

# CLOUD-BASED SERVICE DESK TRENDS AND FUTURE IN THE CONTEXT OF FREENEST

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<p>Abstract</p> <p>The purpose of the thesis was to explore modern ICT support solutions or potential innovations, which can be used in future service desks in cloud-based environments. The assignment came from FreeNest project which is a part of TIVIT Cloud software program. The aim of TIVIT is to improve competitive position in Finish software industry. FreeNest is a cloud-based project development platform which integrates open source software together and offers customers customized project tools. The goal of the thesis was to find possible service desk solutions for cloud services such as FreeNest.</p> <p>The thesis explains the concepts of cloud computing and introduces service desk technologies. The research was carried out by studying new ICT trends and applying them to the needs of the cloud-based service desks. Pros and cons about researched ICT support phenomena and implementations were pointed out and compared to each other. Finally the thesis gives a suggestion for cloud-based service desk implementation.</p> <p>The results showed that service desk models are heading towards collaborative, more cost-effective and scalable schemes. One of the most interesting findings was crowdsourcing. There are already many services which exploit the crowd intelligence in task solving. Crowdsourcing-based solutions are presented as a potential solution for cloud-based service desk.</p>		
Keywords FreeNest, Cloud Computing, Service desk, Technical support, Crowdsourcing		
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Tiivistelmä  Opinnäytetyön tarkoituksena oli tutkia moderneja ICT-tukipalveluita, joita voidaan käyttää pilvipohjaisen service desk –ratkaisussa. Opinnäytetyön toimeksiantaja on FreeNest-projekti, joka on TIVIT Cloud software program -nimistä ohjelmaa, jonka tarkoituksena on kiihdyttää suomalaisen ohjelmistoteollisuuden kilpailukykyä. FreeNest tarjoaa pilvipohjaisia avoimen lähdekoodin projektityökaluja. Jotta FreeNest voidaan tuoda markkinoille, on sen tueksi rakennettava tekninen tukipalvelu. Opinnäytetyö etsii ratkaisuja pilvipohjaisen service deskin toteuttamiseen.  Opinnäytetyö esittelee käsitteet ja teknologiat pilvipalveluiden ja service desk -teknologioiden takana. Opinnäytetyö toteutettiin tutustumalla ICT-alan trendeihin ja soveltamalla niitä pilvipohjaisille tukipalveluratkaisuille sopiviksi. Tutkittujen ilmiöiden hyödyt ja haitat eriteltiin ja eri ratkaisuja verrattiin toisiinsa. Lopuksi opinnäytetyössä annetaan suositus pilvipohjaisen service deskin toteutukselle.  Opinnäytetyön tutkimus osoitti, että tulevaisuuden service desk ratkaisut ovat yhä kustannustehokkaampi ja skaalattuvampia. Yksi mielenkiintoisimmista ilmiöistä ICT-maailmassa tällä hetkellä on joukkoistamisen yleistymisen tehtävänratkaisussa. Markkinoilla on jo useampia toimijoita ja joukkoistamisen soveltaminen tukipalvelurakenteisiin on myös yksi opinnäytetyössä esitellyistä service deskin toteutusratkaisuista.		
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## CONTENTS

<b>1</b>	<b>INTRODUCTION .....</b>	<b>5</b>
<b>2</b>	<b>BASIS OF THE THESIS.....</b>	<b>6</b>
2.1	TIVIT Cloud Software Program .....	6
2.2	SkyNEST .....	6
2.3	FreeNest .....	7
<b>3</b>	<b>Cloud computing .....</b>	<b>9</b>
3.1	Cloud computing now and then .....	9
3.2	The definition of cloud computing .....	10
3.3	Cloud service .....	11
3.4	Cloud service examples .....	14
3.4.1	Rackspace .....	14
3.4.2	Windows Azure .....	14
3.4.3	Google .....	14
3.5	Cloud computing benefits.....	15
3.6	Cloud computing issues .....	Virhe. Kirjanmerkkiä ei ole määritetty.
3.7	The future of cloud computing.....	16
<b>4</b>	<b>TRADITIONAL ICT SUPPORT AND SERVICE DESK .....</b>	<b>17</b>
4.1	Traditional service desk picture .....	17
4.2	Service desk structures .....	18
4.3	ITIL.....	19
4.4	Service Level Agreement .....	21
4.5	Issue Tracking System.....	22
<b>5</b>	<b>MODERN ICT PHENOMENA RESEARCH .....</b>	<b>22</b>

<b>5.1</b>	<b>Modern ICT support .....</b>	<b>22</b>
<b>5.2</b>	<b>Example of an cloud service providers technical support.....</b>	<b>24</b>
<b>5.3</b>	<b>SaaS service desk.....</b>	<b>25</b>
5.3.1	Software as a service .....	25
5.3.2	HelpDeskSAAS .....	25
5.3.3	Freshdesk.....	26
5.3.4	Zendesk .....	28
<b>5.4</b>	<b>Self Service.....</b>	<b>32</b>
<b>5.5</b>	<b>Instant messaging.....</b>	<b>33</b>
<b>5.6</b>	<b>Social media .....</b>	<b>35</b>
<b>5.7</b>	<b>Crowdsourcing .....</b>	<b>36</b>
<b>5.8</b>	<b>Examples of crowdsourcing-based services .....</b>	<b>37</b>
5.8.1	Single task solving: Amazon Mechanical Turk.....	37
5.8.2	Task solving metaplatforms: Crowdflower .....	38
5.8.3	Crowd-base innovation: Dell Ideastorm .....	39
5.8.4	Collaborative crowdsourcing: Ideaken.....	40
5.8.5	Crowdsourcing and data quality .....	41
5.8.6	Crowdsourcing motivation .....	41
<b>5.9</b>	<b>Means of payment .....</b>	<b>47</b>
5.9.1	Free of charge or chargeable service desk? .....	47
5.9.2	Bitcoin.....	47
5.9.3	PayPal .....	51
<b>6</b>	<b>RESULTS .....</b>	<b>53</b>
<b>6.1</b>	<b>Solutions in comparison .....</b>	<b>53</b>
<b>6.2</b>	<b>Suggestions for modern service desk solutions .....</b>	<b>57</b>

6.2.1	Crowdsourcing-based service desk.....	57
6.2.2	SaaS service desk powered support.....	60
6.2.3	Financial matters.....	62
<b>7</b>	<b>DISCUSSION.....</b>	<b>63</b>
	<b>REFERENCES.....</b>	<b>65</b>
	<b>APPENDICES.....</b>	<b>70</b>
	<b>Appendix 1. Kauffman Schulze Motivation survey questions.....</b>	<b>70</b>

## FIGURES

FIGURE 1	FreeNest Logon .....	7
FIGURE 2	Connections between FreeNest, TIVIT, SkyNEST, Nestronite and FinnCloud .....	8
FIGURE 3	Cloud Computing overview .....	13
FIGURE 4	Freshdesk full features and pricing .....	27
FIGURE 5	Zendesk login.....	29
FIGURE 6	Zendesk users' front page .....	30
FIGURE 7	Received ticket in Zendesk .....	30
FIGURE 8	Customer can track the status of requests with Zendesk.....	31
FIGURE 9	ServiceNow Chat window.....	34
FIGURE 10	The transaction of the Bitcoin .....	48

**TABLES**

TABLE 1 Service desk structures.....	19
TABLE 2 Kauffmann-Schulze Motivation Surveys Factors.....	43
TABLE 3 Results of the Motivation survey .....	46
TABLE 4 Pros and cons of non-crowd-based solutions .....	54
TABLE 5 Pros and cons of crowd-based solutions.....	56

# 1 INTRODUCTION

Traditionally ICT support solutions have been implemented by using call center based service desks. Typically customers contact service desks over the phone and service desk employees handle service requests in the office, one customer at a time.

Frameworks of the ICT service provision have changed lately and new more efficient, cost-effective and effortless ways of ICT customer support are in demand. The focus of this bachelor's thesis is to explore modern ways to provide cloud-based ICT support services and the focus is on the future.

The assignment of this thesis came from FreeNest project specialist Marko Rintamäki. FreeNest is a cloud-based project development platform which integrates open source software together and offering customers customized project tools. The intention is to bring FreeNest to the market as a cloud service. For the support of FreeNest service, service desk or other technical support is needed. The solution should be based on future ICT trends, be cost-effective and a service desk should not require lot of hired employees. This thesis describes the future perspective of the possible service desk implementation based on distributed and collaborative solutions.

The main purpose was to find existing ICT support solutions or potential innovations which can be used in future service desks in cloud-based environments. The research was carried out by studying new ICT trends and applying them to the need of cloud-based service desks. The aim is to point out cons and pros about ICT support phenomena and implementations and compare them to each other. With system and process designing it is also important to take a notice of financial points of view; therefore, one part of the thesis is to discuss money matters. Based on the whole research process, suggestions of modern service desk solutions will be given.



## 2 BASIS OF THE THESIS

### 2.1 TIVIT Cloud Software Program

TIVIT is one of Finland's Strategic Centres for Science, Technology and Innovation (SHOKs). The aim of TIVIT Cloud Software program is to improve the competitive position of Finnish software development. Focus area director of Cloud software program's Janne Järvinen explains the factors of competitiveness as follows:

*According to the 2009 survey most significant factors of competitiveness are: **operational efficiency, user experience, web software, open systems, security engineering and sustainable development**. Cloud software ties these factors together as software increasingly moves to the web. (Järvinen n.d.)*

The program is a four-year project which started in 2010 and continues to year 2013. The target of TIVIT Cloud Software program is to be a pioneer of building new cloud based business models which are leaning on software enterprise model and open cloud software infrastructure. (Järvinen n.d.) TIVIT has also founded a project called FinnCloud, which is based on technologies and concept created in TIVIT cloud software program (Nordgren 2012).

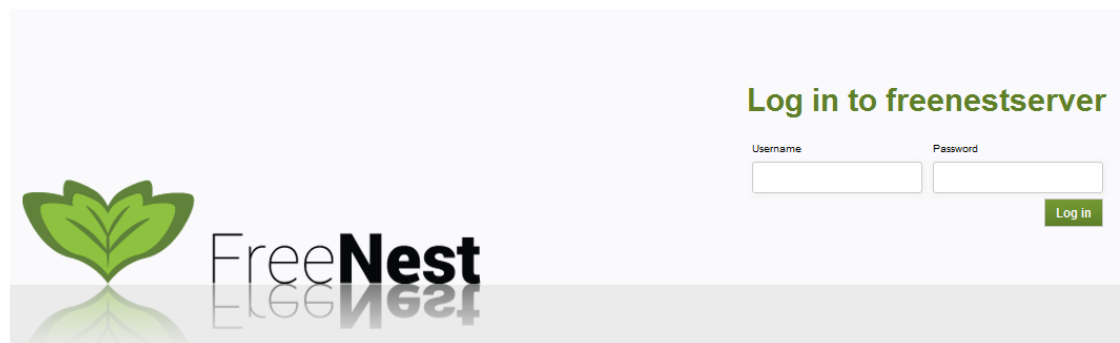
### 2.2 SkyNEST

SkyNEST is a 3-year project in JAMK University of applied sciences which develops and maintains FreeNest product. SkyNEST is a sub project under the TIVIT Cloud Software Program. JAMK students are strongly participating in developing and producing the content of FreeNest. (SkyNEST n.d.)

## 2.3 FreeNest

FreeNest Portable Project Platform is an integrated platform based on Open Source software development tools. FreeNest integrates commonly used open source software together and allows users to create environment for specific needs. It aggregates open source tools into one service package and acts like glue between them. FreeNest differs from traditional project development platform by not being offered as a centralized service but being meant for single team, project or product. Every time when a new team or project starts to work, FreeNest will be launched. (Product development through open source 2012, 22)

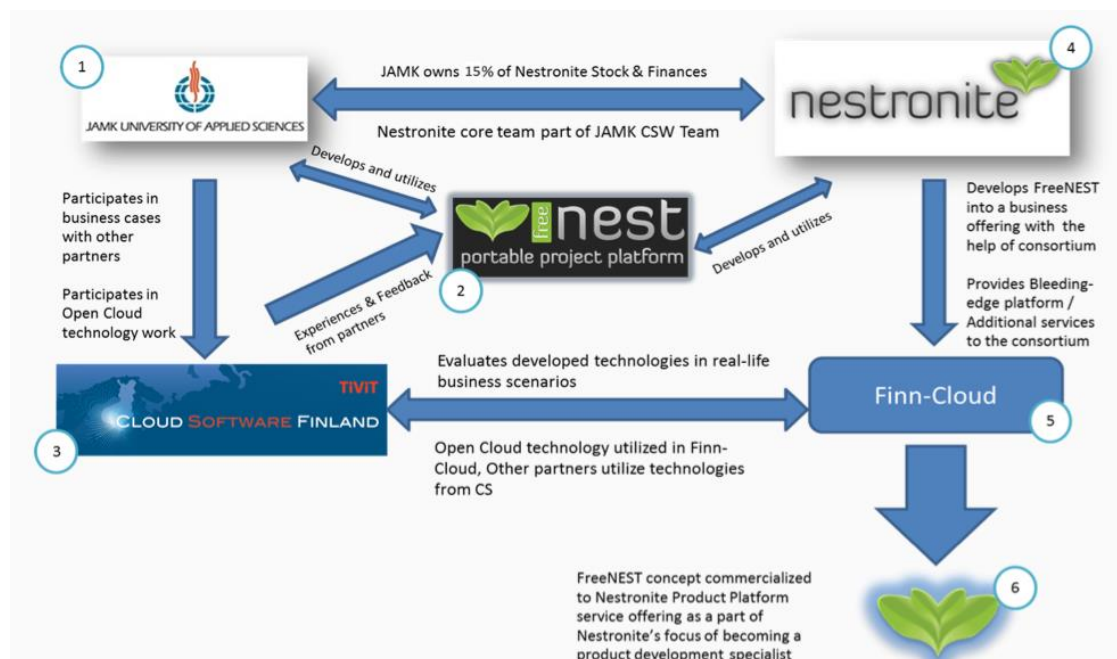
For customers FreeNest would look like a webpage and when customers sign into the page, all features can be found at the same platform. When customers have logged in, the content of their package of services is ready-to-use. **Figure 1** illustrates the FreeNest login page:



**FIGURE 1 FreeNest Logon**

At some point the aim is to bring FreeNest to the market. It has not been chosen yet what will be the party who will start to offer FreeNest as a service but when FreeNest is launched in public market there has to be service desk solution. The aim of this thesis is to point out the best solutions of implementing the cloud-based service desk to be cost-effective and scalable. In 2011 company called Nestronite was founded to

promote commercial point of view of the FreeNest. JAMK is one owner of the Nestronite. Figure 2 illustrates connection between FreeNest, TIVIT, SkyNEST (JAMK), Nestronite and FinnCloud (Kuosmanen 2012).



**FIGURE 2 Connections between FreeNest, TIVIT, SkyNEST, Nestronite and Finn-Cloud (Kuosmanen 2012)**

FreeNest is an open source-based ALM solution. Application lifecycle management (ALM) has three aspects: governance, development and operations. The purpose of governance is to offer right applications to provide for business needs. Governance is present during the whole lifecycle of an application. The first step is to plan which services are taken into use and when the plan is approved the application development lifecycle begins. The development part includes literally the development of the application: requirement definition, designing, testing and updating. When the application has been deployed, it must be monitored and managed throughout the whole lifecycle. This is called the operation part. All three parts of ALM are connect-

ed to one another and doing all of these parts well increases the business value of the application. (Chappel 2008)

ALM is a management model for application management. PCDA model is also important to be familiar with. PDCA (plan-do-check-act) is four-step model for ensuring quality in improving processes and products or dealing with problems. PDCA allows having higher quality results and handling work more systematically. The first step in the process is planning (plan). In this phase planning is made by standards of the business. Visions and missions and also goals and milestones must be defined and documented. Once the planning is done it is time to implement the plan (do). After the work the next step is to analyze data (check). This is not a one-time event but continues as long as the implementation is in use. In final step the achievements are evaluated (act). If the change is not usable cycle can be gone through again with different plan. If changes are successful they are deployed. (PDCA Cycles n.d.)

## **3 CLOUD COMPUTING**

### **3.1 Cloud computing now and then**

The concept of cloud computing is only a few years old but there have already been similar ideas many decades ago. The ICT professionals have introduced models where resources could be shared via one distribution station. This is comparable to a model where electricity is delivered via one distribution system's network to multiple clients. An American computer scientist J.C.R Licklider is considered as the first person to bring the idea of cloud computing to the forefront in late 1960s. Licklider inspired the ARPANET (Advanced Research Projects Agency Network) to evolve. AR-

PANET is the predecessor for internet as we know it nowadays. The primary Architect of ARPANET Larry Roberts has said that J.C.R. Licklider had a concept of an intergalactic network and he believed that everybody could use the same data anywhere in the world. He just did not have a solution to implement this kind of model. (Arpanet n.d.)

Now in 2013 cloud computing has solidified its place in ICT. The global finance crisis and depression that hit the world in the early and mid-2000 (decade) was an excellent opportunity for cloud computing to grow bigger. When a company is using cloud based services they have to do only few or no ICT investments. There are no solid expenses and services can be used only when needed. This can significantly decrease overall expenses. (Salo 2012, 16)

### **3.2 The definition of cloud computing**

There is not only one definition of cloud computing; however, one of the most common definitions is given by American NIST (National Institute of Standard ad Technology):

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

NIST also describes five typical characteristics of cloud services:

1. on-demand self-service
2. broad network access
3. resource pooling
4. rapid elasticity or expansion
5. measured service (Mell et al. 2011, 2)

On-demand self-service means that resources can be brought to use or stopped to be used without contacting the service provider. Customers can decide when to use the resources and pay only when using them. Users can also decide how many services they need and how to use them. (Salo 2012, 17)

Broad network access means that all the services are available for any computer, laptop, or mobile device. Geographically users can be anywhere and the only necessity is a proper internet connection. (Salo 2012, 17)

Resource pooling means that users do not have to know where the resources are located and maintained. There can be several users who can use the same resources. Of course shared resources decrease prices and overall payments. (Salo 2012, 17)

Rapid elasticity and expansion offer a quick and adjustable use of resources. New resources can be taken into use almost immediately. It also helps the service provider to develop software and bring new services to their clients. (Salo 2012, 17)

Service providers also have to measure and monitor the use of resources. The billing often depends on the use of resources. Customers pay for only used services and the service provider has to offer specific information about the used resources. (Salo 2012, 18) There can be also other kinds of payments for example monthly fees.

### **3.3 Cloud service**

As mentioned before, cloud services can be accessed with any computer and the only requirement is a proper internet connection. This means that cloud services are provided on servers located in clouds on the internet. Customers do not know where the servers are located physically and they can access service via web browsers or applications. In 2006 Amazon launched S3 service which is considered as a first cloud

service. S3, simple storage service, provides data storage and service still exists. After that Amazon has launched many other services and one of the most significant of them is Elastic Computing Cloud (EC2). (Salo 2012, 60) EC2 provides virtual servers, AMIs (Amazon Machine Image) and offers compute capacity in the cloud. Customers can choose which features they need and pay only for used resources. (Amazon elastic compute cloud n.d.) Amazon EC2 is one of the biggest service providers in cloud industry.

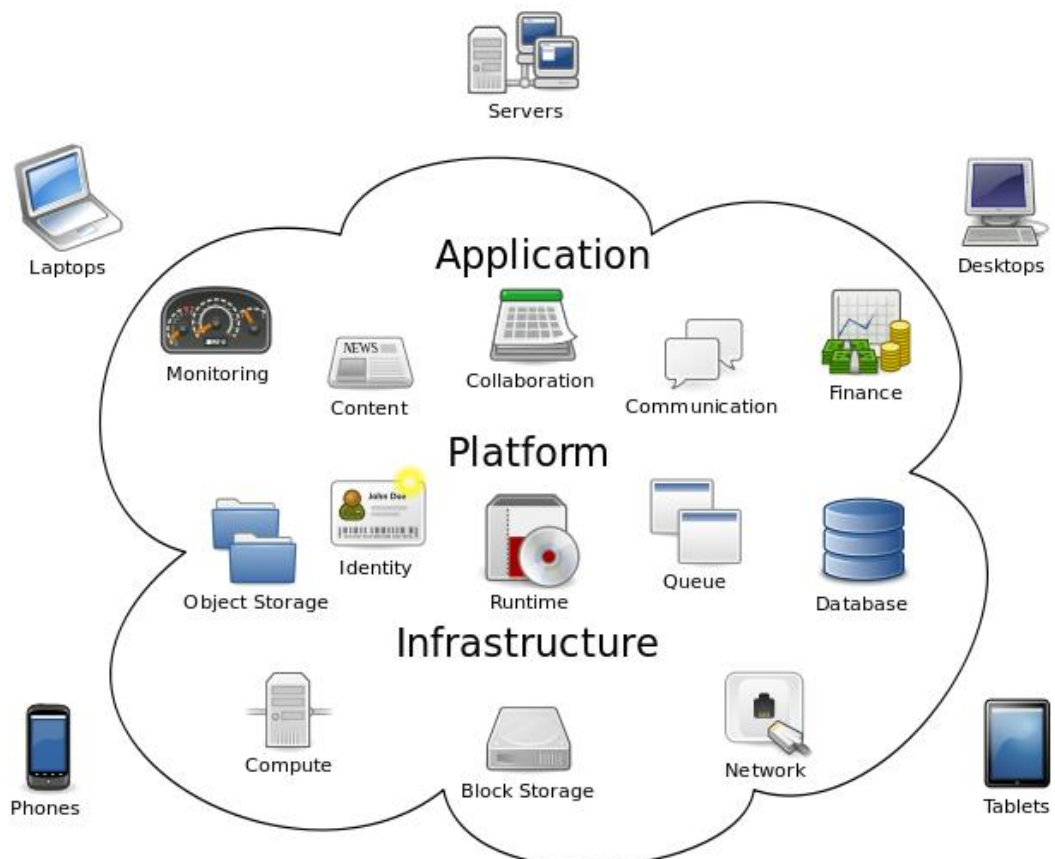
One of the key pieces of cloud computing is virtualization. All cloud environments are virtual, which means that in one single hardware equipment there can be multiple virtual services. Virtual is opposite to a physical. When customers are using cloud service, for example some software, the service is not located in customers' computer. It runs in a cloud service provider's server and the same service can be used with multiple clients. (Chee 2010, 15)

Cloud services are usually divided into three groups: Infrastructure as a service (IaaS), platform as a service (PaaS) and software as a service (SaaS). When customers use IaaS-solution they buy service provider hardware resources from a service provider as a service. It is a flexible way to buy and use capacity because it can be brought into use anytime needed or stopped using when it is not needed anymore. Resources are virtualized and scalability and maintenance are highly automated. Using resources can be started without contacting the service provider. It is a self-service solution and users do not have to access the hardware environment physically. It is up to the service provider to maintain performance and security: there can be many customers using the same physical resources however they have to stay invisible to each other. (Salo 2012, 22)

PaaS offers a platform where software can be developed, maintained and tested. When using these kinds of platforms there is no need to take care of infrastructure matter and usually there are also ready-made modules and interfaces. (Salo 2012, 24)

SaaS is the most widely used of these three services. Software-as-a-service solutions provide software to companies with no effort or extra investment: software is ready to use and no installation is needed. The only requirement is a computer or comparable device with proper internet connection. Companies do not need to install, maintain or update software and there are usually no fixed license contracts. Software can be brought to use whenever it is needed. Billing is usually charged by the minute or based on the number of users or computers. The service provider has a responsibility to maintain services and based on the feedback given by multiple users, software development can be continuous. (Salo 2012, 25)

Cloud service means that something is provided as a service. **Figure 2** illustrates that services can be used with all kinds of equipment:



**FIGURE 3 Cloud Computing overview** (Cloud computing n.d.)



There are also other “something-as-a-service” models but IaaS, PaaS and SaaS are the most widely used and known.

### **3.4 Cloud service examples**

#### **3.4.1 Rackspace**

Rackspace is an example of IaaS level of cloud services. It was founded in 1998 and it provides virtual servers, data storages and load balancer as a cloud service. Customers can choose the service package based on their needs and they can decide how many servers, how much storage and how wide technical support services do they need. Geographically, Rackspace has data centers in three different continents; the services, however, can be provided anywhere in the world. (Salo 2012, 66)

#### **3.4.2 Windows Azure**

Microsoft’s Windows Azure is principally a PaaS platform founded on 2010. It offers also some IaaS resources, such as data storages. Windows Azure has many cloud-based services for example CDN content distributor network for global data sharing, virtual network services and access control services. Like cloud services usually, Windows Azure also provides flexible and modifiable platform for customers. (Salo 2012, 70)

#### **3.4.3 Google**

Google offers many cloud services especially in the SaaS field. Google offers services mostly for consumers and for free of charge. Selection contains for example e-mail service Gmail and calendar service Google Calendar, social media service Google+,

webpage user tracking service Google Analytics and word processing, spreadsheet and presentation graphic software services Google docs. (Salo 2012, 76)

For businesses Google offers Google Apps service which is also cloud-based but it contains more applications, such as data achieving and information governance and it can be integrated to businesses' web pages. (Google Apps for Business. n.d.)

### **3.5 Cloud computing benefits**

The first and the most significant benefit of using clouds is the cost-effectiveness. Companies do not have to make ICT-investments and almost all of the ICT services can be purchased from cloud service providers. Therefore costs are not fixed and this can decrease expenses significantly. Companies can decide when and where to use services. Globalization is a huge trend in economics and cloud computing is adaptable for globalization for its nature. Because there is no need for users to know where the resources are located or how they are maintained, the users can access the resources anywhere if there is a usable internet connection. (Salo 2012, 16)

Cloud computing also offers an ecological option of using ICT-services. Environmentally friendly way of thinking has been one of the most significant phenomena in the latest years all over the world. Cloud computing supports this green thinking in many ways: Resource utilization rates grow because shared resources can be accessed anywhere there is an internet connection. Because there are no limits for geographical position, the need of travelling and therefore accessing the resources will leave a smaller ecological footprint. (Salo 2012, 16)

One of the issues about cloud computing is the privacy of data. Many companies and users access the same data and it is service providers' responsibility to ensure privacy. There are also other concerns about data in the cloud, such as accessibility, information security and data protection. Cloud services also do not offer much of possibilities of managing. Customers do not have access to service providers' servers

physically and usually do not know how services are technically implemented and whether information security is proper or not. What if customers want to change cloud service provider and data cannot be transferred to other service? What if cloud service provider goes bankrupt or from another reason ceases their operations? Cloud services raises lot of uncertainty. Of course these risks have to be taken into consideration when purchasing cloud services; however cloud service providers want to ensure privacy and security of data because unreliability affects negatively to business. (Salo 2012, 36-47)

### **3.6 The future of cloud computing**

Cloud computing is relatively new phenomenon in IT field. Is it transient trend or have cloud services come to stay? IN 2012 European commission's study called Advances in cloud (Schubert, Jeffery 2012) describes future prospect of cloud services. According to study IT field has not reached its full potential and cloud services offers potential to growth. Technologies are developing fast and cloud computing offers a great platform to this growth; however it is possible that in the future there will be new implementations and capabilities that cloud concept cannot fulfill. (Schubert at al. 2012, 66-67)

The future success of cloud services are also supported by public sectors. For example in Finland cloud service laboratory Forge was founded to the Data Center of Kajaani and it is supported by public funds. The ministry of transport and communication in Finland funded the CSC (ICT Center for science) with four million euros to develop Data Center of Kajaani. In the future it is expected that Forge and other cloud-based projects will increase employment and enable more international business to be founded in these kinds of environments. (Moilanen, 2013)

## 4 TRADITIONAL ICT SUPPORT AND SERVICE DESK

### 4.1 Traditional service desk picture

The purpose of service desks in ICT is to provide technical customer service and handle other technical issues. Service desks receive and solve service request and can also handle incidents. A related term to the service desk is a help desk. In some companies there can be even both, the service desk and the help desk with different tasks or different clients. Usually the help desk handles less challenging tasks and the service desk is responsible of more challenging issues. (Rouse 2010) In this thesis a term “service desk” is used to describe all kinds of technical support parties. Service desks can be used to handle different kinds of ICT matters. Service desks can have internal or external clients and the service desks can handle everything between companies’ ICT systems or it can support single products or services.

The first step of the thesis research was to get to know traditional ways to implement the service desks. Traditionally service desks have been call center-based contact points where employees solve customers’ service requests in dedicated offices. Call center is a physical place where service requests are received by a telephone system. A typical service desk employee is an educated professional engineer or technician with regular working hours and fixed salary. Service desks have specific opening hours and outside those hours, phone lines are closed or the service is offered with extra fees. To run a service desk, there has to be an office or another physical space, phone and data communication systems and facilities, employees, managers and outsource resources. Employees must also be trained regularly. This can be very expensive for both service desks and customers. (Help desk review guide 2003, 2)

In traditional service desks, as described above, there is certain number of employees taking phone calls and workloads are very unpredictable. Sometimes service desks could be so busy that all of the customers' service requests cannot be handled in appropriate time and sometimes there are workers without any tasks. Employees get their salaries whether there is a little or a lot of work to do. This is not very cost-effective. It is hard to balance the number of employees, so that service levels remain at the right level. Service level means how many customers have been served in time. If the service level is hundred percent and every customer was served instantly it may refer to too many workers but if the service level is too low that means that there are maybe too few workers. (Help desk review guide 2003, 4)

## **4.2 Service desk structures**

In 2006 Help Desk Institute (HDI) published a wide study which examined the ICT industry and service desks in the United Kingdom. The study was carried out by distributing a questionnaire for approximately 3000 ICT professionals and the aim of the study was to find out the most common service desk practices. (Service desk practices 2007, 10)

The study showed that at the time there were three major service desk structures:

- Technical, highly skilled: All service desk agents take support requests and are responsible for resolving tasks.
- Log and refer: There are separate call takers who do not solve problems. Calls are directed to the group who solves cases.
- Two-tier: There is a first-line support, which takes calls and resolves some of the cases. If more expertise is needed the case will be directed to a second-line support that solves more troublesome cases. (Service desk practices 2007, 10)

According to the survey the Technical, highly skilled service desk structure was the most common in the year 2005. Two years later the two-tier service desk structure has increased significantly. Survey results of 455 respondents representing different organizations are listed on **Table 1**.

**TABLE 1 Service desk structures** (Service desk practices 2007, 10)

	<b>2005</b>	<b>2007</b>
<b>Technical, highly skilled desk</b>	50 %	33 %
<b>Log and refer</b>	9 %	7 %
<b>Two-tier</b>	35 %	56 %
<b>All others</b>	7 %	4 %

It is easy to explain why the two-tier service desk structure has become more popular. First-line analysts have lower salaries and the most of the cases could be solved with less expertise. This could decrease company's expenses. Of course when first-line workers solve easier cases their own expertise increases and later those same workers could be used as second line supports. (Service desk practices 2007, 10). This two tier structure usually means that company has a first-line support, help desk, and a second-line support, service desk.

### **4.3 ITIL**

HDI's Service Desk Practices study showed that one of the most highly valued specific skills in recruitment of new employees were ITIL qualifications. Also, in organizations by the far most qualifications achieved were ITIL qualifications. (Service desk practices 2007, 17) Information Technology Infrastructure Library (ITIL) is the most common and widely used foundation of ICT support and service desk solutions. ITIL is the collection of the best practices about designing, providing and managing IT services. It is up to the company or organization which features of the ITIL they want to use. In

traditional service desks ITIL or at least some of its features or variation are commonly used. (ITIL n.d.)

The current version of ITIL (before known as ITILv3) was released in 2007 and was updated in 2011. In this thesis the term ITIL will be used for describing this current version. ITIL consists of a five books and the whole management lifecycle of ICT services is listed in these books as it was described in ITIL (ITIL n.d.) introduction by itSMF:

1. Service strategy
2. Service design
3. Service transition
4. Service operation
5. Continual service Improvement

Each stage in the ITIL provides value to the business. Service operation is a phase where most of the activities happen and it can be seen in service desks working processes day-to-day. Service desk is a service operation function. In ITIL foundation service desk is a central point of contact between users and service providers. The main objectives of service desks according to ITIL Portal (Service Desk Objectives in ITIL Foundation 2008) are:

- Service desks act as a single point of contact (SPOC) for all of their ICT customers
- Service desks maximize service availability
- Service desks restore service if it is possible
- Service desks provide systems support

Incident management is an ITIL foundation process which is handled by service desk. The mission of this process is to restore normal service operation when some unusu-

al incidents disturb operations. Events, which are not a part of the standard operation of the service, are called incidents. The main objectives of the incident management according to ITIL portal (Incident in ITIL Foundation 2008) are:

- Best use of resources must be used to support the organization during service failures
- All incidents must be registered and tracked
- Meaningful records must be maintained
- Incidents must be handled with consistently

#### **4.4 Service Level Agreement**

An incident can be basically anything that affects to functionalities negatively or abnormally. It could be a problem with the applications or an automatic alarm from the system. Some cases are more critical than others. That is why all incidents must have priorities. Priorities are based on urgency and impact and these factors are defined in Service Level Agreement (SLA). SLA is a contract between the service provider and the customer and it is a very important document for both parties. It defines usually in measurable terms, what services the service provider provides. According to the director of WhatIs.com, Margaret Rouse (2008) SLA should specify at least the following metrics:

- Percentage of service availability time
- How many users can be served simultaneously
- Benchmarks for comparing actual performance periodically
- The schedule for notification, if network changes can affect users
- Response times for different kind of problems
- Dial-in access availability
- Statistics that will be provided



## **4.5 Issue Tracking System**

When service desks handle incidents, one very important part is to maintain records about the cases. Issue tracking system (ITS) is software, which is used for ticketing service requests. It is important to have ticketing system, because it provides all information about cases in a one location. It saves a great deal of time and effort. In ITS the incidents will be recorded in tickets. Typically tickets contain request reports, progression tracking towards solutions and the information about who is responsible for the case. Tickets can be tracked by priority statuses, owners or some other customized details. It is also important that tickets do not contain anything irrelevant, because the pertinent information should be easily found. (Rouse 2007)

# **5 MODERN ICT PHENOMENA RESEARCH**

## **5.1 Modern ICT support**

Now that the thesis has given a picture of traditional service desks, how do modern service desks look like? More and more cloud-based services will be developed and support solutions have to meet the requirements of this change. Modern cloud-based service desks have to be more cost-effective, geographically independent and scalable.

Service desks can be centralized, virtually centralized or decentralized. The difference between centralized and decentralized service desk is that centralized service desks support all of the technologies used by the customers and decentralized service desks support only certain technologies, products or users. The benefit of centralized service desk is that customers have only one contact point for support. It is faster and easier and usually more cost-efficient too. Employees need to be highly skilled to handle all kinds of service request according to usually wide ranges of technologies. Employees usually located in a single location. There can also be virtual service desks which gives an impression of centralized service desk. Internet, telephone systems or other technical implementations direct customers to right expert. In decentralized service desks support is more targeted. Business may have multiple technologies and there can be two or more service desks and each of them handles different kinds of incidents and requests. Decentralized service desk model is usually used in larger companies. There can also be central service desks which direct customers to right experts. (Guide to service desk concepts, third edition n.d. 36-42)

These models also have to be taken into consideration when cloud-based service desk is designed. It is up to the service which model is the best. If selection of services and products is congruent, centralized service desk might be better solution and vice versa; however virtual centralized service desk perhaps is the most contemporary. When traditional service desks are usually call center contact points, the thesis focus is look the opposite way: is it possible to implement service desks that does not requires a single point of contact where employees sit at the office and answers customers' phone calls? Collaborative work and crowdsourcing are discussed widely with public; however, could these phenomena be applied to ICT support models? Based on these factors the following ICT phenomena were researched.

## 5.2 Example of cloud service providers technical support

This thesis was a research about new ways to implement ICT support and service desk solutions for the needs of FreeNest project. FreeNest is not on the international market yet; however there are already service providers who do business with a similar product. One of them is Atlassian JIRA. JIRA provides project management tools in an integrated project platform and Atlassian's support for customers includes personal technical support service and self-service knowledgebase. Technical support is available either five or seven days a week round-the-clock. Customers can choose how widely supported service they will need. Customers can create service requests via Atlassian's website. First a website offers search option and documentation and manuals about product. Customers can also use forums to find answers and chat about the product. If customer cannot find answers on documents or forums, they can leave a service request. This requires signing in to the service. For service request handling JIRA uses cloud-based Zendesk customer service software. Zendesk will be introduced in the next chapter. Customers can leave service request tickets to Atlassian's support team. When a customer is buying a JIRA product, a certain number of technical support contacts per license are included in the price. Atlassian has different support levels and customers can choose which one they will need. Issues are also classified in different severity levels. It depends on service level agreements (SLA) how fast Atlassian will response. For example if applications are down and it is causing business revenue losses, the response must come in one hour, but if customers have only product feature questions, response times can be longer. Atlassian also offers phone support with certain limitations; however the web-based support is recommended because it is available round the clock. (Atlassian support offerings n.d.)

## **5.3 SaaS service desk**

### **5.3.1 Software as a service**

As mentioned in chapter 5.2, Atlassian JIRA has a technical support which uses Zendesk customer support software. In research process many similar service desk as service implementations were found, but Zendesk was the one which appeared the most often. Service desks that use SaaS service desk software are literally powered by software that is a cloud service. They can be accessed anywhere in the world and the only requirement is a proper internet connection. Researching the SaaS service desks showed that cloud-based service desk software is very easy to deploy because the software is ready-to-use but still customizable for companies' practices and image. Features are usually selectable and selections of features are wide. When companies are using service desk software that is billed by the number of agents, it means that the company has to have a fixed number of employees. This brings out a similar problem than with traditional service desks; the number of employees is fixed but workloads can never be predicted precisely.

Three different SaaS service desk solutions were studied more precisely during the research. They all have relatively similar user interfaces and differences between SaaS service desks can be usually seen in features and pricing. During the research Zendesk was in test use to illustrate the use of service desk software.

### **5.3.2 HelpDeskSAAS**

HelpDeskSAAS offers, as the name indicates, service desk as a service. It is designed for mid-sized companies for customer service purposes. Alike other cloud services HelpDeskSAAS does not require installations, it is 100% web-based and it can be used via any web browser. Both service desk employees and customers can use it with any computer and from anywhere in the world. (HelpDeskSAAS overview n.d.)

Customers can leave service requests via web portal or by e-mail. The software includes a ticketing system which categorizes different kinds of requests and separates them into queues. It is also possible to name responsible persons for the queues, so that the requests find the right solvers. (HelpDeskSAAS Ticket management n.d.) HelpDeskSAAS can be integrated to companies' websites and there are also other features that can be added to support system, such as self-service portals. HelpDeskSAAS is easy to bring into use and because it is cloud-based it does not require maintaining, developing or troubleshooting the software. The service provider carries responsibilities about functionality. (HelpDeskSAAS overview n.d.)

Companies can choose from different versions of HelpDeskSAAS based on how many agents (licenses) do they have and how many service requests (tickets) they will handle. For example for five agents and for 250 new tickets per month the price is 25 American dollars on each month. For larger companies with 30 agents and 1500 tickets the price is 125 American dollars. HelpDeskSAAS also offers 30 days free trials. The price is competitive; however there are not so many features in HelpDeskSAAS that for example in Zendesk, which will be introduced later. HelpDeskSAAS is good for companies that want an easy-to-use service desk solution with the most important features such as online-ticketing system and self-service portals. (HelpDeskSAAS Pricing n.d.)

### **5.3.3 Freshdesk**

Freshdesk is the second researched service desk software that is cloud-based. It is quite similar to other SaaS service desks offering ticketing systems, self-service portals and other the most important service desk features. Companies can modify Freshdesk the way they want and they can share tickets via external services, such as data sharing service Dropbox. Employees can access Freshdesk with any computer and anywhere in the world. (Tour de'freshness n.d.) The pricing is based on features and there are four different versions of service to choose from. With extra payments

companies get a comprehensive package of features. **Figure 3** illustrates Freshdesk’s most versatile version, Estate, features:

**\$40**

\$40/Agent/mo annual billing  
\$49 monthly

Perfect if you believe customer support should be fun

**SIGN UP**

- Email Ticketing
- Self-service portal & Knowledge base
- Business rules & automations
- Integrated satisfaction surveys
- Unlimited incoming & outgoing Mailboxes
- Custom domain mapping
- Advanced Rebranding
- Full CSS-level Customization
- Customer Portal Layout Customization
- Social Support across Twitter Facebook
- Integrated community forums
- Ticket time-tracking
- Advanced reports
- Multi-product support
- Multiple portal languages
- Agent collision detection
- Integrated game mechanics
- Access to FreshThemes Gallery
- Integrations with 30+ popular tools

**\$4** For Day Pass access

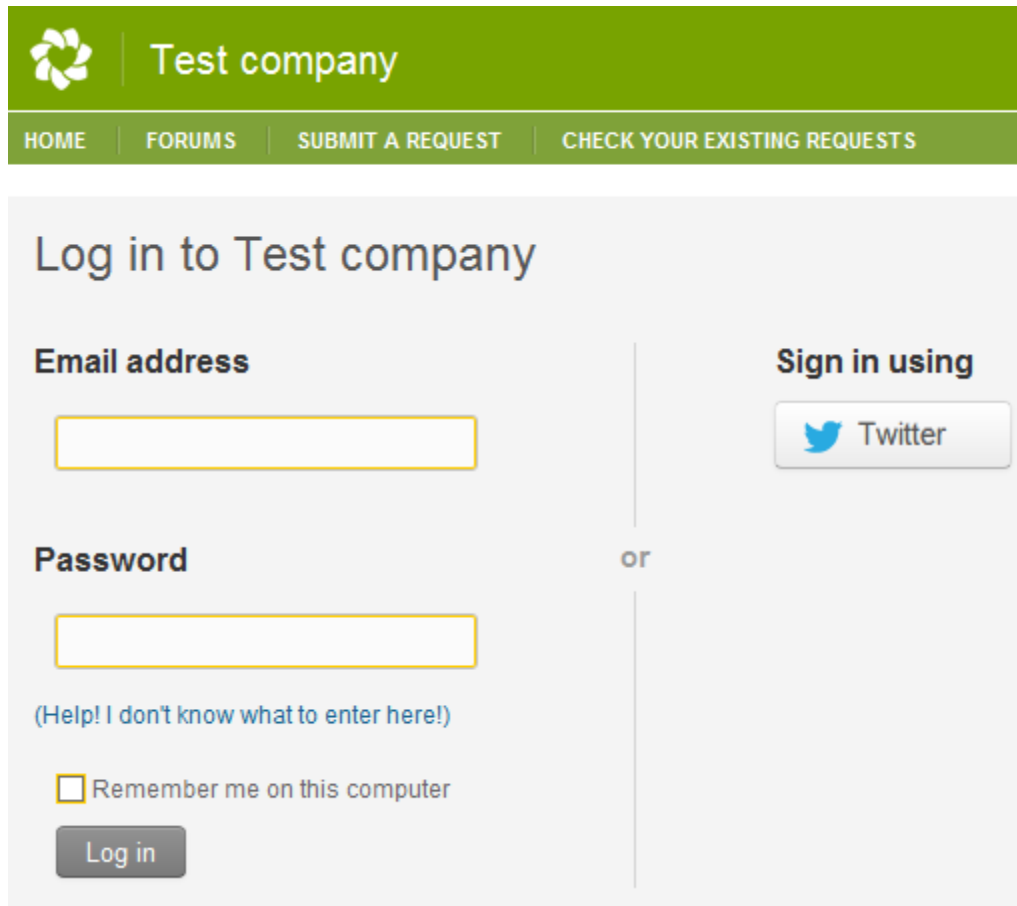
**FIGURE 4** Freshdesk full features and pricing (Freshdesk pricing n.d.)

In comparison the simplest version of Freshdesk includes only five features: Email ticketing, self-service portal & Knowledge base, Business rules & automations, advanced rebranding and Integrations with 30+ popular tools. Pricing is free for first three agents and for more agents 15 American dollars per an agent. Freshdesk is good for many companies because features can be chosen based on the needs. (Freshdesk pricing n.d.)

#### **5.3.4 Zendesk**

During the research process Zendesk was chosen to be SaaS service desk solution that was under a closer analysis. Zendesk is service desk software which includes ticketing system, support portal, forums and many more features. Zendesk offers 30 days of free trial and one part of researching SaaS service desk was to try how Zendesk actually works. Zendesk ask to leave name, e-mail address and company information to create the support channel. (Zendesk pricing n.d.)

Zendesk was made for fictional company, called Test Company. Zendesk was ready for use right away after the registration and Zendesk support pages for Test Company's service desk were created to address <https://saassd.zendesk.com>. The login for both Test Company's service desk employees and customers takes place in the same address. The login via website is illustrated in **Figure 4**:



The image shows the login interface for 'Test company'. At the top, there is a green header with a white logo on the left and the text 'Test company' on the right. Below the header is a navigation bar with four links: 'HOME', 'FORUMS', 'SUBMIT A REQUEST', and 'CHECK YOUR EXISTING REQUESTS'. The main content area is titled 'Log in to Test company'. It features two input fields: 'Email address' and 'Password', both with yellow borders. To the right of these fields is a vertical line with the word 'or' in the center. To the right of the line is a 'Sign in using' section with a 'Twitter' button. Below the password field is a link '(Help! I don't know what to enter here!)' and a checkbox labeled 'Remember me on this computer'. At the bottom left is a 'Log in' button.

**FIGURE 5** Zendesk login

After the login, service desk workers can modify Zendesk pages. Adding users and organizations is very simple and need only few clicks. When users are added, they receive an email with a link to the login. They can now login, create passwords to their accounts and they will see the view illustrated in **Figure 5**:



The screenshot shows the Zendesk user front page for 'Test company'. At the top, there is a green header with the Zendesk logo and the company name. Below the header is a navigation bar with links for HOME, FORUMS, SUBMIT A REQUEST, and CHECK YOUR EXISTING REQUESTS. The main content area features a welcome message: 'Welcome to Test Company Customer Service!' followed by a sub-header 'Overview | Recent'. Below this, there are four sections: 'Announcements (0) »' with 'No topics found', 'Community Help (0) »' with 'No topics found - Ask a Question »', 'Tips & Tricks (0) »' with 'No topics found - Add Article »', and 'Feature Requests (0) »' with 'No topics found - Suggest an Idea »'.

**FIGURE 6** Zendesk users' front page

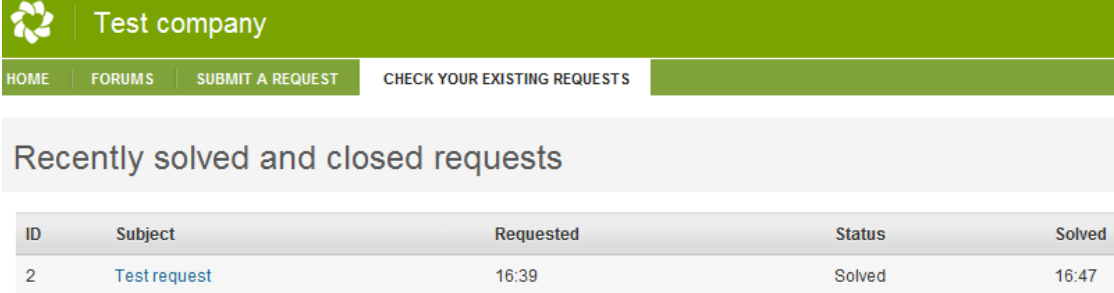
Users can now start leaving service requests and all existing requests can be followed on users' Zendesk pages. When customers have left their requests, service desk employees receive service request tickets. The tickets contain a subject, name of the requester, type and priority. **Figure 6** illustrates the received service request:

Your unsolved tickets (2) ▾		
<input type="checkbox"/>	SUBJECT	REQUESTER
<b>Status</b> Open		
<input type="checkbox"/>	Test request	Test User

**FIGURE 7** Received ticket in Zendesk

Service desk employees can now start solving issues and they can contact customers by leaving notes to tickets. Support is interactive between service desks and customers. Customer can see what is going on with the service request and see statuses of

the tickets. When a service request is full-filled, employees mark the ticket to be solved. Customers can always see the progress of the service request with their Zendesk page and look at the previous requests. The solved request is illustrated in **Figure 7:**



The screenshot shows a customer portal for 'Test company'. The navigation bar includes links for HOME, FORUMS, SUBMIT A REQUEST, and CHECK YOUR EXISTING REQUESTS. Below the navigation bar, there is a section titled 'Recently solved and closed requests' which contains a table with the following data:

ID	Subject	Requested	Status	Solved
2	<a href="#">Test request</a>	16:39	Solved	16:47

**FIGURE 8 Customer can track the status of requests with Zendesk**

As can be seen, Zendesk is very simple software. It is cloud-based so service desk employees and customers can both use Zendesk with any computer, mobile device or any equipment with proper internet connections. It is web browser –based service and the testing showed that it is very easy to bring to use. New agents and customers can be added with few clicks and there are features like instant messenger, live telephone support, social media services, forums and self-service portals. It has multiple features and based on testing they are all relatively easy to manage. The features can be taken into use by ticking boxes at portal setting.

Prices usually vary depending on the number of agents (licenses), Zendesk version and billing interval. For example, the regular version costs 24 American dollars per agent when billing is annual and the enterprise version with all features costs 99 American dollars per agent if service is billed monthly. (Zendesk pricing n.d.)

## 5.4 Self-service

During the research process one certain kind of support was found from the support portals of almost every cloud-based service: self-service. People are getting more and more familiar with computers and information retrieval is very easy because of internet access. Obtaining the information resources by using search engines, wiki pages and databases has become everyday activity for computer users. In working life it is the rule rather an exception that people know how to seek information.

When new products or services come to market, especially in ICT field, a service provider offers some user instructions in a product website. There can be found frequently asked questions (FAQ) which can be used for troubleshooting the most common issues or wider and comprehensive knowledgebase.

One of the most widely used self-service portals is wiki pages. Wiki engines run wiki pages that are edited by certain communities. The most widely known wiki is Wikipedia. Wikipedia is an encyclopedia which is written by wiki users. There are no hired writers or editors and every one can modify Wikipedia. Wiki and Wikipedia are not synonyms. Wikipedia is just one example of wikis. Many companies use their own wikis where employees or other users with editing rights can add, modify or delete wiki pages and then publish pages. Companies can use wikis for internal use or publish pages for customer use. In IT support wikis can be used for offering information, instructions, troubleshooting directions and almost anything that is relevant. Wikis can be modified fast, so information stay up to date. (Pikajohdanto wikeihin 2010)

But can self-service really reduce customer contacts to service desks? According to ICT research center Gartner in ICT companies almost 40 percent of problems can be solved by using self-service portals. Problem is that only five percent of the cases were solved by using self-service. This shows that customers are not willing to use self-service portals or customers do not know how to find information from there.

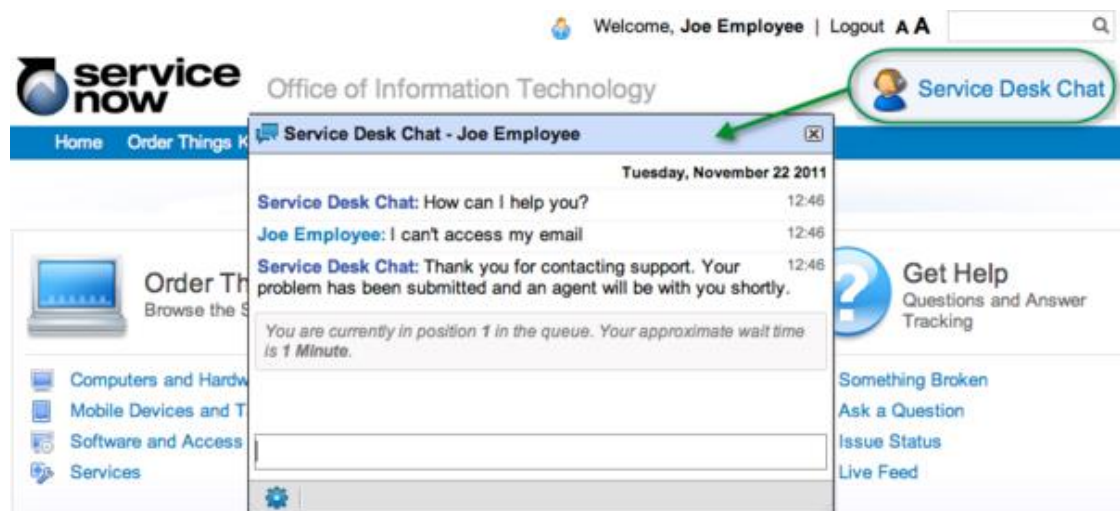
Gartner predicts that only less than ten percent of customers' problem will be solved by using self-service portals by the year 2015. This is not a large number because implementing the ICT self-service requires a great deal resources and effort and it is not a one-time investment. It is time-consuming to build a self-service portal and it needs regular updating as well. (Gartner Highlights Four Myths Surrounding IT Self-Service 2010) Still it is rule rather than exception that companies have self-service portals. It can even look rather bad if a company does not have instructions available in their website. So with self-service it is great amount of work and only small benefits; however it is expected that companies have this kind of service.

Self-service is not sufficient for the sole customer support method, because it is very unlikely, that all information would be on the same page in intelligible and applicable forms. The best way to offer customers a self-service support is to offer self-service as the first stage of the support: customers can first search answers to their questions from wikis or help pages and if that does not provide the right results, customers can contact the technical support.

## **5.5 Instant messaging**

Instant messaging is a way to communicate in real time and it reminds of normal face to face conversations but takes place online. It can be written language-based or even voice and video calling. It can be used via web browser or with dedicated software. Instant messengers, such as Microsoft Office Communicator and Lync have been used for years in companies for internal communication. It is also very common that people use Voice over IP service Skype with their computers to stay in touch with friends and relatives or online chat rooms to talk with other people. Instant messengers can also be used between companies and customers for offering online support.

Instant messaging as a cloud service is easy to implement. For many years there have been different kinds of chat rooms which can be used in a web browser. Ready-to-use instant messaging solutions can be found on the market already. For example, software as a service (SaaS) provider ServiceNow has created an instant messaging service, Help Desk Chat. Customers can contact service desks via an instant messaging tool by using a chat plugin. It is a cloud-based service and all the actions take place in a web browser. It is a real-time communication between customers and service desk workers. When customers need support they have to go to a certain webpage and log in and click Service Desk Chat button to open a chat window. Then customers write down their service requests and they will be entered to the chat queue. When a service desk employee is available, a customer can start to chat and get their problem solved. (Using help desk chat n.d) **Figure 8** illustrates the ServiceNow chat window:



**FIGURE 9 ServiceNow Chat window** (Using help desk chat. n.d)

This is basically how all instant messengers work. Instant messengers are easy to use. It is possible that one service desk member has more than a one customer at the same time and therefore queuing times can be much shorter than in phone call services.

One of the main issues with instant messaging is that a service desk employee and a customer have to be online at the same time. This is a similar situation such as in call center-based service desks where employees wait for the phone calls. Workloads can be hard to predict. Also it can be hard to measure service levels and other metrics. Instant messaging technology should be fully integrated so that managing is as easy as possible. In good quality service desks there should be ticketing systems where all cases are recorded, so it would be a good idea to integrate instant messaging tools straight to the ticketing system. When customers contact a service desk, the tickets are created automatically. The tickets should contain information to specify customers and be linked to the same customer's previous service requests.

## **5.6 Social media**

Today it is a rule rather than an exception, that companies use social media, such as Facebook, Twitter, Pinterest and many more, to increase coverage. These services are usually free of charge and nowadays they often even replace companies' www-pages. Customers get plenty of information from social media pages and one of the easiest ways to implement online customer support is to use social media. For example in Facebook if customers have problems or needs for extra information, they can either post questions from the Facebook wall or leave private messages. Then employees, who are responsible for maintaining Facebook pages, answer to customers. Modern society requires that companies use social media but does it have what it takes to be a channel for technical support? Social media services are very easy to use; however there are a few problems in using social media as a channel of service requests.

The largest problem with the social media supporting is the managing. In service desks there are several factors that have to be measured. It is important to monitor service levels, keep record of ticket volumes and measure a customer satisfaction. When service desk uses social media it is very hard to analyze metrics. There can also

be situations where customers' requests get lost on the Facebook wall because there can be lot of activities in social media at the same time. It can be hard to handle all the requests.

## 5.7 Crowdsourcing

One of the most interesting findings among the ICT trends was a relatively new phenomenon, crowdsourcing. The definition of crowdsourcing was first introduced in Wired Magazine in June 2006 by Jeff Howe and Mark Robinson: (Barbham 2008)

*Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers.*

Crowdsourcing is a process where the work is done by a crowd of people. Usually this takes place online. The main point of crowdsourcing is to bring together the expertise of many people. This can be easily to apply to designing service desk solutions.

One of the commonly known examples of crowdsourcing is Wikipedia. Wikipedia is an encyclopedia where content is created by the crowd. It is a webpage which allow user to add, modify or delete information about the subject. There are no hired writes or editors; however, there are millions of users who create and update the most comprehensive encyclopedia ever seen. These kinds of web pages are called Wikis. Wikis are websites where the content is freely modified by the users. (What is crowdsourcing n.d.)

In ICT crowdsourcing is not a new phenomenon. A good example of crowdsourcing in the field of ICT is Ubuntu community. Ubuntu is an open source Linux operating sys-

tem which is based on philosophy, where all users should have freedom to use software as they wish for free of charge, with the language they choose and regardless of disability. The Ubuntu community is a crowd of people who has gathered around the Ubuntu. The aim of this community is to develop and advance the operations of Ubuntu and offer help for other users. Ubuntu community has many different channels to offer straight support for co-users: forums, IRC (internet relays chat), Wiki and social media like Facebook and Twitter. There are also users who write and translate user instructions, report faults and program new features and fixes. All this is based on volunteering for the sake of Ubuntu and Ubuntu community. (Community support n.d.)

Wikipedia and Ubuntu have shown that crowdsourcing can be efficiently used for producing content and giving support to other members of the community. In this research the focus was on support services and there are already problem solving services which are based on crowd intelligence. During the research the focus was on the most interesting implementations and those will be introduced next.

## **5.8 Examples of crowdsourcing-based services**

### **5.8.1 Single task solving: Amazon Mechanical Turk**

Crowdsourcing examples introduced above are community-based and usually pay-free voluntary work. Could crowdsourcing methods be applied to IT support or service desk activities and maybe even be a fee-based service? There are already several crowdsourcing-based companies that do problem solving and employees get paid for solving little tasks. The idea is that customers have a task, usually a problem, and they pay for someone to solve that case.



One of the most interesting findings during the research was Amazon Mechanical Turk (MTurk). MTurk is a marketplace for work that cannot be solved with computers. The basic idea is to offer human intelligence to solve tasks, because computers cannot be used effectively enough for everything. For example, people can use search engines but it also requires information retrieval skills to find the right search results. Search engines return search results based on relevancy, but the first outcome is not always the right one. It can be very time-consuming to find the relevant information. MTurk offers human workforce to solve tasks that users or companies do not know how to do or do not have resources to do. Service is on-demand and very scalable. Customers can upload tasks which are called HITs (Human Intelligence Tasks) anytime and anywhere and MTurk task solvers, which are called workers, solve those tasks. Anyone can become MTurk workers by registering into the MTurk portal. All MTurk workers have certain skills and reputation and they can be tested before engaging the real task. When workers have shown their skills, the customers, called requesters, post HITs. MTurk workers get small payments from solved tasks. Payments are usually a couple of cents (in U.S. dollars) per task; however, the degree of difficulty can decrease payments. For customers, this is a huge advantage: a lot of resources can be released by other use, because little tasks can be outsourced and customers pay only when they are satisfied. (Amazon Mechanical Turk n.d.)

This kind of task solving, crowd-based supporting service could be a very considerable way to implement technical support. Customers can leave service requests and workers can solve tasks anywhere in the world with their own computer around-the-clock.

### **5.8.2 Task solving metaplatforms: Crowdfunder**

Customers may find single task solving services hard to use, because different service providers do different kinds of tasks with unclear boundaries. That is why there are

also so called metaplatforms which use task-based crowdsourcing services, like Mturk, as ground layers and built above them. Basically metaplatforms act as a task providers and use many labor channels. One of the largest metaplatforms is Crowdfunder. Customers can send their tasks to Crowdfunder and Crowdfunder finds the best task-based service to solve tasks. Some services may offer translating services, other solve IT problems and so on.

When using task solving metaplatforms the commissions have to be paid. Customers pay for Crowdfunder and Crowdfunder run payments in monthly cycles and accounts payments to task solving companies. Of course commissions have to be paid.

(Crowdfunder handbook 2012)

Task solving metaplatforms can be tricky to implement internally because it requires the use of resources to sort and control service requests. When using outsourcing services the prices are higher because of the commissions. For smaller businesses, which have only a small selection of products, using metaplatforms is not very necessary. Metaplatforms are at their most efficient for services which have no clear boundaries about types of tasks.

### **5.8.3 Crowd-base innovation: Dell Ideastorm**

One of the main benefits of crowdsourcing is to use the intelligence of crowds to accomplish something. American computer corporation Dell had a vision that they would have a channel to give a direct voice to their customers so that they can develop new products and services based on customers' needs. AT 2007 Dell launched Dell Ideastorm portal where customers can have online brainstorm and share new ideas with each other and Dell. After that 16 000 new ideas have been posted and almost 500 of them have been implemented. Dell has a promise that every new idea will be read within 48 hours by the Ideastorm team and new posted ideas will have a status which shows whether idea is under a review, implemented before, abandoned, under process, partially implemented or wholly implemented. Dell employees

can join conversations inside postings and discourse with customers. Ideas that are submitted can be anything that is related to Dell services or products. Dell moderated Ideastorm so that contents stay decent. Customers don't get rewarded if their idea is to be implemented but this is normal practice when giving feedback and Ideastorm is comparable to giving feedback. (About Ideastorm n.d.)

There are also many more portals for innovating and brainstorming in different industry fields, such as Nokia's IdeasProject, Coffee shop Starbucks' My Starbucks Idea and car company Fiat's Fiat Mio. (Open Innovation & Crowdsourcing Examples n.d.) That kind of innovating is not exactly a support channel but could be used as an additional service of service desk to bring added value. Customers could share Ideas in one portal so that services and products can be developed. This is a similar idea to forums but the difference is that every idea will be taken into consideration by companies' employees. Of course, this requires extra resources to be dedicated to brainstorming portals and that could be an issue especially with smaller businesses.

#### **5.8.4 Collaborative crowdsourcing: Ideaken**

When customers use task solving services, the task is normally being handled by a single task solver and customers receives the answers directly from workers. That is why there is no room for processing ideas or generating new applications with the help of the masses of people. A company called Ideaken has taken this to another level. Ideaken connects customers to innovators all over the world to innovate together, collaboratively. It is not an actual problem solving company; however the basic idea is easily applicable to technical support services too. The idea is that customers called seekers, need solutions for something and they submit a challenge to Ideaken webpages. The innovators from all over the world will collaboratively try to innovate together with seekers and with each other. Some innovators may have initial ideas and other innovators have ideas to bring them into reality. Seekers must offer rewards for each task and pay some monthly fees based on the size of the company. If seekers are not happy with the results, payments are refundable.

The major benefit of this kind of collaborative system is that the expertise of many people can be brought together. As mentioned before this model could be used in technical support services as well. When customers have problems or questions the intelligence of crowds can be used collaboratively and that can significantly make problem solving easier. Especially when customers have complicated or challenging cases the brainstorm of many people can be important and conclusive.

#### **5.8.5 Crowdsourcing and data quality**

During the thesis research it was noticed that crowdsourcing portals are usually open for anyone without requirements of proven expertise or education. When customers upload tasks or ask for innovating new ideas and solutions, it is not certain that employees taking action have the right know-how. It was important to study if this infects negatively to outcomes. Omar F. Zaidan and Chris Callison-Burch from Department of computer science in John Hopkins university of Baltimore did a study called Crowdsourcing Translation: Professional Quality from Non-Professionals. The study compares the expertise of professionals and Mturk workers in translation tasks. All test subject got sentences in Urdu language and they had to translate them to English. They were also tested by giving them English sentences and they had to choose which one of them was the best English translation and the most fluent. The outcome of the study was that it is possible to get high-quality answer by using crowdsourcing portals. (Zaidan, Callison-Burch 2011, 1122-1128)

Of course this one study is not sufficient to proven that crowd expertise is useful and this study only concentrates on one area of expertise; however based on this it can be possible that crowdsourcing is efficient enough to use as a problem solving.

#### **5.8.6 Crowdsourcing motivation**

Crowdsourcing is definitely a very interesting phenomenon, but it was hard to not wonder why people would donate their time and effort without decent rewards. As

mentioned before, crowdsourcing-based work is usually non-paid or rewards are very small. What drives people to take the actions? Nicolas Kauffman's and Thimo Schulze's did the study "Worker Motivation in Crowdsourcing and Human Computation" to research motivation factors in crowdsourcing. (Kauffman, Schulze 2011) This study, made for University of Mannheim in 2011, divides motivation in two theoretical classifications: intrinsic or extrinsic type. In this section the word "worker" is used to describe a person who is taking actions to be a part of crowdsourcing process. This section of thesis introduces the research and results of Kauffmann-Schulze study.

Intrinsic motivation means that workers are taking actions because they seek personal fulfillment. Intrinsic motivation can be divided into two categories: enjoyment-based motivation or community-based motivation. Enjoyment-based motivation gives satisfaction to a worker on a personal level. It could be something that a worker likes to do or it can motivate workers by challenging them. In the end they can see the results of their work and get their satisfaction. It also allows worker to be creative or even avoid boredom. Feedback is always welcome as well. In community-based motivations workers can interact with people with the same interests and reflect on their own personal identification.

Extrinsic motivation exists when an activity is just an instrument to achieve certain goals. Extrinsic motivations can be divided into three categories: immediate payoffs, delayed payoffs and social motivation. Immediate payoffs mean that a worker gets compensations immediately by solving a task. Delaying payments means that benefits can be used later to achieve some material advantages for example getting noticed by employers. Social motivations are a part of intrinsic motivation but in the extrinsic point of view, for example when a worker wants to avoid sanctions.

In Kauffman-Schulze study there were 431 valid answers given for a survey which examined workers' motivation in crowdsourcing. The survey was sent to Amazon Mechanical Turk workers. Payments for solving tasks are relatively low, so MTurk

workers are a good subject to crowdsourcing motivation study. What motivates them if not the money?

In Kauffman-Schulze study “Worker Motivation in Crowdsourcing and Human Computation” 13 different factors about motivation in crowdsourcing was measured. The factors are listed on **table 1**.

**TABLE 2 Kauffmann-Schulze Motivation Surveys Factors**

<b>Intrinsic Motivation</b>	Enjoyment-based Motivation	Skill Variety Task Identity Task autonomy Direct Feedback from the job Pastime
	Community-based Motivation	Community Identification Social contact
<b>Extrinsic Motivation</b>	Immediat Payoffs	Payment
	Delayed Payoffs	Signaling Human Capital Advancement
	Social Motivation	Action Significance by Ext. Values Action Significance by Ext. Obligations and norms Indirect feedback from the Job

(Kauffman et al. 2011)

Motivation factors in the Kauffman-Schulze motivation study (Kauffman et al. 2011) are explained in the study as follows:

Skill variety:

*Usage of a diversity of skills that are needed for solving a specific task and fit with the skill set of the worker; e.g. a worker picks a translation task because he likes translating and wants to use his skills in his favorite foreign language.*

Task Identity

*Refers to the extent a worker perceives the completeness of the task he has to do. The more tangible the result of his work is, the higher will be his motivation; e.g. a tasks that allows him to see how the result of his work will be used.*

Task autonomy:

*Refers to the degree of freedom that is allowed to the worker during task execution; e.g. a worker who is motivated because a certain task allows him to be creative.*

Direct feedback from the job:

*Covers to which extent a sense of achievement can be perceived during or after task execution. This is explicitly limited to direct feedback from the work on a task, not by other persons.*

Pastime:

*Covers acting just to "kill time". It appears if a worker does something in order to avoid boredom.*

Community Identification:

*Covers the acting of workers guided by the subconscious adoption of norms and values from the crowdsourcing platform community, which is caused by a personal identification process.*

Social contact:

*Covers motivation caused by the sheer existence of the community that offers the possibility to foster social contact; i.e. meeting new people.*

Payment:

*Motivation by the monetary remuneration received for completing a task.*

#### Signaling:

*Refers to the usage of actions as strategic signals to the surroundings; e.g. selects tasks in order to show presence and advance his chance of being noticed by possible employers.*

#### Human capital advancement

*Refers to the motivation through the possibility to train skills that could be useful to generate future material advantages.*

#### Action significance by external values

*Captures the significance of an action concerning the compliance with values from outside the crowdsourcing community that is perceived by the worker when contributing to the community or working on a task.*

#### Action significance by external obligations and norms

*Motivation induced by a third party from outside the platform community that traces back to obligations a worker has or social norms he wants or to comply with in order to avoid sanctions (does not include material obligations).*

#### Indirect feedback from the job

*Covers motivation caused by the prospect of feedback about the delivered working results by other individuals; e.g. working on tasks to get positive feedback from requesters.*

Specific survey questions can be found in **Appendix 1**.

The results of the motivation survey based on 13 factors listed above and surveys questions in Appendix 1 are listed on **Table 3**.



**TABLE 3 Results of the Motivation survey**

Rank	Factor	i/e	Mean	Median
1.	Payment	e	3.0151	3,1509
2.	Task Autonomy	i	2,4149	2.4708
3.	Skill Variety	i	2,4111	2.4708
4.	Task Identity	i	2,2535	2.2808
5.	Human Capital Advancement	e	2,2097	2,2808
6.	Pastime	i	2.0920	2,2808
7.	Community Identification	i	2,0407	2,2808
8.	Direct feedback from the job	i	2,0048	1,9960
9.	Signaling	e	1.8743	1,9006
10.	Action Significance by Ext. Values	e	1,70019	1,7196
11.	Indirect Feedback from the job	e	1,6889	1,6478
12.	Social Contact	i	1,2882	1.1404
13.	Action Significance by Ext.Oblic. And Norms	e	1,0023	0,7603

(Kauffman et al. 2011)

People in different countries use different Likert scales. Value scales have been counted taking into consideration all of the scales that were used. Based on this possible values in mean and medium are between -0.78 and 3.99 where the -0.78 not motivating at all and 3.99 is extremely motivating. Table X also specifies which category factors belong to; intrinsic or extrinsic by using letters “i” and “e”.

“Payment” got the highest score in the motivation survey. Before it was mentioned that MTurk workers get low payments for solving tasks so there have to be some other motivation to act than the money. The survey shows that except the payment factor, intrinsic motivation factors are driving people to act. There are “task autonomy” and “skill variety” very high on a scale which shows that it is important to get personal fulfillments from the job. People want to be creative and have pleasure. Next on the scale is “task identity” which refers to workers wanting to challenge themselves. On the fifth place there is one extrinsic factor “human capital advancement” which means that action is taken because of the possibility of material ad-

vancement in the future. These five factors are above two thirds of the possible maximum. There is a clear pattern: either materialistic benefits or personal fulfillments are the most meaningful motivators to drive people to act.

## **5.9 Means of payment**

### **5.9.1 Free of charge or chargeable service desk?**

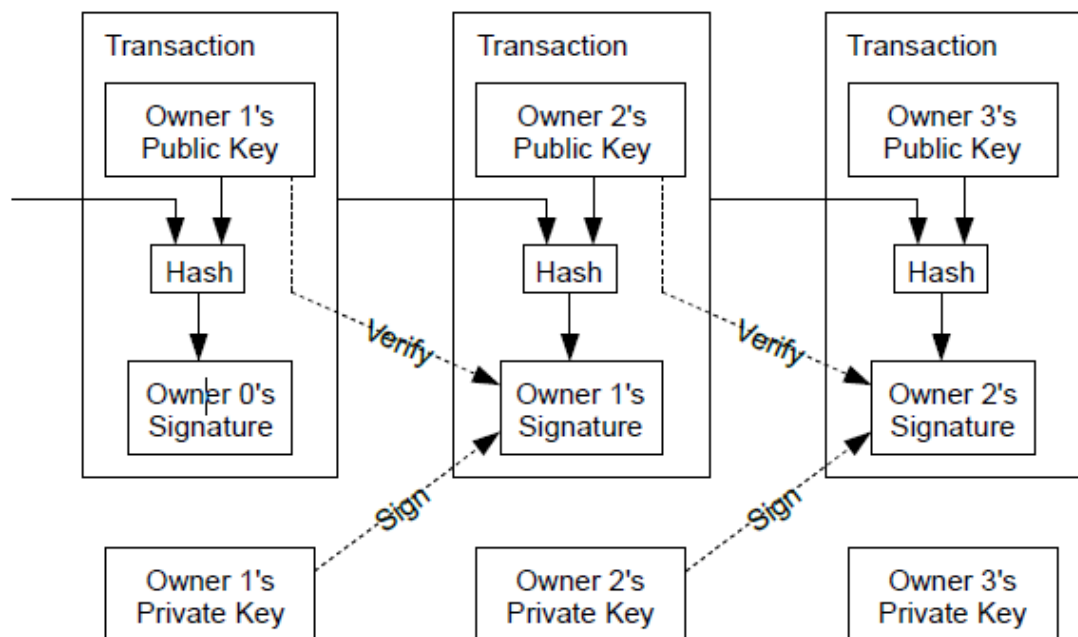
When a service desk is designed one of the main questions is whether support is chargeable or not. The financial side of the support services was also taken into consideration in the thesis. Traditionally in service desks, charging takes place after the support request or support payments can also be based on periodical billing which includes certain amount and certain kind of support. Bills will be sent to customers and customers then will make bank transfers. With this model the company has to have an invoicing solution, contracts with banks, bookkeeping and other usually out-source resources. During the research two non-traditional payment options were explored if they can be used for rewarding from problem solving actions.

### **5.9.2 Bitcoin**

Bitcoin has been on peoples lips for a while now. It is a decentralized digital currency which was first taken into use in 2009 by a pseudonymous person Satoshi Nakamoto. It differs from the other currencies by not being managed by governments or banks. There are no central banks included but Bitcoin users manage the currency themselves. (Mikä on Bitcoin n.d.)

Bitcoin is based on open-source peer-to-peer (P2P) internet protocol, where there are no dedicated servers for Bitcoin transactions. Transactions takes place between two computers and transactions are irreversible. The transactions of the Bitcoins take place on the internet. An electronic payment system is based on cryptographic proof instead of trust so no trusted third parties need to be involved. Bitcoin is a

chain of digital signatures. When electronic coins are transferred the owner digitally signs a hash of the previous transaction. Hash will be then added to the end of the coin with the public key of the next owner. A next owner can verify the signatures so that the chain of the ownership can be verified. (Bitcoinin tekninen kuvaus. n.d.) The transaction process is illustrated in **Figure 9**.



**FIGURE 10** The transaction of the Bitcoin (Nakamoto n.d.)

The reason why Bitcoin has been raised to the review in this thesis is the possibility to implement billing and other financial matters easier and more cost-effectively. One of the considerable questions about choosing the suitable IT support is that is it profitable to charge a customer or not. There are always additional costs that build up when company is dealing with payments such as bookkeeping, management of payments transfer, invoicing fees. When using Bitcoins, many of these extra disbursements can be forgotten. Bitcoin is such a new phenomenon that the Bank of Finland actually defines it as a commodity and legislatively it is not a real currency. (Rahoitusmarkkinaraportti 2012, 21) Taxation of Bitcoin is not yet assigned by the

Tax Administration so this thesis does not have further comment about Bitcoin taxation.

As mentioned before, Bitcoin is independent from all central banks and transaction takes place between to Bitcoin users. When using Bitcoins as a mean of payment there is no need for using any third parties for handling transactions which means that transaction can be made from anywhere in the world immediately and no transfer fees have to be paid. There are no monthly or annual fees like when using the transfer services of central banks. It can significantly decrease costs. It also can be taken into use without contacting any service provider. The only issue has to be done is to take Bitcoin wallet to use. There are different kinds of wallets but typically wallets have to be installed as a file into computer. (Mikä on Bitcoin n.d.)

When a customer needs help and Bitcoins are used as a payment there are few options for billing. Typically in ICT service desk customer will be charged afterwards. There is always a chance, that customer does not pay. When paying with normal currencies and central banks handle money transferring, the debt collection agencies can be used to pursue debts from customers who have not paid their bills and finally the situation can lead to distraint and foreclosure of personal assets. However official authority does not take a stance on Bitcoin issues so payments are basically based on trust between clients and companies. There could also be upfront payment, however it is hard to define beforehand, how much the costs are going to be or even get customers pay in advance without the guarantee of satisfactory.

Based on the information that was found about Bitcoin it was easy to draw a conclusion that one of the main issues with Bitcoin is of course information security. In 2011 half a million dollars were stolen from a Bitcoin user with a pseudonym allivain. Someone hacked into his computer and transferred Bitcoin to their own Bitcoin wallet. Because transactions are irreversible, allivain will probably never get his Bitcoins back. There have also been incidents where Bitcoin exchanging websites were hacked and large amount of Bitcoins were stolen. Because there no safety standards

like in banks and Bitcoin users are themselves responsible for their own Bitcoin wallets the security is very crucial. (Bitcoin mullistaa maksuliikennettä 2011) With Bitcoin users this basically means that Bitcoin wallets must be saved from unauthorized access. This includes at least these steps:

- Password protection: A complex enough password must be used and it should not be told to outsider or written down. Password also should be changed periodically.
- Hardware or a software firewall: Using a firewall helps preventing attacks from the network. It controls incoming and outgoing network traffic.
- Antivirus and spyware protection programs: Using antivirus or spyware protection programs helps to prevent hackers or programs from spying such as collection passwords.
- Updating operating systems and software: Updates are usually made for patch up vulnerabilities.
- Encrypting the Bitcoin wallet: Because a Bitcoin is a file in a computer, it can be encrypted.
- Backup files: If a Bitcoin wallet is saved to a computer, there must be backups. If a computer gets broken, it is possible to lose Bitcoins.
- Using Bitcoin wallets that are not in the computer or wallet which never has access to internet: It is a more complex but also more secure way to use Bitcoins with paper wallets or offline wallets

With Bitcoin, the irreversibility of the transaction can be a serious threat. When traditional currency is transferred, the money shifts between banks. If payments are accidentally transferred to a wrong account, it is possible to cancel the transaction or even if the money has already been transferred, the banks can negotiate with the recipient so they can return the money. With Bitcoin, if users accidentally transfer money to wrong recipients, the only way to get the money back depends on new

money holders. If they are not willing to transfer the money back, then it is lost.

(Bitcoin mullistaa maksuliikennettä 2011)

Bitcoins are put to the market by users who create Bitcoins using a specific geometric formula. This is called mining. It has been prescribed that only approximately 21 million Bitcoins will be created. By the year 2040 99.9 percent of Bitcoins have been mined. After that new Bitcoins will not be created. This can cause Bitcoin to eventually disappear from the market. (Bitcoinin tekninen kuvaus. n.d.) Bitcoin has also claimed to be a pyramid scam. The idea of the pyramid scam is to bring exponentially more money to the founders of a business. Because Bitcoins are created by the mathematic pattern by anyone who is interested, it does not meet the definition of a pyramid scam. However in United States the governmental agency Federal Bureau of Investigation (FBI) is concerned about using Bitcoin in money laundry purposes. It is possible that criminals will use Bitcoin transfers to avoid centralized authority. Anonymity of the transfers makes tracking a lot harder. It is possible that Bitcoins will be used for distributing child pornography or for making the gambling in the internet much easier. (Zetter 2012)

As it was mentioned before there are security issues with Bitcoin. It is discretionary, if these issues are insurmountable or not. Bitcoin is also very unstable at the moment. For example at 10.4.2013 Bitcoin received its top value 266 American dollars and 12.4.2013 value dropped to 60 dollars. It dropped 77 percent in few days. (The Bitcoin Crash Continues 2013) Despite of the negative aspects, there are already companies at the market, which accept Bitcoins. With sufficient effort of ensuring the security, Bitcoins could be a considerable option also for service desk or ICT supports.

### **5.9.3 PayPal**

PayPal was research as another possible means of payment. It is an option for online credit card payment. The idea is that customers add their credit card details only to

their PayPal accounts and when they want to pay for their online shopping they just give their PayPal information: e-mail address and password. PayPal is safer way to make online purchases because vendors will never get customers' credit card details. PayPal can be used in 190 different countries with 24 different currencies. PayPal has acted over ten years as a middleman between customers and vendors. (Why PayPal n.d.)

PayPal is a service for both consumers and businesses. Consumers can create PayPal accounts by adding personal information and credit card details. After that they can start using PayPal for paying online purchases and transferring money. For consumers using PayPal is free of charge when it is used for paying purchases. For businesses PayPal can be added to money transfer actions when customers are buying online. For businesses the fee is 1.9 to 3.4 percent plus 0.35 euros per purchase. So commissions have to be paid. If companies receive high payments the percent is lower; however if money transfers are minor, the higher percent plus 0.35€ of commission per transaction has to be paid. That is why PayPal is not reasonable for receiving low payments. (PayPal fees m.d.)

PayPal is an easy and safe way to handle payments. Although for service desks which use crowdsourcing-based task solving with low rewards, PayPal is not a good solution for the means of payment. The fees can even get higher than the received payments because of the commissions PayPal charges.

## 6 RESULTS

### 6.1 Solutions in comparison

The aim of this bachelor's thesis was to find modern ways to implement service desks and technical support solutions and to compare them to each other. During the research different ICT phenomena were studied and eight of them were chosen to more focused research. In the previous chapter these modern ICT phenomena were introduced and next the pros and cons of all of them are pointed out. For clarity there are two separate tables. The first table, **Table 4**, presents solutions that are non-crowd-based and **Table 5** presents crowd-based solutions.



**TABLE 4 Pros and cons of non-crowd-based solutions**

Solution	Pros and cons
<b>SaaS Service Desk</b>	<ul style="list-style-type: none"> <li>+ Lots of customizable features</li> <li>+Ticketing system included</li> <li>+Easy to bring to use, modify and manage</li> <li>-Pricing monthly per agent</li> <li>-Requires fixed amount of employees</li> </ul>
<b>Self-service</b>	<ul style="list-style-type: none"> <li>+Can reduce contacts to tech support</li> <li>+Improves company's image</li> <li>-Time-consuming to implement and update</li> <li>-Customers do not know how to find information</li> <li>-Cannot be used as an only support channel</li> </ul>
<b>Instant messaging</b>	<ul style="list-style-type: none"> <li>+Real-time support</li> <li>+Many customers can be served at the same time</li> <li>+Easy to implement and use</li> <li>- Hard to manage and measure</li> <li>-Needs both parties to be online at the same time</li> </ul>
<b>Social media</b>	<ul style="list-style-type: none"> <li>+Contemporary</li> <li>+Ready-to-use platforms</li> <li>+Usually free of charge</li> <li>+Easy to use</li> <li>-Service requests can be hard to handle and control</li> <li>-Hard to manage and measure</li> </ul>

SaaS service desk is cloud-based software which offers wide selection of service desk features. Software usually includes at least ticketing system, online service request channel for customers, knowledge bases and self-service portals. Features are usually customizable and pricing depends on the chosen features and the number of employees who use software. SaaS service desk is best for businesses which has easily predictable workloads and fixed number of employees. For cloud service providers SaaS service desk it is a proper implementation for service desk purposes if they are looking for easy solution and they are willing to pay for service that has guaranteed accessibility and functionality.

Self-service is already widely used with many cloud services. It can reduce contacts to companies' service desks; however as mentioned before the effect is not very significant. Self-service is more an image question than an efficient support channel. Customers expect companies to have instructions at their website, and self-service maintains the good appearance.

Instant messaging is not a new phenomenon in ICT field. It can be considered as a replacement of the phone systems. Unlike call center-based customer services instant messaging services are easy to apply to cloud-based service desks. Instant messenger can be used via web browsers and they are very easy to use. One service desk employee can handle more than just one customer at a time. However if a customer wants to leave a service request it requires that a service desks employee is online and ready to take messages and have a conversation with the customer. If instant messengers are used for service desk channel, service hours have to be fixed and both the customer and the service desk employee have to be present at the same time for efficient service event.

Social media is a modern channel to receive service request. People are usually familiar with social media and it is easy to leave service request through social media channels. Although social media is contemporary way of communication it can be hard to manage service requests in social media. Requests can be hard to notice in the middle of all other activities and in the worst scenario customers do not get their answers and this can cause a loss of customers.

**TABLE 5 Pros and cons of crowd-based solutions**

Solution	Pros and cons
<b>Single-task solving</b>	+Cost-effective +Fast responses -Can be hard for customers to use if boundaries are not clear -Can be hard to measure and manage -Data quality?
<b>Task solving metaplatfroms</b>	+Fast responses +Easy to use for customers -Can be tricky to apply to specific service -Commissions or monthly fees when using outsourcing -Data quality?
<b>Collaborative crowdsourcing</b>	+Cost-effective +Fast responses +Brainstorming and idea processing more efficient with collaborative working methods -Can be hard for customers to use if boundaries are not clear - Are workers motivated enough if rewards are not guaranteed?
<b>Crowd-based innovating</b>	+Crowd intelligence +Good for bringing added value to service desks -Not really a support solution -Cannot be used as an only support channel

Single task solving is a crowdsourcing-based solution which offers fast task solving with affordable prices. Customers can upload tasks to crowdsourcing portals and task solvers offers support against small payments. However it can be hard for customers to find right portals to their tasks if boundaries are not defined carefully.

Task solving metaplatfroms are similar to single task solving, but it is easier to customers, because all they have to do is to upload tasks. Crowdsourcing metaplatfroms define in which category do the tasks belong and direct tasks into right workers. Customers do not have to know boundaries of the services and they do not have to

spend time for searching for the correct channels; however it can be more expensive because commissions have to be paid for crowdsourcing metaplatforms.

Collaborative crowdsourcing brings together the expertise of many task solvers. It allows solvers to brainstorm together and share ideas about the tasks. Collaborative crowdsourcing also reminds of single task solving, but rewards are shared between the solvers. It can lead to better results but are solvers willing to share their rewards which are usually relatively small?

Crowd-based innovating is brainstorming of new ideas. It cannot be used as a sole support channel but it can be used as an additional support service. It is useful for both customers and businesses to create new ideas about the service or product.

## **6.2 Suggestions for modern service desk solutions**

### **6.2.1 Crowdsourcing-based service desk**

One goal of the bachelor's thesis was to give a suggestion of futures service desk implementation. Based on the research there is one field that seems to pop out as fast, cost-effective and scalable solution; crowdsourcing-based implementation. Maybe none of the presented crowdsourcing solutions cannot be used as the way they are now; however there are many good features that can be used to build functional service desks.

Because the thesis research was carried out by the context of FreeNest the service desk suggestion is given based on something-as-a-service principle. When services are offered cloud-based, the support should be cloud-based as well. Crowdsourcing solutions fit to cloud services very well. When using crowd-based task solvers one of the problems is, that boundaries are not clear enough and solvers receive task from incorrect fields. It can be also hard to implement task solving metaplatforms internally and if outsourcing services are used, usually commissions have to be paid. The best

solution would be to use cloud service providers own platforms as a point of a contact: the job is done by the intelligence of crowds; however workers have to be registered as task solvers who have knowledge to solve product-relative tasks. It could be an additional feature in package of services and customers can leave service requests when needed. It is similar idea to Mturk or Ideaken but in smaller perspective. There would be no large portal where customers can ask anything. The portal should be dedicated to service providers' services or products. This can increase expertise because workers are more likely familiar with the product. Task solvers get little rewards from solving issues and for customer it is easy and affordable. Collaborative methods can also be used because it brings together the expertise of many people.

Of course one of the questions about implementing service desks with task solving principle is whether there are enough interested task solvers. The rewards from task solving acts cannot be very high and that can lead to motivational issues. Previously presented crowdsourcing motivation study (Kauffman et al. 2011) showed that besides payments, personal fulfillments are usually also very good motivators. Another issue is where to find solvers. Building an ecosystem can be slow and there are maybe not immediately huge masses of anxious solvers. With FreeNest there are already many JAMK students involved and usually with every other service there are interested crowd around the product until the service hits the market. At the beginning it is enough to start with few solvers and when service gets more users, it has probably formed a little ecosystem and more task solver will appear.

During the research it could be noticed that every researched service providers have self-service portals and it is almost self-evident to have one. Even though Gartner study (Gartner Highlights Four Myths Surrounding ICT Self-Service 2010) showed that self-service does not significantly decrease contacts to service desks it is almost an image question to have self-service. Customers expect companies to have self-service portals; therefore a good service desk solution should include self-service.

As the basis of the thesis, the traditional service desk is old-fashioned for requirements of cloud services however one feature maintains its position; ticketing system. It is always important to be able to record customers' contacts because they can be useful for future issue purposes. Of course customers have the rights to ask for information about their service requests, especially if they had paid for the services. Even though crowdsourcing solution is used as a service desk ticketing system should be included to the implementation. As suggested before, crowdsourcing should take place at service providers' own portal. The ticketing system should be attached to that portal as well. All contacts from customers should be recorded into the ticketing system. It does not have to include a user interface where customers can track issue solving process. It can be used as a record-only system.

If crowdsourcing-based task solving solution was in actual use, the task solving progress would follow these steps: At first customers need to login to a service desk portal where customers can leave service requests. If the customers pay for task solving, they have to offer rewards to the task solvers. When the customers have submitted the service requests, the task solvers start to resolve tasks. When record-only ticketing systems are in use, the customers do not automatically get ticket tracking tools to follow the process of the service requests and it is up to the task solvers if they are willing to contact the customers during the solving process. Contacting the customers may be necessary only if more detailed information about the tasks is needed. When tasks are solved, the customers will receive acknowledgments and the customers pay rewards to the person who has solved the issue. Finally, task solvers record cases to the ticketing system by the company's policies. Recordings can also be done during the ticket solving process.

Service Level Agreements (SLA) for a technical support can be hard to define or come true in crowdsourcing-based support implementations. When task solvers do not have fixed salaries they have no responsibility to act. Usually SLA contracts define response times. When companies have employees, they usually have also supervisors monitoring the service levels and if necessary, supervisors assign tasks to em-

employees. With crowdsourcing implementations it can be hard to supervise whether all service requests have been responded or not. Especially when workers motivation is based on personal fulfillments some of the non-challenging or non-interesting cases can be missed. With crowdsourcing-based support it is also important that workers have responsibilities to inform service provider if service cannot be accessed or other problem at the service provider's end has occur so that accessibility levels remain as SLA defines.

Many companies have ICT departments and it is possible that person who is contacting service desk is a person from the company's ICT department. The scenario where person from the ICT department leaves service request to crowd-based task solving portal can be strange customer company's point of view. Professionals in ICT departments usually also make decisions about ITC purchases. The interesting question is that are companies willing to pay for the service which offers technical support via crowd-based channels?

### **6.2.2 SaaS service desk powered support**

The second option for the service desk implementation is SaaS service desk powered support. In SaaS service desk support solutions service desks use cloud-based service desk software which includes all service desk functions. It usually includes at least ticketing system, online service request channel for customers, knowledge bases and self-service portals. Service providers take care of accessibility, functionality and troubleshooting and debugging of the software.

SaaS service desk solution can be implemented in two different ways: internally or externally. In internal solution a cloud service provider hire employees to their own service desks and buy software to all employees. In external solution service desk services is bought from external service providers. For customers it looks the same whether the support is internal or external. If a company is using the external service desks they do not have to take care of the software purchasing or hire the service

desk employees. Solution described in this chapter of the thesis is based on internal implementations because the thesis describes solutions for implementing the service desk, not outsourcing it.

There are many proper qualities in SaaS service desk implementation. At first, it is very easy to taken into use. It does not require installations and the only thing that service desks have to do to get started is to add users and perhaps customize some features. SaaS service desk software does not require any maintaining or trouble-shooting: if there are failures in the software it is service providers' responsibility to fix the problems. SaaS service providers guarantee SLA contract-based accessibility to the software.

SaaS service desk software is usually charged by the number of users. This can be a problem because it requires fixed number of employees. It is hard to predict service request flows. SaaS service desk is also very easy for customers and customers can contact service desk about minor issues too. There should be some limiters to reduce service request volumes. Payments can be used as limiters. If the support is billable, the customers may try to find answers from some other channel at first. If the support payments are included to the prices of the service or the product, the number of service requests per month should be limited to a reasonable amount and request after that will pay extra. This model is on use for example in technical support of Atlassian JIRA which was introduced in chapter 5.2.

In contrast to crowdsourcing-based service desk solution which was presented in chapter 6.2.1, with SaaS service desk solution it is easier to carry out and stick to SLA contracts. When service desks use SaaS service desk software, it usually requires hired employees who have fixed salaries and supervisors to control compliance of SLA contracts. Employees receive service requests straight to the service desk software and selecting only the most interesting cases is not an option. Customers also have tools to track the process of problem solving almost in real time.



With SaaS service desk software task solving progress follows these simple steps: Customers have accounts to SaaS service desk support, which is a web portal and they can send service requests online via that portal. Service desk employees receive the tickets immediately. Employees start to solve the problems and they record information and process stages to the ticket. Customers can track the case during the solving process. When the problem is solved, the ticket is recorded and closed. Customers can later view all of the information of service requests.

SaaS service desk is a considerable option for cloud-based service desk implementation. It is easy to use but requires fixed amount of service desk employees. It offers high quality problem solving, but it is discretionary whether it is reasonable to hire employees with fixed salaries or not. When it is crucial that support solution of the service or product is extremely high quality SLA contracts are strictly followed and customers are also willing to pay for the technical support, SaaS service desk is a suitable solution.

### **6.2.3 Financial matters**

The financial point of view was also taken into consideration during the thesis research. Two different means of payments were studied: Bitcoin and PayPal. PayPal is not suitable for task solving with small rewards because commissions can be larger than actual payments from the customers. PayPal can only be used if payments are large enough to cover the costs of the money transfers. PayPal cannot be used in every country because of the limitation in PayPal service. One of the essentials in cloud services is that customers can use service anywhere in the world. PayPal with geographical limitations is not applicable to this principle.

Bitcoin is a digital currency that can be used anywhere in the world without middlemen. It does not require transactions with banks and money transfer is easy and immediate. Money transfers takes place in the internet, transfers are straight between two Bitcoin users and there are no commissions. Bitcoin has lot of great qualities but

there are also issues related to Bitcoin. One of the issues is security. Because Bitcoin is not managed by central banks and transfers takes place in the internet it requires paying extra attention to information security implementations. Another issue is the instability of the currency. As mentioned before Bitcoin value has changed significantly during the spring 2013. Bitcoin can also be too unfamiliar to customers and it requires buying Bitcoins before using them in reward payments. The future will show whether Bitcoin become viable currency or not.

## **7 DISCUSSION**

During the research one of the most troublesome obstacles was the lack of scientific research found of the study subject. The use of crowdsourcing and collaborative methods is relatively new in ICT business, thus there is no valid information about real effects of using them as a way of implementing technical supports or service desks. It is although clearly detectable that ICT is heading towards more cost-effective and scalable solutions. Cloud services have already entered the market very widely and technical support solutions need to meet the requirements of this change.

Crowdsourcing can be the next major phenomenon on ICT support field. The achievement of the effectiveness of the crowd intelligence, such as Amazon MTurk, has already been proven that crowdsourcing has solidified its place in issue solving too. As the motivation study introduced in chapter 5.8.6 showed, money is not always the bottom line and people do take actions for reaching personal fulfillment. This supports the idea of making business more cost-effective and accessible from all over the world. Crowdsourcing also meets the requirements of green thinking and environmental protection; using of crowdsourcing services does not require large investments to equipment and offices and there is no necessity travelling because the services can be used anywhere and anytime. This reduces the carbon footprint. Crowdsourcing also serves the effects of the globalization.

In ICT it is important that service meet the requirements of cost-effectiveness, scalability and high accessibility. From this point of view it is expected, that in modern ICT field clouds and crowds are worth to keep eye on in the future.

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## APPENDICES

### Appendix 1. Kauffman Schulze Motivation survey questions (Kauffman et al. 2010)

#### Measurement of constructs

The following tables list the survey items. All items are measured using 7-point Likert scales. For the first item in every construct, description for 1, 4, and 7 on the Likert scale are given (see table). For the remaining two items we use Strongly disagree, Moderately disagree, Slightly disagree, Neutral, Slightly agree, Moderately agree, and Strongly agree. We include Cronbachs Alpha ( $\alpha$ ) in the table as a measure for reliability.

We also include our demographic questions in this appendix since they might be useful for future empirical research. The questions are inspired by Ross et al. (2010), Ipeirotis (2010), and the SurveyGizmo question library.

#### Intrinsic Motivation

	Item Phrasing	$\alpha$	
Enjoyment based	<b>Skill Variety</b> How much variety is there in the tasks you work on? That is, to what extent do the tasks you choose require you to do many different things, using a variety of your skills and talents? [Very little variety ... Moderate variety ... Very much variety] "Working on the tasks I choose allows me to do many different things, using a variety of my skills and talents." "The tasks I work on require me to use a number of different skills I have."	.842	
	<b>Task Identity</b> To what extent do the tasks you work on involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and an end? Or is it only a small part of the overall piece of work, which is finished by somebody else? [My works is a tiny part ... Moderate "chunk" ... My work is the whole piece] "The tasks I work on allow me to do an entire piece of work from beginning to end." "Working on the tasks I choose gives me a chance to completely finish a whole piece of work."	.883	
	<b>Task Autonomy</b> How much autonomy is there in the tasks you work on? That is, to what extent do the tasks permit you to decide on your own how to go about doing the work? [Very little autonomy ... Moderate autonomy ... Very much autonomy] "The work I do on Mechanical Turk give me considerable opportunity for independence and freedom in how I do the work." "Working on the tasks gives me a chance to use my personal initiative and judgment in carrying out the work."	.780	
	<b>Direct Feedback from the Job</b> To what extent does working on the tasks itself provide you with information about your work performance? That is, does the actual task itself provide clues about how well you are doing – aside from any "feedback" co-workers or the task requester may provide? [Very little ... Moderate ... Very much] "Just doing the work required by the tasks I choose provides chances for me to figure out how well I am doing." "The tasks I choose provide me the opportunity to check my performance without any need for feedback from other people."	.759	
	<b>Pastime</b> How often do you use Mechanical Turk just to pass your time? That is, how often do you log in on Mechanical Turk to work on tasks or to do something else just because you have spare time and prefer this to other activities you could do (e.g. watching TV)? [Not frequently ... Occasionally ... Very frequently] "I frequently use the Mechanical Turk platform or work on tasks just because I like passing my spare time that way." "I frequently use the Mechanical Turk platform or work on tasks just because I have nothing else to do."	.818	
	Community based	<b>Community Identification</b> To what extent are you motivated because you identify yourself with the community of Mechanical Turk? That is, how often do you act or do not act a certain way because you feel obliged to the Mechanical Turk community as a whole? [Very little ... Moderate ... Very much] "I feel to be an important part of the Mechanical Turk community and try to behave accordingly." "I frequently behave a certain way because I try to support the community of Mechanical Turk."	.824
		<b>Social Contact</b> To what extent does your usage Mechanical Turk give you the opportunity to get in contact with other people? [Very little ... Moderate ... Very much] "Using Mechanical Turk provides me a chance to get in contact with other people." "Using Mechanical Turk enables me to get in contact with other people."	.938

## Extrinsic Motivation

	Item Phrasing	$\alpha$
Im. payoffs	<b>Payment</b> How important is the payment when you consider working on tasks? That is, what role does the opportunity of earning money play when you choose the tasks to work on? [Not important ... Moderately important ... Very important] "The main thing that determines how intensively I work on tasks is the money I am making." "The money I am making really has a strong effect on how intensively I work on tasks."	.735
	<b>Signaling</b> To what extent does working on tasks or using the Mechanical Turk community provide you the opportunity to "advert" yourself? That is, how good are the possibilities to show yourself and your abilities, e.g. to other community members or even to possible employers, in order to benefit from this in future? [Very little ... Moderate ... Very much] "I work on tasks because that gives me the opportunity to advert myself and my abilities." "A major advantage of using the Mechanical Turk platform or working on the available tasks is the opportunity to show myself and my abilities."	.889
		<b>Human Capital Advancement</b> To what extent does working on Mechanical Turk allow you to learn new or sharpen existing skills? [Very little ... Moderate ... Very much] "I work on tasks because it allows me to learn new or advance existing skills." "The tasks I choose are focused on one or more specific skills I like to learn or train."
Social motivation	<b>Action Significance by External Values</b> In general, how significant is it for you to be active on Mechanical Turk concerning your values? That is, if you are active on the platform or work on tasks because you are following certain important values from outside the Mechanical Turk community. [Not significant ... Moderately significant ... Very significant] "Being active on Mechanical Turk is important for certain values from outside the Mechanical Turk community I want to act upon." "I am using Mechanical Turk because it is important for me to act upon certain values from outside the Mechanical Turk community."	.882
	<b>Action Significance by External Obligations &amp; Norms</b> In general, how significant is it for you to be active on Mechanical Turk because you want to follow norms or feelings of obligation? That is, if you use the platform or work on tasks because somebody expects you to do this. Please note that this does not mean material or financial obligations. [Not significant ... Moderately significant ... Very significant] "I am using Mechanical Turk because certain persons expect me to." "I am active on the Mechanical Turk platform or work on tasks because somebody expects me to do it."	.840
	<b>Indirect Feedback from the Job</b> To what extent do the requesters, co-workers or other members of the Mechanical Turk community let you know how well you are doing on the tasks or what they think about your results? [Very little ... Moderate ... Very much] "The tasks I work on provide me the chance to get feedback about my work from the requesters or other community members." "The opportunity to get personal feedback about my work from others is an important motivation to work on the tasks I choose."	.811

## Demographics

- *Your gender* (Male / Female)
- *Please enter your age* (text box)
- *In which country do you live?* (USA / India / Other)
- *What is the highest level of education you have completed?* (None / Primary school / Some high school, not graduated / Graduated high school or equivalent / Some college, no degree / Associate degree / Bachelor's degree / Master's degree / Doctoral degree / Professional Degree (JD, MD))
- *What is your current employment status (not including Mechanical Turk)?* (Unemployed / in education / part-time / fulltime)
- *What is the annual income of the household you live in?* (less than \$7,000 / \$7,000 to \$14,999 / \$15,000 to \$34,999 / \$35,000 to \$74,999 / \$75,000 to \$124,999 / \$125,000 or more)
- *How long have you been working on Mechanical Turk?* (Less than 1 week / Less than 1 month / Less than 3 months / Less than 6 months / Less than 1 year / Less than 2 years / More than 2 years)
- *How much time do you usually spend on Mechanical Turk per week?* (Less than 1 hour per week / 1-2 hours per week / 2-4 hours per week / 4-8 hours per week / 8-12 hours per week / 12-20 hours per week / 20-40 hours per week / More than 40 hours per week)