How to Define Software-as-a-Service – An Empirical Study of Finnish SaaS Providers

Tuomas Mäkilä[1], Antero Järvi[1], Mikko Rönkkö[2], and Jussi Nissilä[3]

[1] University of Turku, Department of Information Technology, Finland
{tuomas.makila,antero.jarvi}@utu.fi
[2] Aalto University, Software Business Laboratory, Finland
mikko.ronkko@tkk.fi
[3] Turku School of Economics, Business and Innovation Development, Finland
jussi.nissila@tse.fi

Abstract. Software-as-a-Service (SaaS) is a relatively new and much hyped model of software delivery where the software is procured as a service over the Internet. We found that there were several different definitions of SaaS. Based on these definitions, we distilled a list of five characteristics that are required for a firm to be considered a SaaS provider. Using survey data from the Finnish software industry, we tested the proposed criteria. Closer examination of the survey indicated the criteria were necessary but not sufficient. Therefore, we extended the criteria to better grasp the phenomenon and tested the changes through a qualitative validation. Also, we found that while a large number of firms are producing software that is technically SaaS, pure SaaS-based business models are much more rare in Finland.

Keywords: Software as a service, survey, qualitative study.

1 Introduction

Software industry is increasingly moving to services, and turning products into tools for vendors to sell services [1]. Software-as-a-Service (SaaS) is a concept that is often mentioned in this context. In general, SaaS refers to a software deployment model, where the software is provisioned over the Internet as a service. A key difference between SaaS and other new "on demand" models and the more traditional internet-based deployment models (such as Application Service Provider, ASP), is that the service is to some extent standardized, whereas tailored software providers can use ASP model to deliver the software. The new on demand services are not limited to providing only software application as a service, but sometimes extend to as far as business process outsourcing [2]. In this paper, we however focus on the application provisioning side since it clearly belongs to software business, while pure business process outsourcing or hardware maintenance does not.

Globally, the period during which SaaS model became well known and popular was in the mid 2000s. In 2005 IDC [3] predicted that 10 percent of enterprise software markets would move to pure SaaS model by 2009. The forecast has not fully

P. Tyrväinen, S. Jansen, and M.A. Cusumano (Eds.): ICSOB 2010, LNBIP 51, pp. 115–124, 2010.

materialized. Even though the SaaS industry is growing at 40-50 percent annually, the global SaaS market this year is estimated to be $6.6B, which is about three percent of total global software and related industry. Moreover, the user acceptance has not been great. In a survey of 333 enterprises in December 2008 in the US and UK, Gartner [4] found low level of approval from customers, describing overall satisfaction levels as "lukewarm". Particularly high cost of service, difficulty with integration, and technical requirements were seen as issues. Still, Gartner concluded that SaaS has become mainstream and growth of SaaS business would continue.

SaaS is a difficult topic for a study since there is no one generally accepted definition of the concept. Instead, there are multiple related phenomena without clear boundaries; traditional application software providers, SaaS providers, and even web portals, online media and media business. It is clear that SaaS is about selling a productized software service and doing this online. However, the exact borderlines between SaaS model and other e-commerce models are unclear. The purpose of this paper is to clarify the definition of SaaS by setting criteria for classifying companies as SaaS and to test this classification approach empirically.

The structure of the article is as follows. In the next section we will review some of the literature on Software-as-a-Service covering a broad range of topics and disciplines from computer science to management. Next we describe our research approach that uses a combination of mail survey and qualitative analysis to test our proposed SaaS classification criteria. In the empirical results chapter, we will go into detail with the results that the quantitative and the qualitative studies produced. Discussion of the results concludes the paper.

2 Definition of Software-as-a-Service

In this chapter we present examples of SaaS definitions and discuss the main characteristics of a SaaS solution, with an aim to understand better the nature of SaaS phenomenon. The definitions of SaaS typically include both business and technical perspectives, the former being the dominating viewpoint.

The term Software-as-a-Service entered the mainstream computing vocabulary a few years into this millennium. Initially, the term was used for various forms of service oriented computing (see e.g. [5]), but is currently used for software that is provisioned over the internet and used usually with a web browser. The same naming convention is currently used also for other parts of the computing stack, e.g. Infrastructure-as-a-Service (IaaS) and Platform-as-a-Service (PaaS) [6].

As a software delivery model SaaS can be considered either as an extension or as a replacement to Application Service Provisioning (ASP), which is a delivery model that contains hosting, maintenance, and support of software [7]. In both models, SaaS and ASP, the software is accessed through the internet or other computer network and the vendor charges service fees. The main difference is that in SaaS the provided software is standardized for all customers, whereas in ASP each customer uses its own instance of the software. The technical solution where several customers use a single instance of the software is called multi-tenancy [8, 10, 9]. It is often argued that multi-tenant architecture is merely a technical solution to a business problem, and thus not essential part of the SaaS business model. From the business perspective, the

key issue is whether or not there is client specific installation and operating work. This impacts the scalability of the solution, its operational and maintenance costs and the deployment speed of new software versions. While multi-tenancy is probably present in virtually all SaaS offerings, it would be possible to achieve the same business benefits by spawning a new instance of the software for each client automatically instead of serving the clients from the same instance of the software.

Table 1. Definitions for Software as a Service

Source	Definition
[12]	In the software as a service model, the application, or service, is deployed from a centralized data center across a network - Internet, Intranet, LAN, or VPN - providing access and use on a recurring fee basis. Users "rent," "subscribe to," "are assigned", or "are granted access to" the applications from a central provider. Business models vary according to the level to which the software is streamlined, to lower price and increase efficiency, or value-added through customization to further improve digitized business processes.
[11]	Software as a Service is time and location independent online access to a remotely managed server application, that permits concurrent utilization of the same application installation by a large number of independent users (customers), offers attractive payment logic compared to the customer value received, and makes a continuous flow of new and innovative software possible
[13]	Software as a service (SaaS, typically pronounced 'sass') is a model of software deployment whereby a provider licenses an application to customers for use as a service on demand. SaaS software vendors may host the application on their own web servers or upload the application to the consumer device, disabling it after use or after the on-demand contract expires. The on-demand function may be handled internally to share licenses within a firm or by a third-party application service provider (ASP) sharing licenses between firms.
[14]	In this form of computing, a customer runs software remotely, via the Internet, using the service provider's programs and computer infrastructure.
[15]	SaaS is different from traditional software licensing, which involves the buyer's purchasing a perpetual use license from the software publisher and then making additional investments for hardware, installation, and maintenance. In contrast, in the SaaS model, users buy a subscription to the software and the software publisher (seller) runs and maintains the software on his own hardware. Users with current subscriptions can obtain access to the software using the Internet.
[8]	Software as a Service (SaaS) is a software delivery model, which provides customers access to business functionality remotely (usually over the internet) as a service. The customer does not specially purchase a software license. The cost of the infrastructure, the right to use the software, and all hosting, maintenance and support services are all bundled into a single monthly or per-use charging.
[16]	SaaS is defined as a model of software deployment via the Internet whereby the SaaS provider licenses an application to customers as a service based on usage or periodic subscription payments. SaaS software vendors typically host the application on their own web servers or enable customers to download the application to consumer devices via the Internet.
[17]	Under SaaS, the software publisher (seller) runs and maintains all necessary hardware and software and buyers obtain access using the Internet.

Table 1 lists various definitions of SaaS in the literature. Five distinct characteristics are typically associated with SaaS in these definitions:

1. Product is used through a web browser.
2. Product is not tailor made for each customer.

3. The product does not include software that needs to be installed at the customer's location.
4. The product does not require special integration and installation work.
5. The pricing of the product is based on actual usage of the software.

The multi-tenancy aspect [9] is regarded as critical in many SaaS definitions, but was not included in the list. We regard it as a technological choice in SaaS implementation, not a critical feature from business perspective. The impact of multitenancy from user's point of view is included in the second and fourth criterion.

3 Empirical Study

To clarify the definition of SaaS and to develop a study method for identifying companies using SaaS-based business models, we developed a set of questions and conducted a survey of Finnish software companies. The sequential explanatory strategy [18] was utilized to further elaborate the result of the quantitative survey by one of the authors. After the analysis of the quantitative data, the criteria of identifying SaaS companies were evaluated independently by the other authors using qualitative techniques.

The purpose of this approach was two-fold: 1) The internal validity of the quantitative survey was evaluated. The main focus was on analyzing whether the existence of the five criteria characterizing SaaS business actually implicates that a firm provides SaaS products. Just as it is possible, but rather imprecise to identify for example a carnivorous creature from the teeth, claws and other easily identifiable "technical" qualities of the creature, the real question is if the creature hunts and eats other animals. Similarly, many firms and their products may have technical SaaS qualities, but the real question is whether the product can provide the values inherent in the SaaS model. 2) Additional information about the identified SaaS companies was collected in order to better understand the quantitative results and summarize the state of SaaS phenomenon in Finnish software product firms.

3.1 Quantitative Survey of Finnish Software Companies

To identify the SaaS providers, the survey started from the premise that a SaaS provider must consider itself as a software firm. This excluded for example a large share of web portals from the study. To identify which software firms are SaaS providers and which are not, the survey used the five criteria presented in the literature review above.

The five items were measured on a five point Likert scale measuring the degree of the agreement on the statement (1=Strongly disagree to 5=Strongly agree). In addition to this scale, the survey form also contained other questions related to for example firm size, growth, and internationalization. In the ideal case, categorized as "pure SaaS", the responses were positive (Agree or Strongly Agree) onto all the five questions. In the "high SaaS characteristics", one response was allowed to deviate. The "Web based solutions" group included two to three positive responses, and largely consisted of hosted non-standard solutions. In addition to the SaaS scale, the

questionnaire included a question of nine different revenue sources (e.g. license sales) and the respondents were instructed to estimate how many percents of their total revenue came from each of these sources. The survey form is available online at *http://www.softwareindustrysurvey.org/*

The data was a subset of a larger data set that was collected as a part of a research project surveying the software firms in Finland. The sample was a list of firms considered to cover the whole Finnish software product industry and majority of the service firms as well. Oversampling was necessitated by the project resulting in the inclusion of 3396 firms in the list, of which 60% was estimated to belong to the population. The sampling frame is further described in [19]. One recognized limitation of the SaaS analysis was that these questions were presented to only a subset of firms. The focus of the SaaS questionnaire was on SMEs and therefore the public listed firms and microenterprises were not included in the study.

The survey was implemented following a modified version of the tailored survey design method [20]. The mailing begun with a pre-notice letter, followed by the main survey package using postal mail. After initial mailing each firm was contacted two to four times using email and telephone. A printed questionnaire and a web form were offered as alternative options for the informants. This phase of the data collection lasted from June through August 2009.

The data was analyzed using Intercooled Stata, version 10.1. After data preparation the data was analyzed with the help of plots and tabulations. In the data screening phase also factor analysis and cluster analysis were used to familiarize with the data. The results from these analyses were not interesting, so we decided to exclude them. Finally, cluster analysis was used to develop a classification based on revenue sources. This analysis is reported in detail in [19] and excluded due to space constraints.

3.2 Qualitative Validation

We performed a qualitative analysis of the SaaS providers identified in the survey using the providers' web-pages as data source. Our goal was to test the technical characteristics, which was used to define SaaS, and analyze whether the criteria were able to capture the essence of SaaS.

Our perception was that the original criteria concentrated on analyzing the SaaS-like aspects of the product itself but did not evaluate whether the actual SaaS business model is in use. To test the possible flaws in the original criteria, two additional characteristics were added: 6) Does the product has multitenant architecture and 7) Can the product be purchased on-line on-demand. These additional characteristics were selected from several possible choices as the most prominent ones. Multitenant architecture is a technical characteristic that is directly connected to many of SaaS business benefits. Therefore it seemed to be a good attribute for analyzing the business potential of a SaaS solution, although the survey omitted this characteristic as too technical detail. On-line on-demand purchasing characterizes many of the well-known SaaS products. This was also an easy attribute to identify through firm web pages and was therefore selected.

In the qualitative study we investigated the web pages of the firms that had met either five ("Pure SaaS") or four ("High SaaS characteristics") characteristics of the

original criteria. The existence of the original characteristics and two added characteristics were determined by examining the SaaS product descriptions in the providers' web pages. Based on the personal experience and the evidence found from the web site, the researchers made a subjective judgment whether the analyzed SaaS product 1) was pure SaaS, 2) had high SaaS characteristics or 3) was not SaaS service at all. In addition, the researchers took notes about the nature of the found SaaS product.

One shortcoming of the qualitative approach is that only the information found from the providers' web sites is used. On the other hand, we believe that one of the key characteristics of a SaaS product is that most of the transactions between service provider and buyer can be done or at least initialized online. Therefore the web sites provide a good view into phenomenon from the buyer's perspective.

4 Empirical Results

The first interesting thing is how prevalent SaaS firms are. Figure 1 illustrates the number of firms in different SaaS classes in our sample. In total, we can see that "pure SaaS" model is very rare with only 4% of the responding firms qualifying with all five criteria. Analysis of revenue (not reported) indicated that these firms were predominantly small and accounted for only one percent of the total revenue of the sample.

If we include also those firms that have "high SaaS characteristics" i.e. have only one SaaS characteristics missing, the size of the subset of the sample increases to 17 percent of the firms and to six percent of the revenues. Based on these values the Finnish software industry is at least at median level in SaaS transformation compared to the global industry that has below five percent of the revenues coming from SaaS. However, this conclusion includes a caveat that the firms in the sample do not include any large firms.

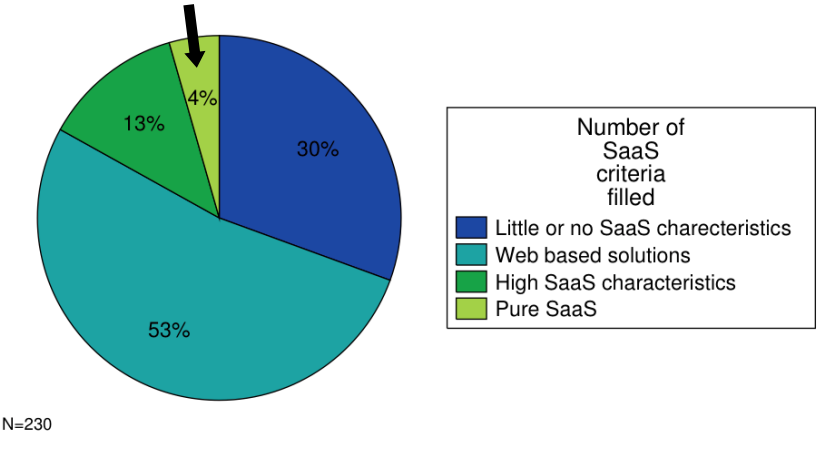

Fig. 1. Prevalence of different types of SaaS firms in the sample ("Pure SaaS" section marked with arrow)

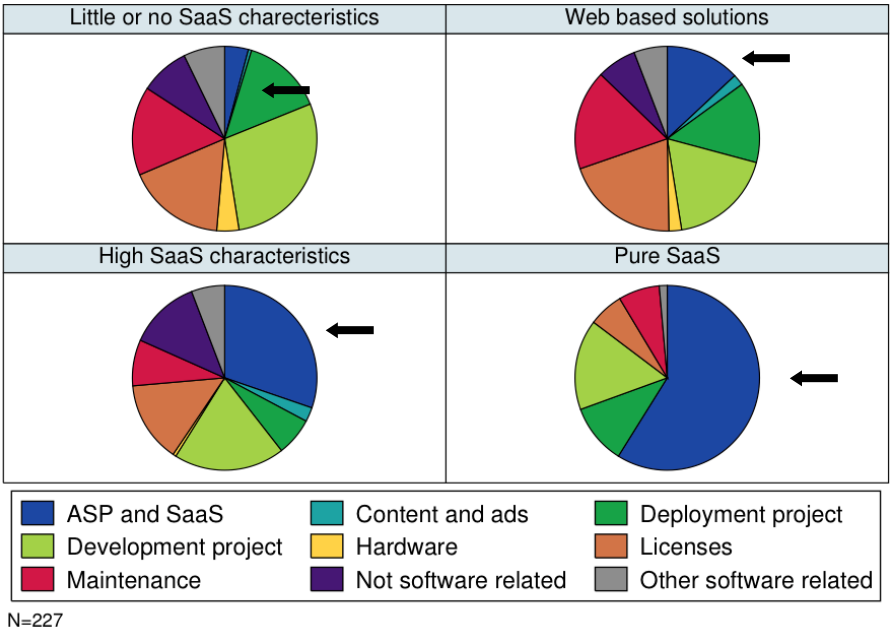

Fig. 2. Revenue shares of firms in different SaaS classes ("ASP and SaaS" section marked with arrow, other categories follow clock-wise in row-by-row order)

After analyzing the prevalence of SaaS firms in the software industry, we will now take a closer look of what these firms are and particularly what the firms that almost meet the criteria are. Based on the self-reported sources of revenue, there is great variance in how these companies make money, as shown in Figure 2. The most distinguishing factor with the "high SaaS" and "pure SaaS" firms is that the "high SaaS" firms deliver products that require customer specific deployment. This resembles the traditional ASP model where a new instance of an application is opened and configured for each customer and offered on the servers of the provider. To make classification of the firms yet more difficult, these firms are sometimes promoting themselves as SaaS firms to show that they are keeping up with the latest trends. If the firm argues itself as being a SaaS firm and the customers agree, but the firm does not meet our five criteria, is the firm as SaaS firm or not? As the definition of SaaS is not yet fully stabilized, it is difficult to give a clear answer.

In Table 2 we cross-tabulate the categories of the firms meeting different numbers of SaaS criteria with the business model classification developed with cluster analysis of the revenue share data. The "pure SaaS" providers are predominantly classified in the ASP/SaaS or product firms based on the business model classification, and even with the firms meeting four of the five criteria ("high SaaS") the standardized offering based business model is in the majority. But already in this category, the development service firms have over 20 percent share, indicating that even if a firm has a product that conforms to all or most of our SaaS criteria, this is not categorically removing the need for customer adaptation and tailoring. As a sign of the existence of continuum

from software to content and producing services based on the software, there are multiple firms having content as their main business model and 17 percent of firms do not have software as their main business.

Table 2. Cross-tabulation of business models and SaaS criteria

	Number of SaaS criteria filled				
Business Model	Little or no SaaS characteristics	Web based solutions	High SaaS characteristics	Pure SaaS	**Total**
Software product	26.9%	35.5%	17.2%	10.0%	29.5%
Deployment project	11.9%	14.9%	0.0%	0.0%	11.5%
Development service	34.3%	21.5%	20.7%	20.0%	25.1%
ASP and SaaS	4.5%	11.6%	37.9%	70.0%	15.4%
Not software	11.9%	9.9%	17.2%	0.0%	11.0%
Content and ads	0.0%	2.5%	3.4%	0.0%	2.8%
Software consulting	6.0%	2.5%	3.4%	0.0%	3.5%
Hardware	4.5%	1.7%	0.0%	0.0%	2.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

During the qualitative validation the web pages of "Pure SaaS" and "High SaaS characteristics" firms were benchmarked against established SaaS providers (e.g. Salesforce.com, Google Apps, Amazon EC2) and their way to communicate about the SaaS products through their web sites. Analysis of the "pure SaaS" category firms revealed that almost none of the firms came close to the benchmark level; It was not immediately clear what the product actually was, what was the pricing, and how the product could be purchased. On the other hand, all of the firms in the "pure SaaS" category clearly had a web-based product with high productization level.

The more detailed results of the analysis on the "pure SaaS" category firms are presented in Table 3. The table shows that firms were not eager to reveal information on the more business-related the characteristics of the product (i.e. the 4th and 5th criterion) in their web sites. If the original criteria had been extended with on-line on-demand purchase requirement, almost none of the firms would have been classified into "Pure SaaS" category.

Based on this analysis, the "pure SaaS" category of the quantitative survey gives no direct false positives but neither identifies correctly pure SaaS businesses if the

Table 3. Qualitative analysis on the characteristics of the "pure" SaaS firms

Characteristics	**No**	**Uncertain**	**Yes**
1. Product is used through a web browser.	8,7 %	13 %	78,3 %
2. Product is not tailor made for each customer.	8,7 %	30,4 %	60,9 %
3. The product does not include software that needs to be installed at the customer's location.	4,3 %	17,4 %	78,3 %
4. The product does not require special integration and installation work.	13 %	47,8 %	39,1 %
5. The pricing of the product is based on actual usage of the software.	13 %	56,5 %	30,4 %
6. Does the product has multitenant architecture	4,3 %	47,8 %	47,8 %
7. Can the product be purchased on-line on-demand	78,3 %	17,4 %	4,3 %

term SaaS is interpreted strictly. Conclusion might be that the original criteria miss some key characteristics of the SaaS businesses. “High SaaS characteristics” category had false positives but also included pure SaaS firms. This suggests that the criteria might be redundant and weight of different characteristics is not equal.

The more detailed analysis of the firms in “Pure SaaS” and “High SaaS Characteristics” categories showed a high variation in business model and product types. Some firms sold software as their core business whereas for the others the software was clearly an addition to consultancy and training services. The product complexity varied from simple standalone solutions to large systems involving several individual software products. Some firms operated locally in Finland without notable growth potential or willingness to grow, while others had global presence and clear growth potential. It also seemed that the word SaaS itself possessed some kind of hype value. Therefore in some cases a web-based software product was advertised as a SaaS product, although the pure SaaS business model was not yet fully implemented nor full SaaS characteristics were met.

5 Discussion and Conclusions

The definition of SaaS is significant for understanding the essence of the SaaS as a phenomenon. Without a proper definition a scientific, especially quantitative, analysis is impossible. In pragmatic level a clear definition is needed for the SaaS providers to identify unleashed business potential, and for the customer to evaluate SaaS providers’ ability to produce long-term value.

Based on the variation in businesses of Finnish software product firms, it is clear that the firms have not implemented SaaS offering and -business in uniform way. Thus it is difficult to capture the SaaS phenomenon into a single set of simple criteria for identification purposes. Such criteria would tell if the firm has a SaaS offering in "technical" sense, but would not identify all the firms that run a SaaS based business. Instead, the identification criteria should reflect more if the firm is trying to benefit from generally expected business benefits of SaaS; Such as low implementation cost, fast sales cycle and deployment, and flexible pricing that fits the customers perceived value.

As a conclusion, we can say that in the maturing software business, SaaS is a small segment having characteristics of an emerging industry. According to market research companies, SaaS is growing fast and approaching mainstream at the global markets. While the Finnish SaaS industry has not been standing still, its development during recent years has possibly not been as good as generally assumed, especially when compared to the global development.

The main finding in this study is that Finnish SaaS firms typically have a technically mature SaaS product, but have not elaborated their business models to fully take advantage of the potential of SaaS. In other words, the firms in the sample produce software with all the technical characteristics of SaaS, but the sales model follows the traditional ASP model more than SaaS.

Considering the overall development towards SaaS, this can in the near future mean that the majority of the application areas where SaaS is used will be taken over by global competitors and potential domestic advantage of smaller regional players disappear.

References

1. ITEA Roadmap for Software-Intensive Systems and Services, 3rd edition. ITEA 2 Office Association, Eindhoven, NL (2009)
2. Pettey, C., Stevens, H.: Gartner says Worldwide SaaS Revenue to Grow 22 Percent in (2009), http://www.gartner.com/it/page.jsp?id=968412
3. Traudt, E., Konary, A.: Worldwide and US Software as a Service 2005-2009 Forecast and Analyses: Adoption for the Alternative Delivery Model Continues, IDC, Framingham, MA (2009)
4. Plummer, D.: The Real Truth About Cloud, SaaS and Saving Money Now, Webinar (2009)
5. Gold, N., Mohan, A., Knight, C., Munro, M.: Understanding service-oriented software. IEEE Software 21, 71–77 (2004)
6. Schaffer, H.E.: X as a Service, Cloud Computing and the Need for Good Judgement (2009)
7. Susarla, A., Barua, A., Whinston, A.B.: Understanding the 'Service' Component of Application Service Provision: An Empirical Analysis of Satisfaction with ASP Services. In: Information Systems Outsourcing, pp. 481–521 (2006)
8. Sun, W., Zhang, K., Chen, S., Zhang, X., Liang, H.: Software as a Service: An Integration Perspective. In: Krämer, B.J., Lin, K.-J., Narasimhan, P. (eds.) ICSOC 2007. LNCS, vol. 4749, pp. 558–569. Springer, Heidelberg (2007)
9. Chang Jie Guo, W.S.: A Framework for Native Multi-Tenancy Application Development and Management, Tokyo, pp. 551–558 (2007)
10. Mietzner, R., Metzger, A., Leymann, F., Pohl, K.: Variability modeling to support customization and deployment of multi-tenant-aware Software as a Service applications. In: ICSE Workshop on Principles of Engineering Service Oriented Systems, pp. 18–25. IEEE Computer Society, Los Alamitos (2009)
11. Sääksjärvi, M., Lassila, A., Nordström, H.: Evaluating the Software as a Service Business Model: From CPU Time-Sharing to Online Innovation Sharing, pp. 177–186 (2005)
12. Hoch, F., Kerr, M., Griffith, A.: Software as a Service: Strategic Backgrounder. Accessed 21, 4 (2001)
13. Software as a service - Wikipedia, the free encyclopedia, http://en.wikipedia.org/wiki/Software_as_a_service
14. Campbell-Kelly, M.: Historical reflections - The rise, fall, and resurrection of software as a service. ACM Commun. 52, 28–30 (2009)
15. Choudhary, V.: Comparison of Software Quality Under Perpetual Licensing and Software as a Service. Journal of Management Information Systems 24, 141–165 (2007)
16. Huang, K.W., Wang, M.: Firm-Level Productivity Analysis for Software as a Service Companies. In: Proceedings of ICIS 2009, p. 21 (2009)
17. Choudhary, V.: Software as a service: Implications for investment in software development. In: Hawaii International Conference on System Sciences, p. 3464 (2007)
18. Creswell, J.: Research design: qualitative, quantitative and mixed method approaches. SAGE, London (2002)
19. Rönkkö, M., Ylitalo, J., Peltonen, J., Koivisto, N., Mutanen, O., Autere, J., Valtakoski, A., Pentikäinen, P.: National Software Industry Survey 2009. Helsinki University of Technology, Espoo (2009)
20. Dillman, D.: Mail and internet surveys: The tailored design method (2007)