Further, the pricing of mobile data transfers may have a limiting effect on the utilization of mobile cloud services, especially in the case of international travelers, who currently suffer from overpriced roaming fees. (Juntunen et al., 2010)

11 Data Provider View

By Y Raivio

11.1 Internet

In social media applications the cloud service provider often includes a role of **data provider**. See figure 4.1.1. This entity collects data, for an example, about user interests based on their search terms, categorize users into market segments, and sell market space to these highly specialized segments (like Google does). Data Provider can also collect user recommendations about services, products, trustworthiness of other users to internal databases and make use of this data in other services along with content provided by users as well as content provided by professional content providers.

The most common revenue model for data providers is online advertising. The whole online advertising market has currently a size of roughly 40 B€, where Google plays a major role with a turnover of about 20 B€. The whole advertising market is roughly 400 B€. Compared to the telecom business, that is worth 2000 B€, advertising is 20% from that and online marketing respectively 2%. Examples of online advertising include contextual ads on search engine results pages, banner ads, Rich Media Ads, Social network advertising, interstitial ads, online classified advertising, advertising networks and e-mail marketing, including e-mail spam [Wikipedia].

The above figures show that, apart from Google, the market is still quite modest, but on the other hand, data provider market can be expected to grow fast. Advertising plays currently the major stake on the revenue sources, but in the future other revenue models can gain more popularity. Data profiling, directory, aggregator and monitoring services are examples of areas where growth can be expected.

11.2 Mobile

Data providers can also expertise on mobile area. One of the first and best examples from mobile operators has been Blyk [BLYK]. It was founded 2006 to be working on MVNO (Mobile Virtual Network Operator) mode. Last year Blyk announced that they will mainly terminate their own MVNO business and concentrate in operator consultation services. Blyk's main business idea was to focus on certain market segment (young people 16-24 years old), collect their profile data and sell the information to advertisers. The basic idea worked but the problem was the MVNO strategy that kept the operational margins on low level. On the other hand, the chosen market segment was limited in one country and the real success would have required a quick expansion to other countries.

Other mobile examples are from the Finnish market. Xtract [XTRACT] has been on the data provider market already over 10 years. Their main business idea is to gather end user data and create relevant marketing data for various purposes. On the telecommunication area, they have applied CDRs (call data records) for segmenting mobile users. They also provide instruments to manage privacy challenges enabling full anonymity of their marketing data. Their technologies can also be applied to internet social services such as Last.fm and Facebook. A similar company, operating on the mobile side is called Zokem [ZOKEM]. They collect the end user data directly from the mobiles. Based on the collected data, company offers their customers so called personal diary that summarises customer's mobile usage habits. The aggregated data can be used for profiling end users, and using for example for advertising purposes. The introduction of open APIs will clearly open new opportunities on mobile profiling arena.

12 Ecologies and Networks

By Oskari Miettinen

Ecosystems thinking in business context is a relatively new concept and has been mostly shaping up during the past decade or so. The ecosystems approach is somewhat influenced by complexity theories, which have been developing in such fields as biology and social sciences (Peltoniemi & Vuori, 2004).

According to Jansen, Finkelstein, & Brinkkemper (2007), in today's software business, software engineering and development are becoming increasingly more complex processes due to a need for integration of various hardware and software systems produced by different organizations. Thus, organizations need to combine both their business processes and components into software supply networks (SSNs) in order to provide their customers integrated products. This kind of development towards increased complexity of the business environment has lead to a situation where it is far more difficult for the members "of SSNs to make informed decisions on development strategy, responsibility, liability, and market placement". (Jansen et al., 2007, p. 21). Anyhow, organizations seem to be increasingly realizing that they do not operate independently in today's industrial context, but instead as functional parts of sophisticated ecosystems (Boucharas, Jansen, & Brinkkemper, 2009).

12.1 Ecology descriptions

In the context of software business, ecologies analysis can be approached from different levels. As illustrated in Fig. 12.1.1 below, Boucharas et al. (2009) divide software ecosystem models into three different scope levels. The first level (a) is the software supply network (SSN). The actors and their relationships are of interest at this level. The second level (b) is the software ecosystem (SECO) level at which the SSNs and their relationships are studied. At the third level (c) the SECOs themselves and their relationships between each other are studied. (Boucharas et al., 2009).

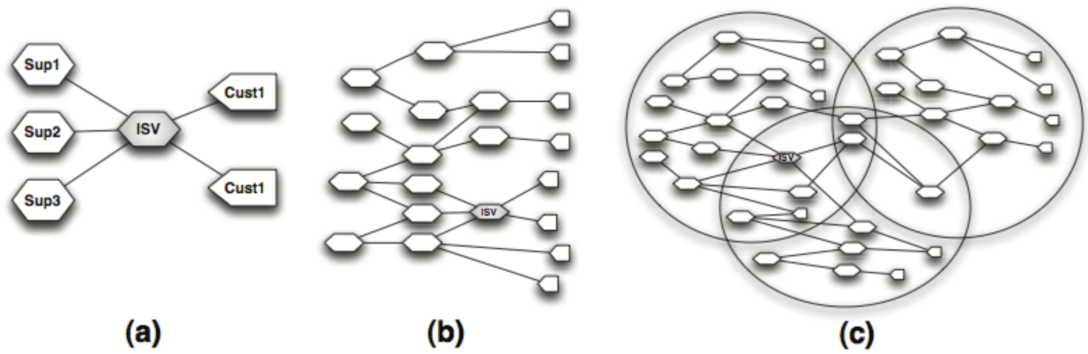

Fig. 12.1.1. Software Ecosystem Scope Levels (Boucharas et al., 2009, p. 42)

The actors of SSNs are ISVs (independent software vendors), their customers, and suppliers.

Jansen, Finkelstein, & Brinkkemper (2009, pp. 1-2) define a SECO “as a set of businesses functioning as a unit and interacting with a shared market for software and services, together with the relationships among them“.

As Jaekel & Luhn (2009) discuss in their white paper, in the context of software business, interesting is the formation of new kinds of SSNs because of the general paradigm shift from traditional software business to cloud software business. Some reasons to formation of these new SSNs include lowered transaction costs and decreased entry barriers. The latter point becomes concrete as many new small enterprises can start offering professional IT services with less starting capital and more flexible costs of operation. The resulting ecosystems are something the authors refer to as “cloud computing eco systems”. (Jaekel & Luhn, 2009). In all, the importance of studying cloud ecosystems specifically seems justifiable.

13 Business Models

By Eetu Luoma

Fritscher and Pignuer (2010) have provided an ontology for analyzing software business models (see Figure 13.1 below). The framework depicts companies' business logic viewed from a strategic standpoint. Framework incorporates nine components of a business model:

- *Value Propositions* describing customer needs and competitive advantage of a service. Here, the composition of service offering should also be considered.
- *Customer Segments* are groups of customers with similar needs and *Distribution Channel*s illustrates how these customers are reached. Further, *Customer Relationships* specifies what type of relationship the customer expects and how it is establish and maintained with him.
- To deliver the services business has to have *Resources* (staff, machines, knowledge), which are transformed through *Key Activities* (development, production) into the final service. Companies also rely on resources or on activities of an external *Partner Network*.
- The *Cost Structure* aligned to the core ideas of the business model (key resources, key activities) and *Revenue Streams* indicating the value the customers are willing to pay an the type of the transaction.

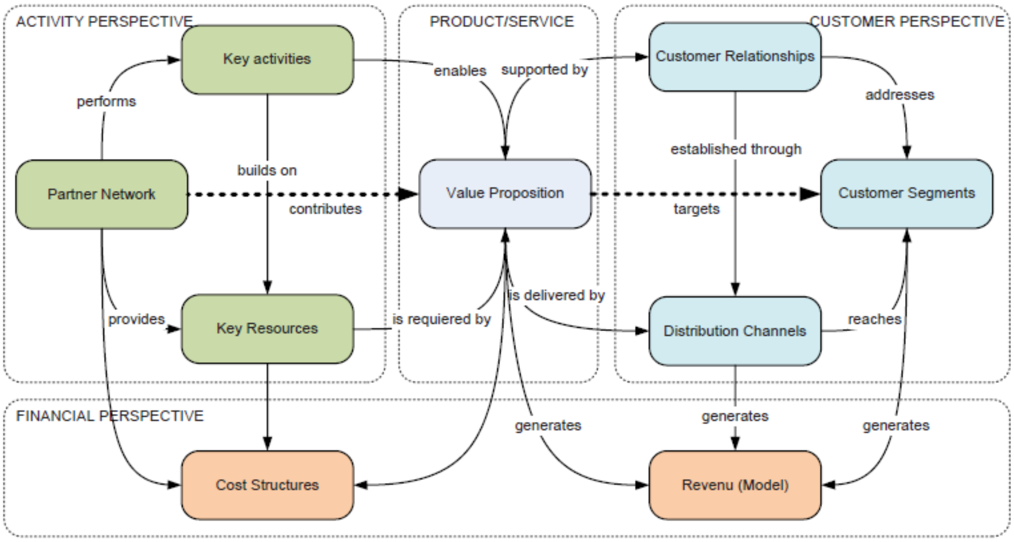

Figure 13.1. Business model canvas (Fritscher and Pigneur, 2010)

In the following, the focus is on value propositions, financial perspective, and distribution channels of cloud computing business models.

13.1 Cloud Computing offering and value propositions

Originally Software-as-a-Service (SaaS) referred to the means of outsourcing software development and operating, i.e. acquiring and deploying standardized software systems, which are being operated by the software vendor (Gold et al., 2004). During the years the definition has developed towards the one presented in the Chapter 3 of this report. York

(2009) discusses differences between SaaS business model and traditional software business models in terms of information economics, economics of technology in delivery and customer needs. Comparison of four business models is presented in Figure 13.2 below.

Managed services -Difficult to deploy, easy to deliver -Offline purchase, offline support -High price, low volume (Customer needs) -Modest competitive advantage -Unique business processes -Tight, custom integration -Transferrable risk -Modest internal IT capability -Need not immediate -High expense budget	**Software as a Service** -Easy to deploy, easy to deliver -Online purchase, online support -Low price, high volume (Customer needs) -Low competitive advantage -Common business processes -Loose, standard integration -Transferrable risk -Modest internal IT capability -Immediate need -Low expense budget
Enterprise software -Difficult to deploy, difficult to deliver -Offline purchase, offline support -High price, low volume (Customer needs) -High competitive advantage -Unique business processes -Tight, custom integration -Non-transferrable risk -HIgh internal IT capability -Need not immediate -High expense budget	**COTS software** -Easy to deploy, difficult to deliver -Offline & offline purchase and support - High price, low volume (Customer needs) -Low competitive advantage -Common business processes -Loose, standard integration -Non-transferrable risk -Modest internal IT capability -Immediate need -Low expense budget

Figure 13.2. Comparison of SaaS to other business models (York, 2009)

Mell and Grance (2009) demonstrate the possible cloud computing service offerings and their architectural compositions using the IaaS, PaaS and SaaS concepts. The options are shown in Figure 13.3. This illustration suggests that there are three basic types of service offering and that vendors may utilize various combinations of services either including cloud computing technologies developed internally or acquired from partners, or create service offering by utilizing more 'traditional' structures.

For instance, a SaaS vendor may utilize open source components to create the run-time environment, acquire licenses to database management system, develop their application on top of these and deploy the components in their own data center. Alternatively, the same vendor has the option to subscribe to a PaaS vendor's service, including the platform components and virtualized servers, and develop their application on top of these. From end-users viewpoint, both deployments can look and feel the same.

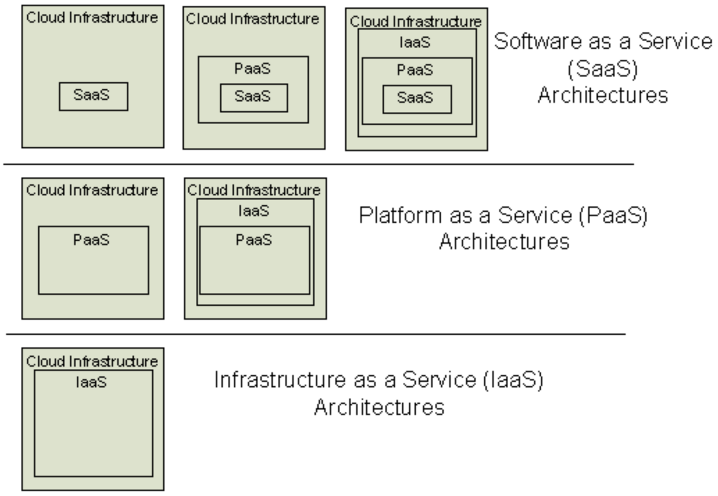

Figure 13.3. Cloud computing service compositions (Mell and Grance, 2009)

In section three above, the components of PaaS were introduced: on-demand infrastructure, runtime environment, data platform, application integration, development environment and common services. Dubey and Wagle (2007) suggest that PaaS offerings are likely to evolve driven by customer requirements and supply-side traction. The authors propose that users will demand platforms fulfilling one of the three primary needs: application delivery, application development or access to the marketplace. Therefore, the article divides the platforms in three archetypes:

- *Delivery Platforms* including two variations: managed hosting and cloud computing. The core offering of the delivery platforms includes physical data center, systems management, storage and computing as a service and the runtime environment in the cloud. Extended offering would also include the Common services.
- *Development Platforms* including three variations: traditional development tools, cloud based development environments, and simple mash-up based application development tools. The core offering of the development platforms include application integration layer in addition to the environment for developing applications.
- *Application-led Platforms* including two variations: APIs only and e2e platform. The core offering here is the SaaS application (e.g. Salesforce.com) including the integration layer and development tools.

An example of PaaS offering

Google Apps is an example of a PaaS offering. We present it based on analysis by Paakkolanvaara & Luoma (2009). It provides communication, collaboration, and productivity tools. Google's developer tools support extension of the functionality of Google's applications, integration with other systems, or building new applications. The components of Google's platform offering include: Google Apps engine, Google Web toolkit and Google Secure Data Connector. The management (provisioning, deployment) of Google Apps is accomplished with the Google Apps admin console.

Google App Engine is a platform for developing and hosting web applications in Google-managed data centers. Its architecture consists of load balancers, web server nodes, stateless APIs (URL Fetch, Users and Mail APIs) and stateful APIs (DataStore API and MemCache API). Of stateful interfaces, the DataStore API hides the datastore clusters and MemCache API is a in-memory key-value cache. URL Fetch API can be used to access resources on the Internet. Developers' application are implemented either using Python or Java, and uploaded the the web server nodes.

The Secure Data Connector (SDC) enables building custom applications that may access en-terprise's data. In the SDC architecture, the customer applications use Google's tunnel servers to make requests to the connector behind the corporate firewalls. SDC also supports data trans-formation to transfer internal data to the cloud applications (e.g. ERP, CRM databases).

Google provides developers with several options in creating user interfaces. With Google Web Toolkit (GWT), developers can write AJAX front-end in the Java programming language which GWT then cross-compiles to work across all major browsers. Further, the Google Visualization API enables developers accessing multiple sources of structured data for display. In addition, Google provides a set of application interfaces (Google Apps APIs) enabling integrating Google’s communication and collaboration tools to corporate existing ICT infrastructure.

SaaS components	**Product names**	**Archetype**
On-demand infrastructure	Google infrastructure	Delivery
Storage as a service	Google infrastructure, Google File System (GFS)	Delivery
Computing as a service	Google infrastructure	Delivery
Run-time environment	Apps Engine	Development
Common services		
Billing	Google Checkout	
Metering	Admin console	
Monitoring	Admin console	Development
Provisioning	Admin console	
Authentication	Google Accounts	Development
Performance management	Admin console	
Data platform		
Multi-tenant database	App Engine, DataStore API	Development
Metadata customization	App Engine Google Visualization API	Development
Application integration	Admin console	Development
Mash-ups (SaaS-SaaS)	?	
Middleware (SaaS-On-premise)	Secure Data Connector	Development

Table 13.1. Google’s PaaS components (Paakkolanvaara & Luoma, 2009)

SaaS value propositions

In addition to features of the SaaS offerings fulfilling the actual needs of end-users like providing process automation or processing capacity, they hold qualities making the offer more valuable than similar products deployed with traditional models like bespoke software business model. Such qualities is often referred as value propositions, and in IT outsourcing they may be divided into software vendors’ and customer’s benefits. Further, IT outsourcing value propositions may be categorized into financial, flexibility and strategic benefits (Lee et al. 2003). The following sets provide an overview of the SaaS value propositions gathered from academic and trade literature and listed according to these dimensions.

Claimed benefits of SaaS for the customers / end-user organizations:

Flexibility:
- SaaS enables prompt deployment of application
- SaaS offers flexibility in case of changing requirements
- SaaS has global reach of services,
- SaaS offers better service through SLA
- SaaS enables customers to use of the latest update and version of the software
- SaaS is provided with backup service and security features from the provider
- SaaS enables reduces dependency on a platform or an equipment

Financial benefit:
- SaaS requires less resources for installation and maintenance
- SaaS scales based on the actual volume
- SaaS has lower costs on hardware and platforms
- SaaS has more predictable software cost
- SaaS requires less dedicated IT personnel
- SaaS has lower up-front costs
- SaaS impacts as an expense in the income statement rather than in the balance sheet
- SaaS reduces the need for customer training
- SaaS has lower TCO

Strategic benefit:
- SaaS customers are not locked into single license
- SaaS enables benchmarking of processes
- SaaS enables acquiring best practices with low costs
- SaaS enables focusing on core competence

Claimed benefits of SaaS for the software vendors:

Flexibility:
- SaaS enables remote management of the software and the platform
- SaaS mitigate version control
- SaaS enables new features to be deployed promptly and with minimal costs
- SaaS decreases the size of updates
- SaaS facilitates maintenance with only one configuration
- SaaS enables utilizing a single platform for all applications

Financial benefit:
- SaaS increases the predictability of the cash flow
- SaaS increases the predictability of the required capacity
- SaaS reduces the need for customer training
- SaaS lowers the costs of customer acquisition
- SaaS enables light RFI and RFQ processes
- SaaS decreases the software piracy
- SaaS enables achieving economies of scale

Strategic benefit:
- SsaS supports achieving long-term contracts
- SaaS enables achieving larger contracts with lower valuation and risk
- SaaS enables packaging and providing several software cost efficiently

In the further work of Cloud Software program we search empirical and conceptual evidence on the existence and importance of these presented potential benefits.

13.2 Revenue models for Cloud Computing

Laplante et al. (2008) summarize the shift from traditional models of developing bespoke software systems and perpetual licenses of the commercial software off the shelf software to cloud related models: The SaaS delivery model separates software ownership from the user and the owner is a vendor who hosts the software (or leases a hosting service) and lets the user execute it on-demand. This on-demand licensing enables software to become a variable expense, rather than a fixed cost at the time of purchase, in other words, reduce the up-front costs of license purchases and software deployment expenses (hardware, infrastructure, training).

There are four main models for charging customers on cloud services: Subscription model, metered model, transaction-based model, revenue sharing (SIIA, 2001), freemium business model (Anderson, 2006) or advertising-supported business model. Further, the software vendors may combine the revenue models also with, and it is usual to charge entry-fee for the deployment and use per hour rate for customer-specific customization projects.

1. Subscription-Based Model: Monthly payment is calculated on the software actually used, and includes a commitment as to the actual number of users. Subscriptions are usually written on a per-seat or named user basis. With the subscription model, usage is difficult to control and monitor, and its adoption is favored by managers more concerned with convenience than with resource control (Katzan, 2009). Examples include Salesforce CRM offering, where a Contact Manager service costs USD 5 per user per month, or an all-inclusive service costs USD 250 per user per month.
2. Usage-Based Model: Payment is determined by application usage and is typically related to peak or near peak levels of usage. Payment may be tied to e.g. the number of CPUs, number of concurrent users, the storage space used, or bandwidth required. With the metered model, the usage is easily measured, monitored, and verified and lends itself to managerial control on the part of the user (Katzan, 2009). Such metering can be applied to differing levels of service. For instance, customers may acquire storage space using Amazon's S3 service, where the first 50 terabytes costs USD 0.15 per month, the next 50 terabytes USD 0.14 per month, and the following 400 TB USD 0.13 per month.
3. Transaction-Based Model: Software vendors sometimes charge customers for each business transaction, and different types of transactions may have different prices. For example, a software vendor providing financial management may charge USD 3.5 per sent paper bill or notice.
4. Value-Based (a.k.a. Shared Risk or Revenue) Model: In revenue sharing model, the payment is linked to the achievement of preset goals. This pricing option motivates the software vendor to develop customers business to achieve greater revenues.
5. Freemium is a business model that works by offering a basic service for free, while charging a premium for advanced features. Freemium models may be based on limiting e.g. features, time, capacity or seats of the basic version. There are many examples of Freemium models in digital media and VOIP. For instance, Skype, Spotify, Pandora and LinkedIn use freemium model.
6. Advertising-based business model is comparable to the freemium model in that end-users are able to use the service for free. However, in ad-based model the end-users are 'paying' with their attention, and the vendor charges the advertisers. Google search engine is the most famous example of ad-based business model.

13.3 Cost structures

A study by Hamilton (2010) suggests economies of scale to apply for cloud computing. His data from 2006 compare very large and mid-size data centers in terms of networking, storage and labor costs. The data indicates that acquiring and providing to customers large amounts of computing, network and storage capacity is more economic: Large data centers are on average seven times more cost-efficient. Further, the data indicates that is pays off to set up large-scale data centers for internal use and sell the excess capacity at lower price that smaller data centers could achieve.

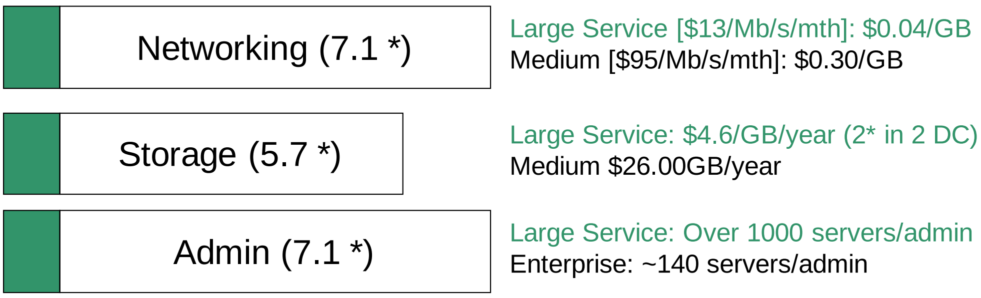

Figure 13.4. Service economies of scale (Hamilton, 2010)

Hamilton further presents data on costs of large data center incurring mainly from investments (and amortization) on servers. On average, servers would incur 54 percent of the costs, power and cooling around 34 percent in total, networking around eight percent, and infrastructure costs (incl. facilities) around five percent. This cost division excludes labor costs, which according to Intel are around 13 percent of the total costs. Intel (2009) also notes that data center costs are only eight percent of total server costs: OS, middleware and application constitute 73 percent and server platform 19 percent of the server total cost of ownership.

Katzan (2009) deals with development and deployment costs, relevant to SaaS offering. He claims there are two areas that can be addressed: the application architecture and the operational structure. With regards to architecture, the basic point is that if a customer requires unique features, then the cost of providing that software and the price of the ensuing service will be higher than if a collection of customers needs the same features. Unique features can be achieved through separate copies or through the use of metadata, but both will increase the development costs. Concerning operating the software, if separate instance of the software are deployed for each customer, the costs are higher, whereas with multi-tenancy tenants can share the various factors of operation, and the operational costs will be lower through economy of scale.

What seems to be missing in the current literature is the analysis on the costs of designing, implementing, testing and marketing software as a service. In addition, costs incurring from supporting services, such as the common services included in the PaaS platform, as well as changes in the customer service costs, have not been touched upon in the literature yet. From the customers perspective, attention should also be paid on the economic issues around migrating infrastructure, platforms and applications.

13.4 Marketing and distribution channels

SaaS is claimed to be a major driver for structural changes in the software industry (Choudhary, 2007). Compared to the established value chain formation, with application provider (performing development), system integrator (deployment) and service provider (operating), SaaS vendor may now more easily accomplish pre-integration of software infrastructure and application, operate the software system, and bypass the traditional supply chain. In addition, one may view that the software provided as a Service is becoming a virtual good, a digital product, enabling software vendors to perform their marketing and sales in the Internet, and the service is instantly available for use with the standard browser.

However, with most software vendors it is likely that intermediation in SaaS supply chain is also needed. With regards to marketing and sales, the major change induced by SaaS provisioning is that the channel will become pull-oriented. In such case, the software vendor must be able to attract the potential customers to search for information on their offering. Here, large existing customer base is required. Also, the smaller transactions and metered business models will require efficient billing processes. The software vendors are used to small volume of large transactions. Consequently, new kind of capability or assistance from an intermediary is needed. The swift from license agreements in traditional software business to service level agreements in SaaS business also necessitates new capabilities, namely the software vendor are required to perform service assurance processes differing from what they are accustomed to.

One option is to organize the channels in a way that the software vendor focuses on the (production and) delivery channel, marketing and sales are handled by online portal and financing channel is accomplished by credit card companies. Such restructuring is already visible in small applications, for instance in the case of Apple's online store. However, for enterprise-grade software systems, communication service providers are a likely option, due to existing capabilities and assets. Their strengths in taking a position as SaaS intermediaries are considered in the following.

Communication service provider as a channel partner

Improving ARPU through new services is of interest to communication service providers (CSP) operating in mature markets. Until recent years, the CPSs have focused on the media and entertainment services, but CSPs are also well positioned to act in the channels - as an intermediator and an aggregator – to deliver the software vendors' offering to the customers.

An intermediation broker provides a service that adds value on top of a given service by providing some specific capability. Here, CSPs would offer intermediation for SaaS services of such as identity management or access management. Intermediation brokers could also supervise pricing and billing. An aggregation brokerage service combines multiple services into one or more new services. Here, CSPs would bundle the existing

ISV offering under one concept, which is then easily accessible to end-users gaining one-stop-shop experience. Additionally, the CSP may provide the data integration, process integrity or intermediation needed to bring multiple services together. (Plummer & Kenney, 2009).

Lucas (2006) suggests the following to be strengths for CSPs in SaaS market:
1. Network Assets. As the applications and data are hosted and accessed over the Internet, SaaS by definition requires network connectivity. The CSPs have a strategic asset that is a fundamental enabler of the SaaS offering. The important question here is on what type of network support will be needed. As more requirement are placed performance of the application, reliablity, low-latency and bandwidth, the more the customer turn to CSP to provide and guarantee quality of service (Qos).
2. Service Assurance. SaaS benefits from enhanced telecom services such as security, service assurance, QoS transport and more. CSPs can help mitigate these risks for SaaS providers.
3. Billing Expertise. SaaS providers will need billing systems, as the SaaS business model assumes recurring, service-based revenue. CSPs have this expertise. They know how to bill for a broad range of services, business models and credit models, and how to process large volumes of usage data, and perform complex settlements.
4. Marketing channels. SaaS vendors shall need a marketing channel and the CSPs are in the best position to make this happen. CSPs have insight into user profiles, preferences, buying patterns, interests and so on. CSPs can make that happen in the wireless and cable space, because for the most part they control the devices and the customer relationship, so they have a natural way to promote SaaS offerings.

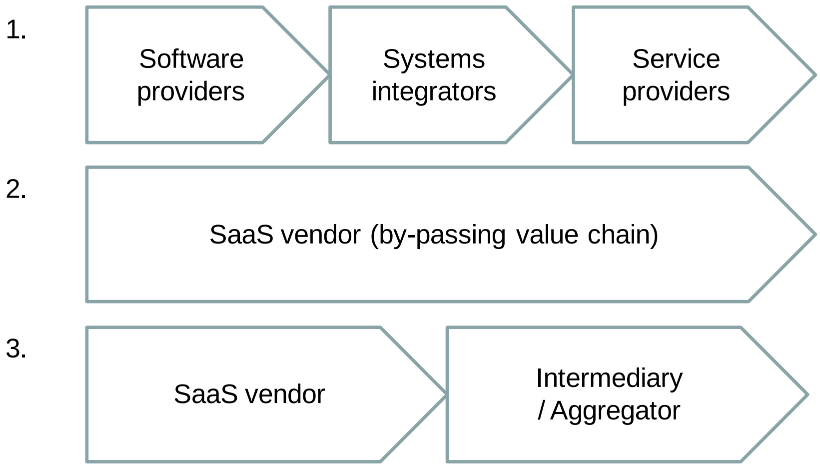

Figure 13.5. Examples of changes in value chains

To illustrate the business model aspects of cloud computing, a description of SaaS vendor's business was created. The considered aspects are in line with the ontology by Fritscher and Pigeuer (2010). An overview of the business model is presented in Table 13.6.

Looking at the offering and client perspectives first in this example, the software vendor would provide its customers a business application as a service. The application would take care of automating parts of the customers' business process, likely to be one with low level of customer specificity to allow providing a standard application on one-to-many basis. Such offering would possess three advantages over previous means to deliver: cost-efficiency, very short deployment time and off-premise operating allowing customers to focus on their core competence. This example company would focus on a number of SME customers, thus, not targeting mass-market. This would allow the software vendor to manage reasonable amount of customer-specific configurations. These would be enabled through flexible application implementation including configurable open source run-time environment, process engine and middleware component at database interface allowing data model configurations. For few specific and large customers, the example vendor would also provide service for managing and executing manual parts of customers' processes.

In order to provide such services, the software vendor would lease hosting services from infrastructure services provider, which would provide all the required data center services, excluding only running of the business application. In addition, the example vendor would buy a license to a DBMS. Key activities of the software vendor would therefore include application and platform development, needed to implement and maintain the features of the business application and to integrate the platform components. First line help-desk functions and some specific integration tasks would be outsourced or insourced to customers.

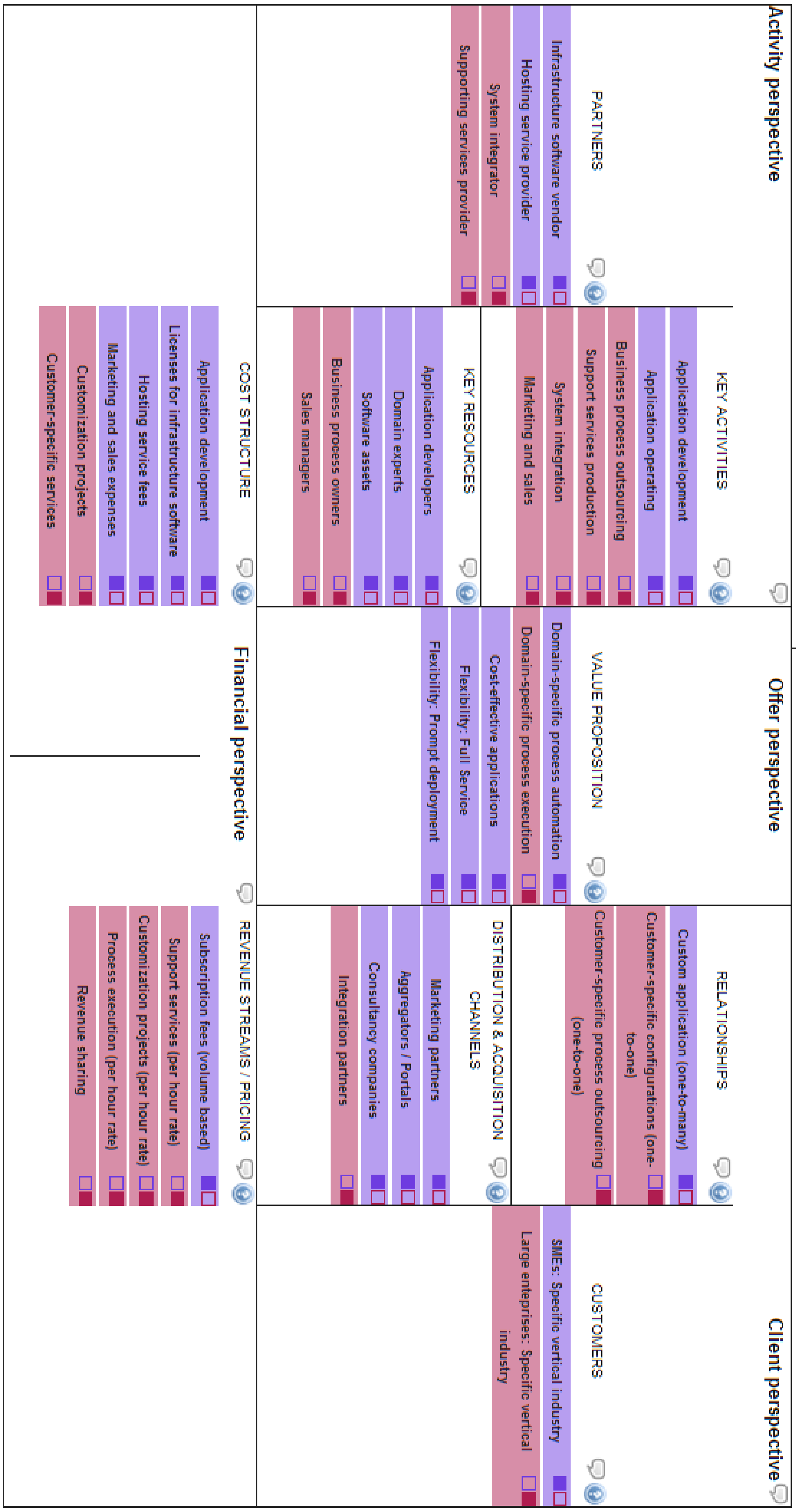

Figure 13.6. An example of SaaS business model

Marketing and sales of the standard application would be mainly accomplished by channel partners, such as communication service providers aggregating different kinds of application to their offering. In addition, domain experts providing consultancy for the specific vertical industry would perform commission-based marketing and sales on behalf of the software vendor.

Main source of revenue for the example vendor would be subscriptions to the service (both standard and custom applications). There is also a minor front-fee for the deployment of the service. Support services, customization projects and BPO would be charged on per hour rate. With some of the SMEs, the front-fee is waived and revenue sharing model is applied (a certain percentage of the customers profit). Main costs are incurring from application development efforts and sales activities.

14 Research Methods an Empirical Data

14.1 Research Methods for Cloud Software Business

By Pasi Tyrväinen

Figure 2.1.1 in Chapter 2 outlined analysis of Business in the Cloud to three levels:

- Software Industries,
- Ecosystems and
- Firms.

Business research can be performed in all these levels, but the applicable results from previous research and the research methods vary according to the levels.

Firms

When the unit of analysis is a firm, the concepts we are interested in mostly relate to the business model elements, value proposition revenue models, cost structures, internal and external resources and competences, assets, distribution channels, key customers, customer segments etc. as described in Chapter 13. The relevant previous research includes transaction cost analysis comparing in-house production with insourcing and outsourcing, product management, marketing, internationalization etc. The usual research methods applied start with observing single company behaviour with qualitative methods in case studies (Yin 1991:56) or explorative data analysis (Robson 2002:399) and generalizing the observations into a model containing causes and consequences, which can tested with quantitative methods for large number of firms. The flexible approach often using qualitative data allows exploring an area, and a fixed research design is deployed when the problem area is understood and more precise hypotheses can be derived. The fixed approach often involves mathematical analysis, and where possible quantitative data and CDA (Confirmatory Data Analysis) following the procedures of classical statistical testing (Robson 2003:399). In cloud software business this means, for example, analyzing the business model elements causing success or failure of a few firms and trying to see if the cause-effect relation is visible in the population of Finnish or US firms.

Ecosystems

We can analyze the supply chain of individual firms, but when a large number of firms collaborate in an ecosystem to serve a market segment, the relationships can better be described by the networks or ecosystems, where firms position themselves based on the function(s) they perform and the competences and assets they possess. In this analysis we are often interested in the means to reach and maintain dominant positions in networks, abilities needed to build new ecologies, competition of ecologies, balance of dominant providers, dominant customers and dominant intermediaries etc. Research methods tend to favour qualitative analysis of individual ecologies, although quantitative data is also used.

Industries

Many new industries are started with innovative firms which produce a large part of the offering in-house all the way from hardware components, core software infrastructure components and application software used by the customers. Along competing offerings the functions and roles of firms in ecosystems tend to get split into a set of firms whose roles and functions start to standardize and form layered structures. This kind of vertical dis-integration (or Horizontalization) is often followed with emergence of competing ecologies around standard interfaces and standardizing use of the technology adopted. (Tyrväinen et al. 2008) A growing number of customers will be paying smaller unit prices of the whole product, where services used for tailoring a product are gradually shifted into business process consulting services supporting use of the standard product consumed either as a software or as a service (Choudhary 2007). This kind of industry evolution can be analyzed qualitatively with the support of quantitative data. Simple quantitative market data analysis as such is often insufficient without understanding of the cause-effect relation behind the numbers.

14.2 Data collection

By Aku Valtakoski

The work package will collect data on the cloud technologies use of Finnish software firms, as well as on the intent of these firms to use cloud computing in the future. These data are collected as a part of the annual Finnish software industry survey (OSKARI 2010). In addition, the survey contains additional questions on firm performance, size, characteristics, customers, internationalization, offering, and the competitive environment. These data allow us, firstly, to analyze the potential impact of cloud computing on firm performance currently. Secondly, we will be able to characterize the software firms who are likely to transition to cloud-based business. In summary, the survey data will allow us to get a realistic view of the extent and nature of firms who are interested in the cloud computing paradigm within the Finnish software industry.

The survey is executed by the Software Business Laboratory of Aalto University, and it was released in the middle of May 2010. Full data should be available in August 2010. A closer description of the research process can be found in Rönkkö et al. (2009). The longitudinal database on the Finnish software industry enables comparison with past firm characteristics and performance.

The data will be used in three ways. First, it allows us to characterize firms with cloud computing interests with respect to their size, age, etc. This characterization may be complemented with cluster analysis to create firm profiles with respect to cloud computing use. Secondly, the data enables us to run regression analyses to determine whether cloud computing actually provides any benefits for software firms. Third, the collected data allows us to set up further research, which may query the business of cloud computing using software firms in more details. This includes identifying potential firms for case studies.

15 Summary Conclusion and Further Work

By Author, Author and Author

Availability of fast and inexpensive global communications networks and standardized Internet based protocols to use it has enabled a restructuring of software and IT services industry. There is currently going on a horizontalization of industries providing different services layers needed, when users use software based services. This development is commonly called Cloud Computing.

There exists competing architectural cloud computing models and business models due to immaturity of the technology and business practices. However, a widely cited and commonly agreed definition on Cloud Computing identifies five essential cloud computing characteristics, three service models, and four deployment models. The characteristics are 1) On-demand self-service; 2) Network access, the computing resources can be accessed over a network; 3) Resource pooling, also referred as multi-tenancy; 4) Rapid elasticity of computing resources to adjust to scale, and 5) Measured service. The three service models are: 1) Software-as-a-Service; 2) Platform-as-a-Service; and 3) Infrastructure-as-a-Service. The deployment models are: 1) Private cloud; 2) Public cloud; 3) Community cloud; and Community cloud.

When speaking of cloud software, we refer to different software applications and products that can be used to produce SaaS, PaaS, and IaaS services. But we include also the client side view on the analysis. Different Cloud services demand clients through, which they can be used. Sometimes there are even Cloud Services that provide parts of the client functions like Facebook.

In the real world the choice between a Cloud Services based model and a traditional model is not bipolar, but there exists a continuum of configurations in between. Based on survey of Finnish software company population focused on producing applications and now transforming to providing SaaS offering, we have identified four clusters of companies based on their approach to cloud computing characteristics: Companies with no real exposure to cloud world, pure SaaS companies that have adapted fully the characteristics, high SaaS companies differ from pure model in one characteristics, and the Web based solutions companies that have selected 2-3 cloud characteristics. We assume the situation be similar also in the other service area.

Currently IT industry based on public cloud services have yearly revenues of $15-20 Billion meaning that they form about 2 percent of IT services and software industries. In the standardized product segments the share is higher as SaaS services account about 4% of software product markets. However, these figures exclude infrastructure hardware, software and services used in corporate internal data centres and private clouds. Public cloud services altogether, including advertising based services have yearly revenues of $50-60 Billion meaning that they form about 2 percent of total information and communications technology (ICT) industry. Cloud business is growing yearly over 20 percent.

From the Finnish point of view, an interesting and fast growing sub-industry in Cloud is Mobile Cloud. Mobile Cloud can include: 1) Access method from mobile to fixed cloud, 2) Enabler for new services utilizing the benefits of mobile devices and a cloud, and 3) Ad hoc cloud, where mobiles provide cloud services for each other. Currently the Mobile Cloud market is small, below $1 Billion globally, but it is growing fast and it is expected to reach over $10 Billion global volume in five years

15.1 Transition from software project and products business to cloud software business

Roles of firms in cloud software business can be described based on the expected cloud software industry structure. Firm's role in an ecosystem further determines the success factors and needed competences for the firm. A firm can define and transition into a new business model to be used based on the previous analysis.

The four base models to provide offerings in Cloud environment based on software assets are:

1) Providing applications as a service. This is the most common position for the majority of existing small and mid-sized companies providing applications either as products or projects. Instead of selling licenses and helping clients to install and use the applications, the companies deliver the applications as automated service from a datacenter. Many times this transformation can be evolutionary. In most cases, the customer relationships are the most valuable asset of these companies and they can mode their customers gradually to services based model.
Less than half of the business services volume originates from plain software applications while majority of the services in US contain non-software or physical components, logistics etc. (as in eBay and Expedia).

2) Providing client IT infrastructure as a service. For local smaller companies this model is mainly based on providing professional services above mass services that are either globally leading Cloud services like Amazon's storage space or based on globally leading software products like Microsoft's Windows and Office product families. In this transformation, the provider has either to change orientation from make self to buy leading offerings approach. Another possibility to software producers is to focus on the software needed in provisioning and delivery processes of IaaS.

3) Providing software or services to the client side of the cloud. This offers two different business models. Either a project or embedded systems oriented company can build software to client devices, most often in some form of project delivered to client device manufacturer. Another model is to provide software for services based client environments like Facebook or Twitter.

4) Providing platform as a Service. The business models available in this area are only emerging so software companies willing to transform to this area need to be innovative and flexible.

Integration and other professional services dominating traditional software industry seem to have smaller role in public cloud services than in private clouds and traditional enterprise systems business. Currently the share of cloud integration business out of public clouds business in total is only about one third of the share of integration business out of total software business. This is rather natural as cloud software is rather standard compared to enterprise systems requiring much tailoring and integration.

15.2 Risks of cloud software business.

There are multiple risks related to Cloud transformation. The can be divided to strategic level an operational risks. On strategic level, the two major risks are less possibilities to lock-in customers and longer payback times of product development investments.

The Cloud development changes traditional customer software purchasing process from one characterized by a long project demanding implementation, configuration and even tailoring and integration to customer's environment to a one characterized by a acquisition of standardized services that can be used through standardized infrastructure and client environment. The cost of changing the provider declines as well as the sunken investment on client side. Increasing purchasing power of buyer usually means lower margins.

In traditional license and product sales based software business, customers pay a majority of their long term costs up-front to the software vendor about same time as the provider delivers software. In SaaS business model, the vendor needs 2-4 years to collect the same revenue. Thus the investment payback time increases. This means, for instance, that wrong technological choices have a longer term impact.

On the operational side, Cloud means a total change in management of relationships with other members of the ecosystem. In traditional software business the vendor just delivers the code and it is client's problem how reliably IT production works. When the same software is delivered as a service, it is vendor's responsibility to manage the infrastructure that runs the application. If the subcontractor providing infrastructure services fails, software vendor cannot deliver service to its customer. Usually the business customer has demanded a service level agreement from the vendor. This means that the vendor starts losing money immediately, if one of the subcontractors fails. This situation demands totally different approach to supplier network management than in license and project sales.

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