TAMPERE UNIVERSITY OF TECHNOLOGY

Department of Industrial Engineering and Management

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STRUCTURES AND OPERATIONS OF OPEN SOURCE VALUE NETWORKS

Master of Science Thesis

Prof. Mika Hannula has been approved as examiner
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ABSTRACT

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The objective of this thesis is to discover the structure and operations of value networks that are formed in the open source software field. To achieve this objective, the following research questions were used: 1) What kind of open source value networks exist? And how do they differ from each other? 2) What kinds of roles are there in open source networks and what kind of relationships are there between different participants? 3) How do companies operate in open source value networks? The questions emphasize company viewpoint to open source value networks, as in this thesis the network analysis is carried out from the company perspective, not so much of community perspective.

In theoretical part of the study, the concept of open source value network is examined, focusing on the literature about value creation in industrial networks and the open source environment. The main outcome of the theoretical part is the general model of creating and capturing value in open source network. This model is then used in the empirical part of the study to form the value networks of the case communities which are Eclipse and Debian. The research data for analyzing the case communities is gathered from different sources; the primary data includes a series of qualitative interviews and a quantitative survey. Based on the analysis of the theme interviews, the roles of the companies are identified and included in the networks. Finally, the comparative analysis of the value networks summarizes the empirical part.

Together with the developers of the communities the companies and the customers form an open source value network. The differences, for example, in values, norms and working methods affect the relationships between the participants and value creation in the networks. Together the participants set the requirements for the value they create together in a professional open source value network. Therefore, Eclipse can be considered to be mainly business-oriented whereas Debian is more of a hobby to the developers. The value network of Eclipse exemplifies the general open source value network model described in the theory section more precisely than the value network of Debian.

Companies that have functional and active relationships to open source communities have great possibilities to benefit from open source. Still, the contribution to the networks does not depend on the company's size. The best ways to cooperate with communities, and therefore to create value with the communities, are through partnerships, by employing developers to the groups of core developers, and by interacting through the company's own community.

TIIVISTELMÄ

TAMPEREEN TEKNILLINEN YLIOPISTO
Tietojohtamisen koulutusohjelma
MYLLÄRNIEMI JUSSI: Avoimen lähdekoodin arvoverkkojen rakenteet ja toiminnot
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Tämän työn tavoitteena on selvittää avoimen lähdekoodin ympärille muodostuneiden arvoverkostojen rakenteita ja toimintoja. Tavoite voidaan nähdä kaksijakoisena; ensinnäkin pitää selvittää, mitä ovat arvoverkostot, jonka jälkeen voidaan tutkia arvoverkostoja avoimen lähdekoodin näkökulmasta.

Tavoitteen saavuttamiseksi haettiin vastauksia seuraaviin tutkimuskysymyksiin: 1) Minkälaisia avoimen lähdekoodin arvoverkostoja on olemassa ja miten ne eroavat toisistaan? 2) Minkälaisia rooleja avoimen lähdekoodin verkostot pitävät sisällään ja minkälaisia suhteita verkostojen eri osapuolet muodostavat? 3) Miten yritykset operoivat avoimen lähdekoodin arvoverkostoissa? Tutkimuskysymykset muodostettiin yrityslähtöisesti, sillä työssä tutkimusilmiötä analysoitiin yritysten näkökulmasta, ei niinkään avoimen lähdekoodin yhteisöjen näkökulmasta.

Työ rajattiin käsittelemään kahta erilaista avoimen lähdekoodin ympärille muodostunutta yhteisöä. Kyseiset yhteisöt ovat Eclipse ja Debian, jotka ovat tutkimuskohteina myös tämän diplomityön toimeksiantajana toimineessa Tekes-rahoitteisessa OSSI-tutkimusprojektissa. Yhteisöt valittiin perustuen niiden erilaisiin lähtökohtiin; Debianin toiminta perustuu enemmänkin vapaaehtoisuuteen, Eclipse puolestaan toimii yritysmäisemmin ollessaan monelle kehittäjälle päätulonlähde.

Lähdemateriaali yhteisöjen analysointia varten hankittiin monesta eri lähteestä. Pääsääntöisesti lähdemateriaali pitää sisällään sarjan kvalitatiivisia haastatteluja sekä kvantitatiivisen tutkimuksen. Haastateltavina toimi avainhenkilöitä eri yhteisöistä, joita on haastateltu yhteistyössä muiden OSSI-tutkijoiden kanssa. Vastaavasti kvantitatiivinen tutkimus, joka toteutettiin projektin tutkijoiden toimesta vuoden 2006 aikana, pitää sisällään Eclipse ja Debian -yhteisöjen kehittäjien näkemyksiä.

Yhteisöjen verkostorakenteita analysoimalla oli tarkoitus selvittää, millaisia arvoverkostoja avoimen lähdekoodin ympärille on muodostunut. Näissä verkostoissa isossa roolissa ovat erilaiset yritykset, joiden linkittymistä avoimen lähdekoodin arvoverkkoihin tässä työssä myös tutkittiin. Tätä varten tutkimukseen valittiin viisi erityyppistä yritystä, joista jokaisesta haastateltiin yhtä keskeistä henkilöä. Teemahaastatteluiden avulla toteutettiin yritysanalyysit, joiden perusteella oli tarkoitus selvittää yhtäläisyyksiä teoriassa mainittuihin eri yritysrooleihin, jonka jälkeen yritysroolit voitiin yhdistää tutkittaviin avoimen lähdekoodin arvoverkkoihin.

Perustana empiiriselle analyysille sekä itse haastattelumateriaalin keräämiselle oli teoreettinen tarkastelu. Teoria keskittyi tutkimuksessa kahteen eri osa-alueeseen, jotka ovat arvoverkostot sekä avoin lähdekoodi. Näiden kahden eri osa-alueen perusteella muodostettiin käsitys siitä, kuinka avoimen lähdekoodin verkostoissa arvoa tuotetaan.

Pohjana arvoverkostoteorioille olivat eri tutkijoiden näkemykset verkostoteorioista, joissa pääpaino on teollisten verkostojen (industrial networks) tarkastelussa. Yhdistämällä teollisten verkostojen sekä arvoverkostojen teorioita työssä muodostettiin synteesi, jonka tuloksena saatiin arvoverkostomalli. Mallin perusteella voitiin ottaa kantaa muun muassa arvon tuotantoon erinäisissä verkostoissa, verkoston osapuolten välisiin suhteisiin sekä resurssien integroinnin tärkeyteen. Arvoverkostolla tässä työssä tarkoitetaan jatkuvassa muutoksessa olevaa verkostoa, jossa suoraan sekä epäsuorasti toisiinsa sidoksissa olevat toimijat tuottavat arvoa niin itselleen kuin loppukäyttäjille.

Työn toinen teoreettinen osa-alue koski avointa lähdekoodia. Avoimella lähdekoodilla tarkoitetaan toimintoja sekä periaatteita, joita noudattamalla lähdekoodi pyritään saamaan mahdollisimman avoimeksi. Avoin lähdekoodi on tutkimusalueena vielä sangen nuori, mistä johtuu termistön sekavuus eri tutkijoiden välillä. Tässä työssä termi avoin lähdekoodi on verrattavissa englanninkieliseen vastineeseen open source. Kyseistä aihetta lähdettiin työssä käsittelemään esittelemällä avoimen lähdekoodin määritelmiä, erilaisia lisenssejä sekä joitakin yleisimpiä liiketoimintamalleja. Pääpaino avoimen lähdekoodin käsittelyssä oli kuitenkin erilaisten verkostomallien esittelyssä. Verkostomallien yhteydessä työssä tuotiin esille näkökulmia myös yhteisöjen rakenteista, yhteisössä toimivien kehittäjien rooleista, verkostoissa toimivien yritysten rooleista, sekä edellä mainittujen osapuolten suhteista.

Teorian lähdemateriaali koostui tutkittavien alojen viimeaikaisesta kirjallisuudesta sekä erinäisistä julkaisuista, mukaan lukien muun muassa OSSI-tutkijoiden tekemistä julkaisuja. Verkostoteorioita on tutkittu jo vuosia, joten lähdemateriaalin hankkiminen ei tuottanut ongelmia. Myös avoimesta lähdekoodista kirjoitettuja teoksia on runsaasti saatavilla. Sen sijaan avoimen lähdekoodin verkostoja osana liiketoimintaa ei ole laajemmin tutkittu, mistä syystä myös avoimen lähdekoodin arvoverkostoja vertaavien tutkimuksien löytäminen oli hankalaa.

Kahden edellä mainitun teorian osa-alueen perusteella muodostetaan käsite ”avoimen lähdekoodin arvoverkosto”. Käsitteen ympärille rakennettiin malli, jonka perusteella arvon tuottamista avoimen lähdekoodin verkostoissa voidaan analysoida.

Mallia hyödynnettiin analysoitaessa empiirisesti Eclipsen ja Debianin arvoverkostoja. Arvoverkostoja analysoitaessa pohdittiin, miten arvoa tuotetaan, ketkä ovat osallisena arvon tuottamisessa ja ketkä hyötyvät arvon tuottamisesta kyseisissä arvoverkostoissa. Jotta arvoverkostoja voidaan analysoida, pitää tunnistaa verkostojen eri toimijat. Avoimen lähdekoodin verkostoissa toimijoita on huomattavasti enemmän kuin esimerkiksi tavallisessa ohjelmistotekniikassa. Tärkeimpinä toimijoina voidaan pitää kehittäjäyhteisöjä sekä niiden kanssa yhteistyössä toimivia yrityksiä.

Eclipse ja Debian ovat yhteisöinä hyvin erilaisia. Kuten työssä käytetty kvantitatiivinen tutkimus osoitti, Eclipse on usealle kehittäjälle tärkein tulonlähde, kun taas Debian on harrastus. Tämä vaikuttaa yhteisöjen suhtautumiseen asiakkaita kohtaan. Eclipse panostaa erittäin näkyvästi kumppanuuksiin eri yrityksien kanssa, josta saa kuvan, että heidän yhteisössään asiakas otetaan huomioon kehitystyössä. Vastaavasti Debian

panostaa myös kumppanuuteen, mutta heidän pääyhteistyökumppaneinaan mainitaan yhteisön omat ylemmän tason kehittäjät sekä käyttäjät, jolloin avointa lähdekoodia tuotetaan pääasiassa kehittäjille itselleen, ei niinkään asiakkaille.

Muodostettaessa arvoverkostoja, joissa Eclipse ja Debian ovat mukana, otettiin huomioon myös erinäisten yritysten roolit kyseisissä verkostoissa. Haastatellut viisi yritystä analysoitiin perustuen heidän kontribuutioonsa avointa lähdekoodia kohtaan. Tulokseksi saatiin kuusi erilaista yritysroolia, joiden yhtymäkohtia avoimen lähdekoodin arvoverkostoihin voidaan vertailla.

Yhdessä yhteisöjen kehittäjät, yritykset sekä myös asiakkaat muodostavat avoimen lähdekoodin arvoverkoston. Verkoston tavoitteena on tuottaa arvoa kyseisille tahoille jokaisen vaatimukset huomioon ottaen. Yhdessä, pääsääntöisesti yritykset sekä yhteisöt, muodostavat verkoston ydinkompetenssin, joka huolehtii arvon tuottamisesta. Eclipsen arvoverkostossa ydinkompetenssi muodostuu edellä mainituista tahoista, kun taas Debianin arvoverkostossa ydinkompetenssin muodostaa ylemmät kehittäjätiimit.

Yritysten pitäisi pystyä vaikuttamaan edellä mainittuihin ydinkompetensseihin, mitä kautta he saisivat parhaan hyödyn itselleen. Eclipsen arvoverkostossa tämä näkyy kommunikointina yhteisöjen ja yritysten välillä, mutta Debianin tapauksessa yhteistyö ei ole niin selvää. Yhteistyötä yrityksien ja yhteisöjen välillä voisi nostaa esimerkiksi palkkaamalla yrityksen omia kehittäjiä työskentelemään yhteisöissä. Haastateltavissa yrityksissä tämä ei tuottanut ongelmia työntekijöiden oman vapaaehtoisuuden takia. Toinen keino on vaikuttaa yhteisöihin yrityksen oman yhteisön kautta. Muutamalla haastateltavalla yrityksellä on pystyssä oma kehittäjäyhteisö, mutta heidän yhteyksistään ulkopuolisiin yhteisöihin ei ole varmuutta, joskin tähän tulisi panostaa.

Case-yritysten perusteella sekä analysoimalla case-yhteisöjen arvoverkostoja voidaan todeta, että yritykset, jotka panostavat eniten avoimeen lähdekoodiin, omaavat parhaimmat suhteet yhteisöihin. Panostukset näkyvät yleensä muun muassa vapautettuina patentteina, kehittäjäyhteisöjen tukemisena sekä yleisen keskustelun ylläpitämisenä. On kuitenkin huomioitavaa, että pienemmänkin kontribuution omaavilla yrityksillä on erinomaiset mahdollisuudet yhteistyöhön erinäisten yhteisöjen kanssa. Eclipse, muun muassa, pyrkii kohtelemaan jokaista yritystä samalla tavalla riippumatta yrityksen koosta.

Tutkimuksessa tavoite selvittää avoimen lähdekoodin ympärille muodostuneiden arvoverkostojen rakenteet täyttyi ottaen huomioon käytettävissä olevat resurssit. Koska tutkimuksessa analysoitiin vain kahta eri yhteisöä, kovin yleistettävää arviota ei voida tehdä. On kuitenkin huomioitava, että määräänsä enempää aineistoa avoimen lähdekoodin arvoverkostoista ei ole löydettävissä, joten vertaavien analyysien tekeminen on hankalaa.

Jatkotutkimusta ajatellen tutkittavien yhteisöjen määrää voisi nostaa, jotta saataisiin parempi yleiskuva arvoverkostoiden muodostumisesta. Näin ollen teoriaosassa muodostettu malli arvon tuottamisesta avoimen lähdekoodin verkostossa voitaisiin testata laajemmin. Lisäksi tutkimusta voisi kehittää ulottamalla analyysin koskemaan yksityisiä henkilöitä, koska avoimen lähdekoodin verkostoissa yhden henkilön panostus arvon tuottamiseen havaittiin merkittäväksi.

ACKNOWLEDGEMENTS

Almost exactly six years ago when I was a young student, I could never have thought of doing a Master's Thesis on open source software. It is about coding, and I do not have a clue of it. Fortunately, soon after I started my work I realized that the field of open source could be studied from the viewpoints of my interests and from the viewpoints I have studied.

During this interesting year I have been doing this thesis, and actually during these six years I have been a student, there have been people who I want to express my gratitude. To first of all, I want to thank the examiner of this study, Professor Mika Hannula, for guiding and teaching me during these six years. Also the director of this thesis, Doctor Nina Helander, you have been a greater support during this whole process than you could ever imagine. Thank you for supporting my ideas and guiding me through all the obstacles. It is been a pleasure to work with you.

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Finally, my dear Virpi, you have been with me through all these years. If there were enough words I would like to thank you for your help and support - with all my heart!

Tampere, 7th of August 2007

Jussi Myllärniemi

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1 INTRODUCTION

1.1 Research background

Nowadays, open source software is a well-known term in business. It is an important part of information technology, for example Linux is part of it, OpenOffice and MySQL. Open source software has become a relevant business model for the biggest companies, in Finland, for example, Nokia makes Internet tablets that are based on it.

Open source software is a term which is used for a software itself. It is strongly related to programming. The concept open source is more extensive than the term open source software. It could be examined from different points of view: business, technology and sociology. In this thesis it is studied from the business perspective, from value networks point of view, to be exact.

Open source value networks are networks that are built around the open source ideology to offer the best value to its actors. The term open source value network has not been used quite broadly. Actually it is hard to discover relative findings related to studied field, which sets some limitations and requirements for this study.

The principal of this study is the Institute of Business Information Management at Tampere University of Technology which is one player in the research project called OSSI. OSSI means 'Managing Open Source Software as an Integrated Part of Business'. It is a multi-disciplinary research project between TEKES, four universities and 10 companies. OSSI started in the summer 2005. The research objective of the project is to develop methods and tools for companies to manage the utilization of open source more effectively as an integrated part of their business.

During the first years of OSSI three research reports have been published. They are called 'Multidisciplinary views to open source software business', 'Empirical insights on open source software business' and "Essays on OSS practices and sustainability". There are some articles that play a major role in this study. For example the article 'The value network approach to open source software business' written by Nina Helander and Jarkko Laine forms the theoretical background of this study together with the recent literature of the open source field.

1.2 Objective and research questions

The OSSI -research project develops a management framework by examining the phenomena from the perspectives of sociology, technology and business. The business perspective is further divided in the research project to legal aspects, economics, business models, competitive strategy and value networks. (OSSI project description from http://ossi.coss.fi/ossi)

This thesis is a part of value network analysis which is done during the project. The aim of this study is to discover the structure of value networks that are formed in the open source software field. The analysis is made from the point of view of the companies involved in the open source business.

The aim can be solved by answering following research questions:

1) What kind of open source value networks exist? And how do they differ from each other?
2) What kinds of roles are there in open source networks and what kind of relationships are there between different participants?
3) How do companies operate in open source value networks?

Question one is more theoretical than questions two and three. It studies the pre-existing value networks from a theoretical viewpoint and it also takes a stand on the studied case networks. Questions two and three concentrate on analyzing the empirical material. The roles are chosen based on previously made analyses. Those roles are then connected to the case networks under investigation and then the relationships are analyzed. On the other hand, question three emphasizes the analysis of the ways the companies operate in open source value networks. As stated above, questions two and three are mainly empirical in nature but there is also some theoretical background behind these research questions. The answers to the research problem are presented in the conclusion of this thesis.

1.3 Research scope and limitations

This study is governed by the OSSI project and therefore it sets down some limitations. The main point is to study value networks in the open source field from the view point of companies. Single relationships among different players in networks are not studied too deeply, emphasis is on the level of network analysis.

Previously during OSSI some facts have been written about network theories and communities. Those facts help the writer to form his ideas and conceptions of this field. Nevertheless, the aim is not to rewrite something that has already been done during this project. The main emphasis is on empirical analysis, but theoretical references to OSSI's reports can be discovered. If not direct references, there are at least some common theoretical conclusions. Relevant theories to this study, like industrial networks and value network models, have been studied before during this project.

According to SourceForge.net (2007) there are over 150 000 registered open source projects in the world, and because of that the number and spectrum of open source communities are really rich. It is impossible to study all of them, at least very deeply,

and that is why only five communities were chosen as objects of study in OSSI. OSSI concentrates on studying GNOME, Eclipse, Debian, MySQL and Laika communities. This thesis concentrates on analysing Debian and Eclipse communities. It has been concluded that there communities differ greatly from one another (Mikkonen et al. 2006a). For example, Eclipse is more company oriented than Debian, while Debian is more based on voluntarily. Because the bases of the communities are different, it provides different approaches to analyzing open source value networks.

There are also some major companies in the OSSI -project and those companies have their own interests. Consequently, this study concentrates on doing open source value network analysis from the view point of companies, not from the view point of communities.

The number of studies concerning open source networks as a part of business which are done before OSSI -project is limited (Helader & Laine 2006, p.50), which complicated this study. Besides the analysis that is done during the project, the references which help or support this study are hard to find. There is a risk that the study leans too much on the theories and conclusions stated before in the OSSI -project. This difficult academic starting point offers a great motivation to the researcher.

1.4 Research approach and methodology

1.4.1 Paradigms behind this study

Olkkonen (1994, p.26, 60) presents two different kinds of paradigms behind science research, or in this case behind business economics: positivism and hermeneutics. In positivistic ideology a researcher is an objective observer and repeatability of results creates the truth (Metsämuuronen 2005, p.200). According to Olkkonen (1994, p. 50) acquiring the information is based on solely confirmed and established findings. While in positivism research approaches are based on gathering large material and statistic analyzing methods, hermeneutic approaches emphasize the deeper understanding of studied matter. Collected material is narrower and it is qualitative. The reality is subjective. (Olkkonen 1994, pp. 26-27)

Burrell and Morgan (1979, p.3) converge philosophy of science also from the viewpoints of subjectivity and objectivity. This approach is described in figure 1.

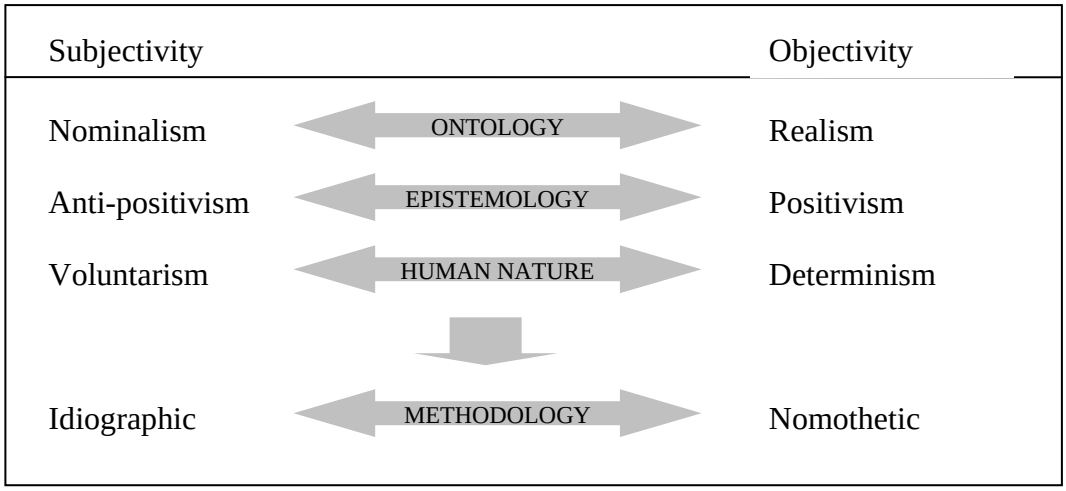

Figure 1. A scheme for analysing assumptions about the nature of social science (Burrell & Morgan 1979, p.3)

Ontology, epistemology and human nature affect directly the methodology that is used in a study. Ontology's basic question is *what exists*. It considers the common nature of reality (Burrell & Morgan 1979, p.1). Epistemology is the study of knowledge and justified belief (Steup 2005). W*hat can we know and how* is the basic question of epistemology. It studies, for example, the nature of knowledge and its possibility. The human nature, in this sense, refers to whether humans are determined by their environment, or whether they have "free will" (based on Burrell & Morgan 1979, p.6).

Ilvonen (2006 p.6) summarize Burrells and Morgan's (1979) thoughts about the differences of subjective and objective approaches quite understandable: according to a subjective way of thinking, reality is relative and the researcher's interpretation contributes strongly to the research, and according to an objective way of thinking truth exists, and from truth knowledge can be acquired by observing the subject from outside and analyzing quantitatively collected material. These theories and ideas form the base for creating the working methods, which are called research approaches and research strategies (based on Olkkonen 1994, p.26).

In this study the viewpoint is mostly subjective. The researcher's interpretations and especially the interviewee's conceptions about open source and, for example, about the relationships are relative.

1.4.2 Research methodology

The selection of the research approach is based on the research problem, on the way the information is acquired and on the results the writer wants to achieve. A very common way to divide research approaches in business economics is a model made by Neilimo and Näsi (1980, p. 67). Their model consists of four different approaches: conceptual, nomothetical, decision-oriented and action-oriented (ibid.). Kasanen et al. (1993, p.257) have added a fifth research approach to this model: constructive (Figure 2.). These

approaches are divided into two axes. Theoretical – empirical axis describes the method that is used to gather the information, and descriptive – normative axis to describe the intended use of information (Kasanen et al., 1993. p. 257).

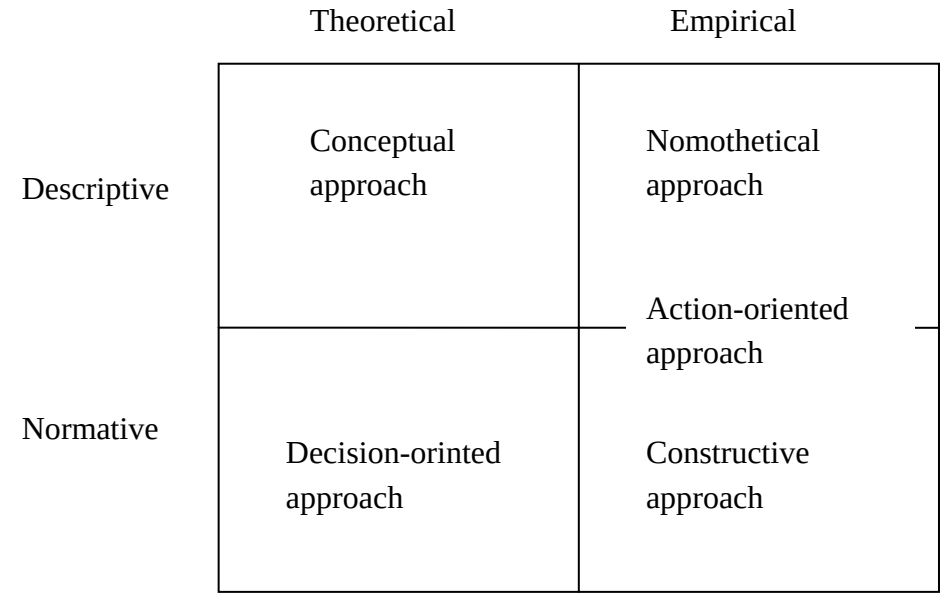

Figure 2. Five research approaches (Kasanen et al. 1993, p.257)

The purpose of the conceptual approach is to produce conceptual systems (Olkkonen, 1994, p. 65). Neilimo and Näsi (1980 in source Olkkonen, 1994, p.61) point that the approach is based on earlier made conceptual analysis and/or empirical theory. They (1980, p. 32) say the method used by this approach is thinking and the results are achieved through analysis, synthesis and comparison. The approach could be represented in either positivistic or hermeneutic research (Olkkonen 1994, p.80).

The nomothetical approach, on the other hand, aims to state the empirical findings in the form of general laws (Kasanen et al. 1993, p.255). According to Olkkonen (1994, p.67), the purpose is to prove connections that are either causal or at least correlative. He (ibid.) says that this is the purest form of positivistic research. The research aims to a result as objective as possible, and is driven by rich methodological rules (Neilimo & Näsi 1980, pp.39-40).

The decision-oriented approach is also based on a positivistic form of science. The aim is to develop mathematic-based methods and the results are usually mathematical. (Olkkonen 1994, pp 70-80) “The results are meant to help management in running the firm” as Kasanen et al. (1993 p.256) summarize the idea.

The action-oriented research approach is based on a hermeneutic form of science, and its main focus is to understand the subject under investigation. The researcher’s own interpretation based on his/her under understanding is essential, as is also the close relationship between the researcher and the subject. Researches deal with the

functionality of organizations, management, problem solving, decision processes etc. (based on Olkkonen 1994, pp. 72-73 and Kasanen et al. 1993, p 256)

In the constructive approach, according to Kasanen et al. (1993, p. 245), the goal is to solve problems with the help of constructing models, plans, diagrams, organizations etc. This research method consists of both positivistic and hermeneutic forms. Kasanen et al. (1993, p 246) also conclude that not all problem solving studies are constructive research, but this approach aims to verify the results in practice, as it also aims to solve problem and to develop the proposed decision.

This study could be divided into two sections, theoretical and empirical. The starting point for the study is a research problem, which in this case is presented in chapter 1.2. Literature survey forms the theoretical base of the study and gives the researcher the ability for a broader analysis of the studied field.

In this study, there are some common features that are typical to the conceptual approach. The theoretical subtext is based on earlier studies and literature works which are common for the conceptual approach, like Neilimo and Näsi (1980) previously pointed out. Because of the previous statement and the aim of the theory, which is to describe some common methods and concepts behind open source, it is hard to imagine conducting this study without using the conceptual approach.

At the same time the theory has already been written during the OSSI-project and now is time to test the theory in practice. In that case the emphasis is on empirical examination. The collected material has an important role to play in this study. The empirical part of the study is based on accurately chosen and discretionary chosen interviews. The previous statement and the fact that the sample of interviews used in this research is quite small are typical features of qualitative research (Eskola & Suoranta, 2005, p. 61).

In the following paragraphs, the interviews will be discussed in more detail, but so far it could be said that the empirical approach has mainly viewpoints from action-oriented approach. In the action-oriented approach there are only a few subjects, the researcher and the subject are closely related and there are no exclusively external or neutral findings available from the subject (based on Olkkonen 1994, pp.72-73).

The empirical part of this study is based on a case study. A case study is an empirical inquiry that, according to Yin (1994, p.13) “investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. Yin (1994, p.80) continues that the methods of gathering the information are documentation, archival records, interviews, direct observations, participant observation and physical artifacts. It is typical of a case study

to gather diversified information in many different ways (Metsämuuronen 2005, p.206). The case study research could be either single- or multiple-case study (Yin 1994, p.14).

According to Hirsjärvi and Hurme (2004, p.22) a case study could be based on either qualitative or quantitative examination. In their work, Hirsjärvi and Hurme (2004, p. 22) also present the thoughts of Glesnen and Peshkin (1992) and Creswell (1994) about how they differentiate qualitative and quantitative researches. According to Glesnen and Peshkin (1992) quantitative research aims to generalization, predictability and causality, when qualitative research pursues to contextuality, interpretation and understanding the actors' point of view. In quantitative paradigm the research subject is independent of the researcher, while according to the qualitative strategy, they are interacting. Creswell (1994) also points out that according to quantitative approach the reality is objective and congruent whereas according to qualitative approach it is subjective and various.

As Yin (1994) stated, a case study is one way of gathering information. Hirsjärvi and Hurme (2004, pp.35-36) point out that an interview is a flexible method that suits for many starting points and intentions, and it emphasizes that people need to be considered as subjects. Most case studies are about human affairs (Yin 1994, p.85). An interview is a kind of the conversation which, according to Eskola and Suoranta (2005, p.85), happens from the researcher's own initiative and according to the researcher's lead.

Eskola and Suoranta (2005, p.86) divide different types of interviews in structured, semi-structured, theme- and open interviews. A structured interview is often called a form-interview, or a survey as Yin (1994, p. 85) calls it. The questions are formalized (order and amount) and same for every interviewees (Eskola & Suoranta 2005, p.86). An open interview is the one that is closest to a conversation, it is unstructured: the questions are open and the answer for the previous question leads to the next (Hirsjärvi & Hurme 2004, pp.45-46). A theme interview is often placed in the middle of structured and open interviews, and for example Hirsjärvi and Hurme (2004, p.47) call it a semi-structured interview.

In a semi-structured interview, the questions are same for everyone, but there are no prepared examples for answers. In theme interviews, on the other hand, the themes of the questions are defined in advance, but there is no specific order or shape of questions. (Eskola & Suoranta 2005, p.86) Distinguishing between theme and semi-structured interviews is also difficult because the term theme interview is unknown in languages other than Finnish (Hirsjärvi & Hurme 2004, p.48).

This study presents a qualitative case study that investigates two different main cases (Eclipse and Debian). In-depth understanding of the studied cases is achieved through the utilization of versatile data, which is typical of a case study inquiry. The primary data includes a series of qualitative interviews, but also a quantitative survey. Besides the primary data, also secondary data has been used. It includes web pages, company

material, journals etc. In this multiple-case study, the cases are first studied separately, while the main differences and similarities are compared afterwards. In addition to the analysis of the communities, the study includes five different company cases that are linked to the analysis of the cases of Eclipse and Debian.

As the aim of the present study is to understand the phenomenon under investigation, qualitative research methods are followed in the study. In addition, the researcher and the research subject are closely related. It could be said that interviews in this study are semi-structured, which Hirsjärvi and Hurme above define in a slightly confusing way as theme interviews. The interviews are not pure theme interviews, though. Viewpoints, which are sometimes called as interview themes, are the same for every interviewee, but, for example, the enterprise representatives chosen for the sample are experts in different fields, and so questions could vary to some extent during the interviews. In an open interview the interview situation is typically close to a conversation and some questions are formed during the interview. The question forms are the same.

1.5 Key definitions

In this chapter, the most important key definitions concerning this thesis are introduced.

Free software vs. open source. There are some philosophical differences between the terms. Free software means the freedom to use, study, copy, modify, and redistribute computer software. The concept of open source is based on the philosophy of free software. According Vainio and Vadén (2006, p.10) for free software the freedom is a social and ethical imperative, and open source is a requisite for on effective software development process.

Free/open source software. The combination of free software and open source software is called as FOSS.

Network. It is formed by the relationships between unlimited companies and organizations. A network is perceived as an open system of a business relationship. Networks could be studied, for example, on the levels of macro networks and micro networks. (Möller et. al. 2004, p.10 and p. 27)

Open source. A more extensive term than open source software. A set of principles and practices which follow the source code is made available to everyone and any programmer can modify it to better suit his or her needs and redistribute the improved version to other users (modified Goldman & Gabriel 2005, p.29).

Open source business model. It is seen as a tool for exploring new business ideas and trying to capture the essentials of each business alternative. The open source

environment creates certain characteristics for these business ideas and alternatives. (Seppänen et al. 2007, p.1).

Open source community. A group of talented people who share the same interest, the same goal, and communicate with each other achieve that goal more effectively (Goldman & Gabriel 2005, p.52).

Open source license. Licenses ensure that the source code is available to everyone to inspect, change, download, and explore it as they wish (Woods & Guliani 2005 in source of Seppänen et al. 2007, p.2).

Open source software. Any computer software which is distributed under an open-source license or is available under terms the meeting the Open Source Definition made by OSI (Helander & Rissanen 2005, p.841).

Open source value network. Together the developers, companies and customers form the open source value network, in which everyone's core competencies are used for value creation. The purpose of the open source value network is to create the value which corresponds to the requirements set by the participants in the opens source value network.

Value network. It is a network where value is formed through ever-changing open network by actors who are directly or indirectly connected to each other. Value is created to end users as well as to actors themselves.

1.6 Structure of the study

The structure of this study is presented in figure 3. This study is divided in to four different parts, which are the introduction, theory, empirical study and conclusions. Actually, there are also four different chapters in the thesis.

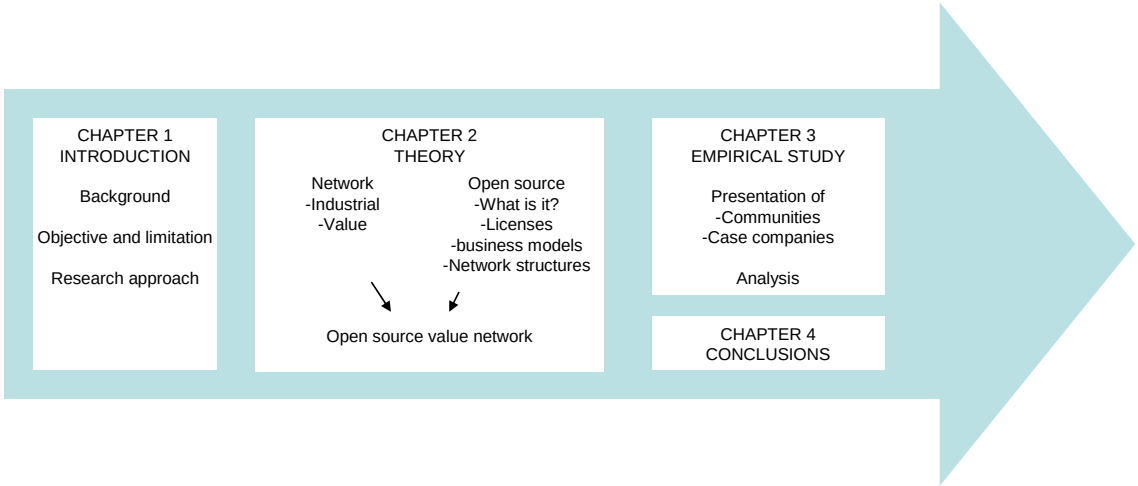

Figure 3. The structure of the study.

The second chapter ”Open source value network” is divided into three main subjects. The first is network theories. The subject is approached by explaining some facts which industrial networks are based on, the next topic is value networks, which is actually the main point of this first part of theory.

The second subject of the theory is open source. The most important issue in that subject concerns the open source networks and the structure of open source communities, although there are also some explanations of open source licenses and business models. The network models of open source include the definitions of different actors’ roles.

The final subject in the theory section is the open source value network which is the summary of the whole theory. The concept open source value network is presented.

Chapter 3 is about empirical study. This is the most important chapter of this thesis. First the case communities are analyzed and the companies are presented. At the end of this part there are analyses of how companies are linked to value networks of selected communities and how value is created in the case communities..

Finally, chapter 4 summarizes this whole thesis.

2 OPEN SOURCE VALUE NETWORKS

2.1 Network approach

In the 1980's, international network researches became common in many disciplines (Pietiläinen et al. 2005, p.18; Vesalainen 2002, p.8) and since then networks have been the object of many different studies. There are also lots of different research approaches. For example, Araujo and Easton (1996) (in source: Pietiläinen et. al. 2005, p. 18) classify network researches into ten different trends: social research, innovation networks research, researches between major organizations, actor-network theories and industrial networks are the most interest ones for this study. Pietiläinen et al. (2005) have compiled earlier studies that are based on network approach. They (2005, p. 18) state that various network researcher intend to interpret and model action and behaviour through network structures.

Terminology in network theories and in networking is still somehow undeveloped and confused. The term networking can be used for (the process of) forming nets or networks. Networking is forming business connections and contacts through informal social meetings (Collins English Dictionary 2005). Kulmala (2003, p.32) says networking is a form of social behaviour which turns into networking when people who know each other via different ways cross-use each other's services. Möller et. al. (2004, p.10) specify the terms net and network to clarify the approaches mentioned above:

> A net is a net-organization that is formed by a certain group of companies, which is built consciously and objective-orientedly. Typical examples are strategic nets and business nets.
>
> A network is a larger complex than a net, for example macro networks, industrial networks etc. It is formed by the relationships between unlimited companies and organizations. It is perceived as an open system of a business relationship.

Jarillo (1993) continues the definition by Möller et al. by saying that the viewpoint of a strategic net differs from that of an industrial network. In the strategic net the focus is on the company's wilfully developed and organized nets which are seen as a model of how to do business (in source: Möller et. al. 2004, p.219).

Möller et. al. (2004, p.27) clarify the network approach by recognizing the levels in analyzing networks. The levels are macro networks and companies' target networks, which are part of micro level's networks. Macro networks include different industries and clusters that are formed between them. (ibid.) In macro level networks there are

more complex systems of relationships (Malinen 1998, pp. 213-217). The term network, which is described above, models this level.

Möller et. al. (2002, p.1275) also use the terms network organization and network of organizations. The latter refers to any group of organizations (like markets or network of firms) while a network organization is a much simpler one (e.g. strategic networks). Micro vs. macro perspective can also be seen in this approach.

Companies usually work in a much more limited environment (target networks) which they form with other organizations. Because networks are not transparent, the actors in the network cannot know networks very widely. (Möller et. al. 2004, pp.28-29) Malinen (1998, p.213) describes a network at a micro level as an exchange relationship that includes a minimum of three different organizations. Different actors at the micro level have different relationships, which form the basis of networking.

Like Malinen and Möller et. al. did, also Helander uses this same approach in her doctoral thesis (2004). She has studied business networks and value creation, which are joined together in a discussion of value-networks. She (2004, p.73) lean on different sources when proposing studies of business networks like industrial networks, business ecosystems, strategic enterprise networks, strategic alliances and focal nets. Industrial networks are so-called macro networks and strategic alliances and focal nets are micro networks (ibid.).

Like Vesalainen (2002, p.8) points out, the problem is the variety of network approaches and the different network terms rather than the lack of them, which also sets some challenges for this study. The main idea behind the approaches described before, is more or less to describe networks from the point of view of the actors and the whole organization, like Malinen (1998, p.217) points out. Helander and Laine (2006) have studied open source networks earlier during the OSSI –project by using this same approach. They used industrial network theories as a base for a much deeper theoretical network analysis, like value networks. This study is a logical continuity to the earlier studies in the OSSI-project and so the theoretical background will follow the same line by concentrating also on the issues of value networks and open source, which are the writer's own area of interest. In this study, the term network is used as Möller et al. (2004, p.10) describe it instead of net, because when talking about open source networks the definition of a net is not suitable. The size and openness of open source networks do not fit with the term net.

2.2 Industrial networks

Researchers of Industrial Marketing and Purchasing Group (IMP) produced industrial network research approach in the 1980's. Its roots are in marketing research. It determines a network as a bunch that includes resources and activities which are

controlled by actors. (Möller et. al. 2004, pp. 218-219). The evaluation level refers to business relationships between companies and networks that are formed from those relationships (Pietiläinen et al. 2005, p.23). IMP school's approach studies companies' exchange relationships and for example interaction processes, participants and operational environment which are related to relationships (Tikkanen 1996). The purpose is to understand the big picture of industrial business relationships from the point of view of the actors and the networks (Pietiläinen et al. 2005, p.25).

Easton (1992) proposed four major approaches (four different angles) to industrial network research which, in his words, help to understand the networks' 'nature' and 'essence'. Networks can be studied as relationships, structures, positions and processes. These terms are explained in the next chapter.

2.2.1 Approaches to industrial network research

Relationships among firms are the essential of an industrial network approach; they formulate the base of networks. Observing networks as relationships takes into consideration both the organizations within the network and the people within the organizations. People's relationships across organizations are important for this approach. Relationships are formed of different elements: mutual orientation, dependency of other firm and investments. Mutual orientation means that firms are working and interacting with each other; dependency of another firm means bonds which exists between different firms, and investments are said to be processes in which resources are committed in order to create, build or acquire assets which can be used in future (Johansson & Mattson 1986). (in source: Easton 1992, pp. 8-16)

The structures of networks are based on interdependency between firms or organizations. Independent firms have much more unstructured networks, or industrial systems like Easton points out, than interdependent firms. The limits of the network are drawn by the compactness of its relationships. (Easton 1992, pp.16-19) Also actors' mutual dependencies affect the structures of the networks. These dependencies can be either compact or loose (Möller et al. 2004, pp.223-225).

When observing networks as positions, the focus is on a single firm rather than on a whole network, this is called as a micro perspective approach. The position of company is defined by its network relationships and by the resources the firm controls, which are closely related to each other. The network position of the company determines the role of the firm against other firms. In other words, the network position influences the way the company interacts with other companies, how it is considered and evaluated by other companies in the network. (based on Easton 1992, pp. 19-21 and Möller et. al. 2004, pp. 225-227)

Networks are both permanent and dynamic although continuous interaction changes networks all the time. There are two dialectical processes that shape networks: actors' competition about critical resources and benefits you get; and actors' cooperation between competitors. (Easton 1992, pp.21-25) There are also some minor forces, as Möller et. al. (2004, pp. 227-228) describe it, behind network evaluation: companies' functional dependency, companies' power structure, network's knowledge structure and network's history and beliefs.

2.2.2 ARA-model

According to Helander (2004, p.74) Håkansson and Snehota (1989) point out that the network approach takes into account the relations between different actors. A network is formed by actors, activities and resources which are linked up together.

Håkansson and Johanson (1992) introduce the actors-resources-activities (ARA) model, which could be seen as a basic theoretical background of industrial networks. As stated above the model includes variables as actors, resources and activities, which are related to each other.

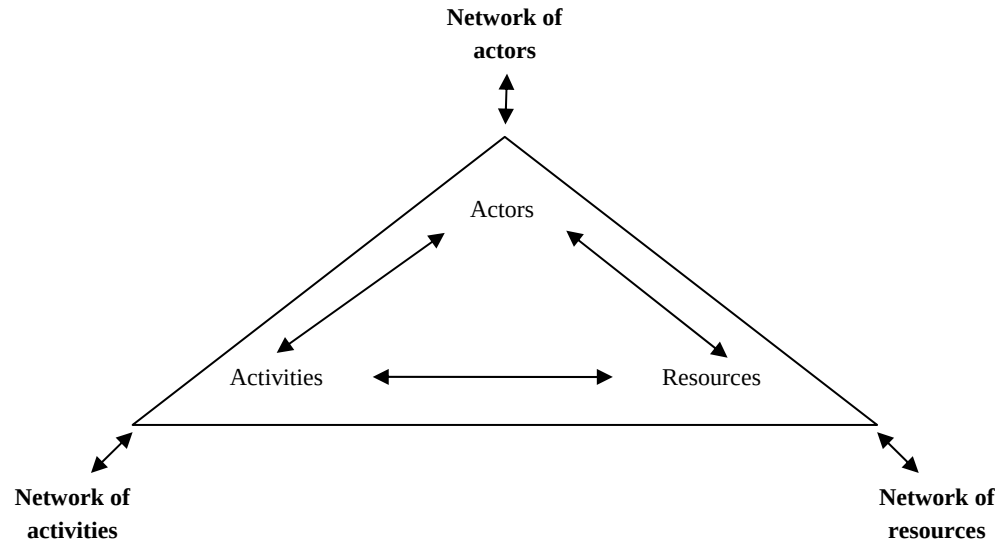

Figure 4. The ARA model of industrial networks (Håkansson & Johanson 1992).

Actors can be individuals, groups of individuals, parts of firms, firms and groups of firms, which perform activities and control resources. Actors have five characteristics. They perform and control activities which means for example which activities to perform, how these activities are to be performed and which resources are to be utilised when performing the activities. Depending on the depth of the relationships the actors can access each other's resources. Third characteristic is that actors control resources directly or indirectly. Direct control is based on ownership and indirect control is based on relationships with other actors. Actors are also target oriented which means that the general goal of the actors is to increase their control of the network. This is achieved

through control over activities and/or resources. Finally, actors also have different knowledge of other variables in the network. (Håkansson & Johanson 1992, pp. 28-30)

An activity occurs when one or several actors use resources by utilising other resources. This means combining, developing, exchanging or creating resources. There are two main kinds of activities: transformation and transfer activities. Through transformation activities, which are always directly controlled by one actor, resources are changed in some way. Transferring control of a certain resource (or resources) from one actor to another is changed through transfer activities. As actors above, activities are linked together. There is a great number of relationships between activities. It is common for networks, and important to notice, that new activities, changes in old activities, rearrangement of activities or changes in relationships between them can make networks more efficient. (Håkansson & Johanson 1992, pp. 30-31)

Activities, both transformation and transfer, demand resources which are heterogeneous resources. The resources are controlled by actors, which was already mentioned in this chapter. They have attributions in many dimensions, which lead to their use. Resources can be used in many different ways. One characteristic of resources is the utilisation of the resource in activities. Performing transformation activities requires transformation resources etc. (Håkansson & Johanson 1992, pp. 32-33)

The elements described above form the structure of a network. Actors form relationships with each other and similarly resources and activities related to each other form a network, and finally these networks are close to each other and are bound together by several forces combining the whole network. The important forces are functional interdependence, power structure, knowledge structure and intertemporal dependence. Functional interdependence means that heterogeneous demands are functionally related to heterogeneous resources that are needed to satisfy the demands. A power structure is formed between actors which control activities and resources. Knowledge and experience of the present and earlier actors bound together the designs of activities as well as the use of resources. Finally, intertemporal dependence means that the changes made in the network must be accepted at least by the majority of the actors in the network and, therefore, the changes are marginal and closely related to the past. (Håkansson & Johanson 1992)

Industrial networks are full of interdependencies which actors within the network need to be able to observe and process in order to achieve success. The industrial network model offers a tool for that. (Ford et. al. 1998 in source: Helander 2004 p.77) It is possible to study inter-organizational and inter-individual relationships from a holistic perspective through the industrial network model (Helander & Laine 2006, p. 47).

2.3 Value networks

Industrial networks, as can be noted from chapters 2.1. and 2.2., consist of a group of several interdependences. In industrial networks, some companies and organizations form relationships that are characteristic of these certain participants. Actually, companies form relationships with particular companies, in other words, specific partners, which they feel are strategically significant for their business (Dubois 1998, in source: Möller et. al. 2004, pp. 28-29). In these cases, the term business net can be used (reference to page 11).

Business nets are built by consciously and objectively with a specific goal, and they are built by a specific bunch of companies where each participant is given his/her own role. These kinds of nets are strategic for their members, and because of that, are also often called strategic nets or value nets. (Möller et. al. 2004, p.29)

The value net is often referred to a value network. This problem becomes more obvious when using terms from English and Finnish reference sources, like in this thesis. In this thesis the term value network is used. Value net is understood as a smaller value network, it is a part of a bigger network. Möller et al. (2004, p.10) presented before the most important difference between net and network: network is formed by the relationships between unlimited companies and organizations.

The concept of value network expands the value chain concept by Michael Porter. In this case value is formed through an ever-changing open network, while in the value chain it is formed more linearly. (Tapscott & Caston, 1993, in source Parolini 1999, p. 41) In value networks the question is not only about the own competencies of the company - which could also be called value functions - suppliers and partners, but you also have to take into account customers and their partners (Helander 2004, p.86).

Another important theme besides value creation to be included in the study is the analysis of the roles the members of the net. These roles form the base for the methods and solutions that affect the construction and management of the networks. This is something the industrial network approach has been criticized for. For example, Pietiläinen et. al. (2005, p.27) mention that industrial network researches do not take into account the viewpoint of the relationships that are formed between people. Instead, the researches discuss network relationships from the viewpoint of the companies.

Value network has recently been studied quite a lot. There are some models which offer interesting viewpoints to the subject, like the model of value-creating networks by Kothandaraman and Wilson (2001), the value system continuum by Möller et al (2002) and the value net tool by Parolini (1999). The model of Kothandaraman and Wilson (2001) take into account most comprehensively the value, relationships and

competencies that were already mentioned before, and that is why their model has been chosen for the theoretical background of this thesis.

The following chapter will introduce moore deeply the model of value-creating networks by Kothandaraman and Wilson (2001). It is formed by three core concepts of value creating; core capabilities, superior customer value and relationships. While Porter's value chain discussion is from the perspective on an individual firm, the model of value-creating networks offers a more suitable tool of analysis for this thesis. After the discussion about the model, summary chapter 2.3.2 presents some conclusive thoughts about the model of value-creating networks and the previously mentioned ARA model. The chapter is also supplemented with ideas of other value network researchers, like Möller et al. (2002 and 2004) and Parolini (1999).

2.3.1 The model of value-creating networks by Kothandaraman and Wilson

Before introducing more specifically the model mentioned above, it is important to understand the common terms, which form the basis on which value network theories have been built on. These terms are important for model of value creating networks and also for other theories not relevant to this research. The terms are value, core capabilities and relationships.

Satisfying customer needs or creating a satisfied customer relationship is no longer enough to win their loyalty. Firms must create better value to their customers. Creating better value for customers means that managers must integrate the resources to use the core capabilities of the firm to deliver a product (market offering) that satisfies the needs at a competitive price (Kothandaraman & Wilson 2001, p.380).

Value consists of the relationship between the price and the market offering. By delivering superior value in the marketplace a company can win the battle for customers. Like Helander (2004, p. 72) points out, customers always measure value in relation to their own needs.

Creating value depends on how well companies can deliver performance on the benefits that the customers care about. High performance requires core competency in technology and business processes. (Parolini, 1999) Core competency could be defined as an aggregate of capabilities. These core capabilities provide the means to deliver superior performance in the way that is important to customers. (Kothandaraman & Wilson 2001, pp. 380-382)

It is obvious that creating value requires the assembling of core capabilities beyond the capabilities resident within the firm. A network of firms could offer a wider set of capabilities needed to produce superior value to customers. By developing stronger

relationships with key partners, who can add value to market offering, firms assemble these networks. (Kothandaraman & Wilson 2001, pp.382-384)

As stated earlier in this text, firms must create value, for example, to purchase customers, whereas value creating depends upon their core capabilities. In addition, because of limited capabilities firms must seek partners to produce superior value to customers. This creates networks that compete against each other. Kothandaraman and Wilson (2001) describe these networks as value-creating networks.

A model of value-creating networks, created by Kothandarman and Wilson (2001, p. 384), define three building blocks and their interrelationships. These blocks are superior customer value, core capabilities and relationships. The model is presented in figure 5.

The objective of the model is to describe how superior customer value can be created. It is created by capabilities of member firms of the network. The way the firms are combined to create this value is influenced by the nature of relationships between the firms. As authors pointed out, the quality of relationships facilitates the creation of value. Relationships also hold the network in place and thereby help the firms' ability to maintain and improve capabilities. (Kothandaraman & Wilson 2001, p.384)

In proportion the core capabilities constrain the quality of the relationships between the firms in the network. The explanation to this, according to the authors, is the willingness of firms to develop relationships with those firms that have unique capabilities. (Kothandaraman & Wilson 2001, p.384)

As presented in figure 5, superior customer value (or actually customers) determines the core capabilities they wanted from the network. By appreciating the value the network deliveries the customers also reinforce the quality of the relationships between the members. The relationships between the three building blocks are reciprocal paths between each other. (Kothandaraman & Wilson 2001, p.384)

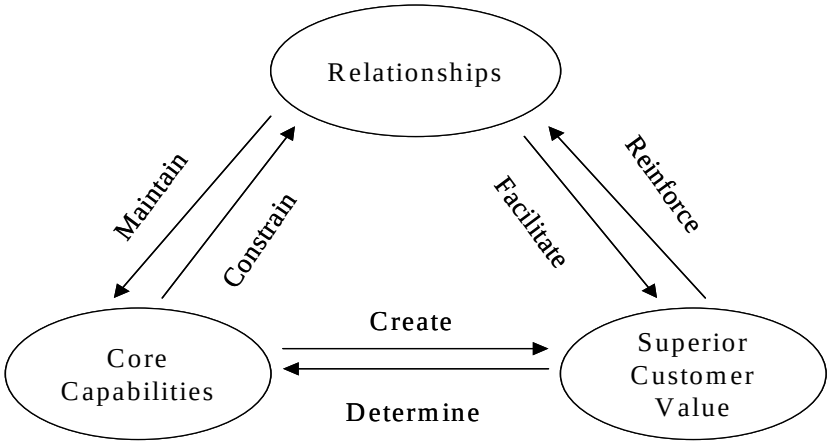

Figure 5. Model of value-creating networks (Kothandaraman & Wilson 2001, 384).

It is important to remember that the model is just theoretical. In the reality, the business situations differ from each other. There might be different barriers between elements in the value networks. But even in this kind of form the model is useful for companies for understanding their position or role in the value networks. Like Kothandaraman and Wilson (2001, p.385) mention, firms do not normally think about their position in the networks, they just compare them with each other, especially between competitors.

2.3.2 Theoretical synthesis: the model of value network

Also Möller et al. (2004, pp. 32-33) base their notion of value networks on Porter's value chain –concept. Actually, they do not use the term value network, but instead they talk about value creating systems, which are the base of the network. The value creating system is based on the view that each product, service or system expects specific value operations executed by companies and functions. Möller et al. (2004, pp. 32.33) claim that the character of the value creating system and the purpose of the network are in a central position outlining the characteristics of business networks and consequent managerial capabilities.

In the model "Value production and network capability base" Möller et al. (2002) present a thorough picture of how capabilities are linked to value creation in the network context. This model offers a useful way to analyse managerial capabilities, which are needed when acting, organizing or building networks. In this thesis managerial capabilities are not analyzed on the same level as is done by Möller et al., but nevertheless, some of their bottom ideas have been utilized.

Parolini (1999) also discusses value creating systems. These systems comprise of value functions and the companies that are needed to manage those functions. To be precise, Parolini describes value creating systems as a set of activities creating value for customers. Activities are carried out by using sets of human, tangible and intangible resources. Furthermore, these activities are linked by different kinds of flows, which are made up of material, financial and information resources and also influence relationships.

Although the theories of Möller et al. (2002) and Parolini (1999) about value networks have not been used very widely before, some of their thoughts have been used in the next figure. Figure 6 connects the ideas behind the models of industrial networks (ARA) and value-creating networks which were presented in more detail earlier in this thesis, by including the ideas of managerial capabilities by Möllet et al. (2002) and Parolini's (1999) thoughts on value functions.

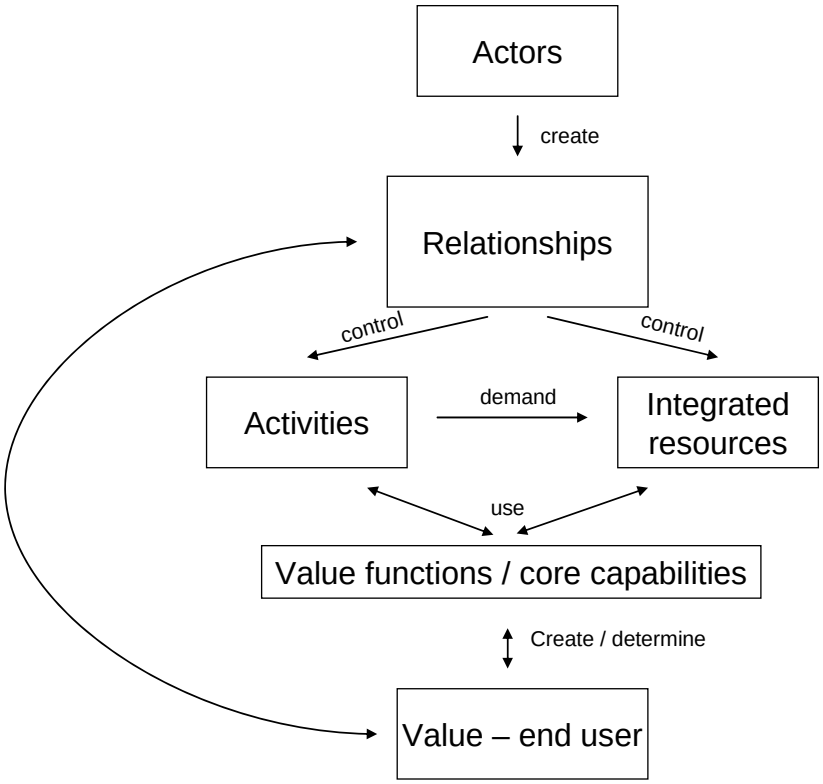

Figure 6. The model of value network

As in figure 5 relationships, core capabilities and superior customer value are in central role. But also the role of actors, activities and integrated resources are stressed. For example, Möller et al. (2004, pp.33.34) emphasize that when analyzing different kinds of networks it is important to define the actors of the network and the value functions the actors control[1] in a relatively precise manner.

Actors create relationships between other players in the network. Through these relationships actors control the resources and activities. The resources must be integrated which means that the players in the value networks must share their resources to achieve the best possible value. In real life, there are many examples on how companies have integrated their resources, for example, in joint product development processes.

The boundary between activities and integrated resources and value functions / capabilities is not very clear. At least Parolini and Möller et al. define the value functions as activities. In the figure 6, the activities and integrated resources are separated from capabilities and value functions because it stresses that not all activities and resources, which are important for the company, are core activities. Like

[1] The value systeem continuum is based on this argument. The continuum recognises the value creating systems on which the networks are based on. It describes the ideal types of the value systems and their overlapping characteristics. But because single companies' positions and roles are difficult to place in the continuum, the continuum is not such a relevant tool in this thesis. More about the value system continuum and the open source can be read from Helander & Laine (2006).

Kothandaraman and Wilson (2001, p.381) point out, a single firm is fortunate if it has three or even four core capabilities.

As stated several times before, final customers do not only consume value, they also can (or should) participate in value creating activities. This is pointed out also by Parolini, who takes her ideas further by including consumption activities to VCSs. The number of value customers obtained may depend on how they consume the potential value created. (Parolini 1999, pp. 64-65). In this study, the purpose is not to explore how consumers or end users benefit or use the value the networks offer. It is more important to recognise that end users have a significant role in the network and they do affect the value.

2.4 Open source

Many writers, for example Goldman and Gabriel (2005), and Weber (2004) and Pavlicek (2000) state that open source is a new, innovative and even revolutionary way to do business. Open source can be considered as a kind of a strike against traditional software engineering. Traditional software engineering, in this case, means closed software development which is done by own employees of companies.

Goldman and Gabriel (2005, p.29) define the basic idea of open source briefly as “by making the source code for a piece of software available to all, any programmer can modify it to better suit his or her needs and redistribute the improved version to other users”. Weber (2004, p.62) continues the definition by saying that “the key element of open source process, as an ideal type, is voluntary participation and voluntary selection of tasks”. These definitions are general enough if you are explaining open source for someone who has not heard about it before. But in this thesis, it is essential to go a little further and explain, for example, what the software behind open source is and who does it. Hopefully the idea of open source and open source software is clarified, because in the reference sources used in this study it is still somehow confused.

The next chapters explain what open source software is. The definition is based on The Open Source Initiative (OSI), which could be seen as a parent organization of open source software. After the definition the basic business models and licenses are shortly introduced. The terms are defined thoroughly enough for the reader to understand them later on in the text.

After the necessary definitions, some of open source network theories are presented. Firstly “the onion model” by Goldman and Gabriel (2005) helps to understand the structure of open source communities. Next theories by Seppänen (2006, p.7) and the OSSI Research Group (2007, p.7) clarify the roles which companies have in open source. These “models” are also used in the OSSI-project.

Räsänen (2004) introduces the Open source software value chain, which represents in more detail the actors that can participate in the open source software value networks. Also Goldman and Gabriel (2005, p.61) have developed a model that takes into account the companies' viewpoint in the open source environment.

The conclusion about the theories mentioned above is presented in chapter 2.5.

2.4.1 What is open source software?

Hansen et al. (2002, p. 461) offer quite a simple explanation for the question of topic: open source software means that the source code is distributed along with the executable program, it is free to use and it includes a license allowing anyone to modify and redistribute the software. The definition mentioned above is quite general, but easy to understand. Helander and Rissanen (2005, p.841), on the other hand, summarize the concept of open source software as any computer software which is distributed under an open-source license or is available under the terms meeting the Open Source Definition made by OSI. According to The Open Source Initiative (OSI), the distribution terms of open source software must comply with the following criteria (OSI 2007):

1. Free Redistribution. It means that the software must be freely given away or sold. The license of the software should not restrict this. The software could be a component of an aggregate software distribution containing programs from several different sources.

2. Source Code. The program must include the source code or be freely obtainable. Also the distribution of the source code must be allowed.

3. Derived Works. Also the redistribution of modifications and derived works must be allowed under the same terms as for the license of the original software.

4. Integrity of The Author's Source Code. The license may restrict the source-code from being distributed in a modified form only if the license allows the distribution of patch files. This means that the modification of the source code could be denied when changes and improvements must be delivered as separate additions.

5. No Discrimination Against Persons or Groups. It means that the license must not discriminate against any person or group of persons, so that no one can be locked out.

6. No Discrimination Against Fields of Endeavor. The license must not restrict anyone from making use of the program for example in business or in some kind of research. The purpose of the use cannot be limited.

7. Distribution of License. The rights attached to the program must apply to all to whom the program is redistributed.

8. License Must Not Be Specific to a Product. The rights attached to the program must not depend on the program being part of a particular software distribution. The rights of the program remain although it is separated from the original distribution.

9. License Must Not Restrict Other Software. The license must not place restrictions on other software that is distributed along with the licensed software. The license cannot insist that any other software it is distributed with must also be open source.

10. License Must Be Technology-Neutral. The contents of the license must be independent from any individual technology.

Above mentioned definition was about open source software. There is also term free software, which is often confused to open source software. Free software means that user has freedom to run, distribute, study, change and improve the software (Free Software Foundation 2007a). There are philosophical differences between the terms free software and open source software. Concept of open source is based on the philosophy of free software. According Vainio and Vadén (2006, p.10) for free software the freedom is a social and ethical imperative, and open source is a requisite for effective software development process.

Because the terms free software, open source software and open source are used more or less in a confusing way, in this thesis will be used mainly the term open source. In the research of business economics is mostly used term open source than free software, and during the interviews made in this thesis, the term open source was used. In some cases the term open source software is used, but because of open source is understand as a more extensive term than open source software it is more appropriate suited for the purpose of this thesis.

2.4.2 Licenses

Woods and Guliani (2005 in source of Seppänen et al. 2007, p.2) stated the importance of licenses by saying that “the most important difference between software created by the open source communities (group of developers) and commercial software sold by vendors is that open source software is published under licenses that ensure that the source code is available to everyone to inspect, change, download, and explore as they wish”. Based on the definition the software license either can or cannot be considered as open source. OSI maintains up the list of the open source software licenses which meet the definition. There are 58 licenses which OSI has approved. (OSI 2006a) Next those licenses are introduced. There are also other additional open source licenses which do not meet the criteria of OSI, but are still referred to as open source.

Some of the most popular licenses that OSI (2006a) lists and which Goldman and Gabriel (2005, p.112), and Pavlicek (2000, pp.165-170) also mention are Apache License, Berkley Software Distribution (BSD) license, GNU General Public License (GPL), GNU Library General Public License (LGPL), MIT License, Mozilla Public License (MPL), IBM's Common Public License (CPL), Common Development and Ditribution License and Eclipse Public License. Also companies like Nokia and Sun have some licenses which meet the criteria of OSI.

In the present thesis, as mentioned several times before, licenses are not so relevant when it comes to the results of the study. The next section briefly introduces some of the most important licenses mentioned above.

Around 1980, the University of California at Berkley started to create the BSD (Pavlicek 2000, p.25). It is the Unix derivative, and a number of open source licenses are variations of it (Goldman & Gabriel 2005, p.126). This Unix derivative is based only on a simple copyright. According to Pavlicek (2000, p.166), the following clauses must be allowed: 1) copyrights appear in the source, 2) copyright statement must accompany binaries in a separate file or in the documentation, 3) advertisement must acknowledge the Unversity of California and 4) University of California endorsements must be arranged by permission.

This means that the license allows redistributing and it is possible to use it in a closed source commercial product. Only the names of the original code writers must be included in the code and ino different versions based on it. In 1999 the clause that states that any advertisement for derived products must include a statement saying the product was based on work done by the original contributor was removed. (Goldman & Gabriel 2005, p.126)

There are several variations based of the BSD. One of those is made by Apache Software Foundation. The Apache License is used with the Apache web servers. This license adds a clause saying that any derived product cannot use certain terms in the product name without prior permission. The term Apache may only be used by permission. (based on Goldman & Gabriel 2005, p.126 and Pavlicek 2000, p.170)

The MIT license is almost similar to the BSD. There is only one clause that says the copyright notice and the permission notice must be included to the source code. (OSI 2006b)

Perhaps the most popular open source license is the GNU General Public License. Calore (2007) says that an estimated 60 to 65 percent of the world's open-source projects distribute software under the GPL version 2. For example, Linux operating

systems use it. Initially, the GPL was created by Richard Stallman[2] for the use of the Free Software Foundation. An early version of it was used for the GNU Emacs in 1985. The version 1.0 was published in 1989. (Goldman & Gabriel 2005, p. 123)

The GPL license intended to guarantee the developer's freedom to share and change all version of the program. The license makes sure the software remains free for all its users. This means that if someone distributes copies of such a program the same freedom affects the next developer. Only if the software based on the GPL is used internally, for example in some company, the source code modifications do not have to be published. (based on Free Software Foundation 2007b)

Goldman & Gabriel (2005, p. 123) summarize in a very understandable way the philosophy of the GPL: *although organisations can sell computer software, the source code should be freely available for developers to learn from and to modify*. So it is possible to do business with the GPL; you can sell the software licensed under the GPL, you can resell it, modify it etc.

The second license The Free Software Foundation has is LGPL, which is used for software libraries. The biggest expectation to the GPL is that LGPL is informal in that LGPL allows the software to be linked into proprietary programs, which GPL does not. (based on Pavlicek 2000, p.165 and Goldman & Gabriel 2005, p.124)

Finally, there is one license or at least the product which is based on MPL license that is very common and well-known for all internet users. The Mozilla Public license was created by Netscape in 1998 to cover the code in the open source project called Mozilla. Actually, Netscape first wrote the Netscape Public License (NPL), which was later improved based on the feedback from users. The MPL was created. (based on Pavlicek 2000, p.169 and Goldman & Gabriel 2005, pp.121-122)

The MPL expanded the GPL. It allows the companies to use the source code to create new proprietary larger works and does not require them to publish it, but only if the original code remains unchangeable. It also requires that anyone who modifies the original code must make those changes public. IBM's Common Public License is one is almost similar to the MPL. (based on Weber 2004, p.184 and Goldman & Gabriel 2005, pp.121-122)

[2] Almost every open source publications have a mention about Richard Stallman. He is the founder of the Free Software Foundation and the GNU project (more about GNU project in page 47). The differences about free and open source are dealt in chapter 1.5 Key definitions.

2.4.3 Open source business models

“A business model is seen as a tool to explore new business ideas and try to capture the essentials of each alternative” (Seppänen et al. 2007, p.1). They (2007, p. 6) continue that in the open source environment there is no need for a specific open source business model as such, but the environment of course sets some characteristics for the models. For example, the licenses mentioned above set some limitations. There are still some business models in open source which are used more often than other models. Because of the fact that Seppänen et al. (2007) presented above, the term open source business model is used in this thesis for describing the models that are often used in the open source environment.

Goldman & Gabriel (2005, p.37) list some classic open source business models, which help to understand the basics of how business is done in the open source environment:

- Bundle open source software with perhaps some other software and with support, charging for the bundle and for additional testing and quality.
- Add value in the form of additional modules or surrounding software and sell that additional software bundled with the open source software.
- Provide a service based on the open source software, such as a subscription service that updates the customers’ sites with a tested and assured code.
- Sell consulting services that leverage open source software.
- Sell ancillary things such as books, T-shirts, and mugs.
- Sell hardware that runs the open source software particularly well.
- Sell software that uses the open source software as a platform.
- Release the software as open source, but license the software to companies that wish to use it in a proprietary product.
- Sell the newest version, but release the previous version as open source.

Koenig (2004) goes little deeper in his analysis of seven open source business strategies. He uses strategy as a term, but for example Puhakka (2007, p.10) presents the same seven strategies as business models. Also some other writers, for example Goldman & Gabriel 2005 and many different internet sources, discuss, for example, dual licensing as a business model. Actually Koenig (2004) himself does not separate the terms strategy and business model. Puhakka & Seppänen (2006, p.33) also emphasize the confusing nature of these terms, although these terms are not the same. In this thesis, the terms strategy and business model are used to refer to the same phenomenon since discussing the differences between them in not essential to the subject.

Figure 7 presents different kinds of business models. Puhakka (2007, p.10) has extended Koenig’s (2004) presentation by adding more companies as examples. These models are introduced in the following chapters.

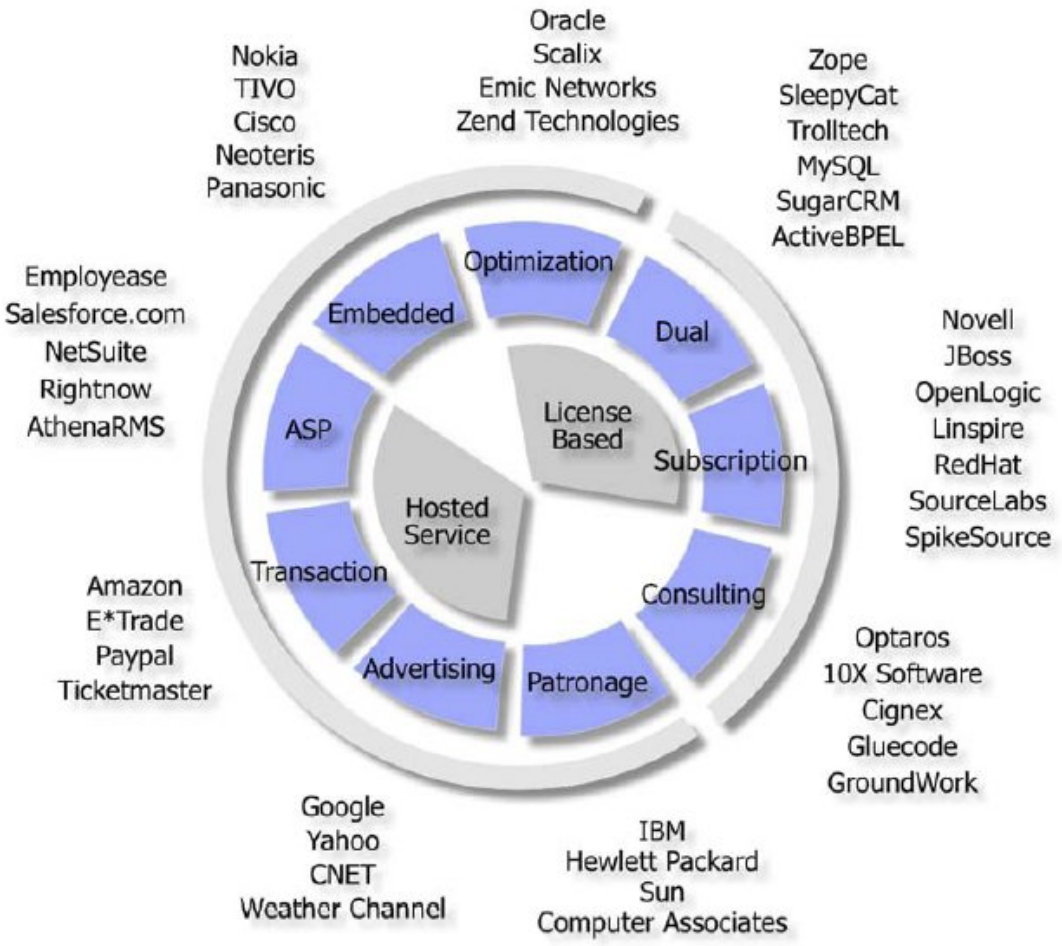

Figure 7. Sample of business models (Puhakka 2007, p.10)

Optimization means that a company is ready to optimize its own products according to the needs of customer. For example, Oracle creates products which are compatible with Linux, although Oracle has its own Oracle Unix –product, which is almost comparable with Linux. Their applications are optimized to achieve greater value. (based on Koenig 2004)

Dual means dual licensing. Dual licensing gives developers the possibility to choose between two licenses. In this case two different open source projects can share their source code with each other. (Goldman & Gabriel 2005, p.128) Companies typically use this approach when they give their customers a freedom to choose, between a commercial license and the GPL. There are, of course, some limitations with this business model, like 1) modifications the customer does must be made public, 2) the free code cannot be used as a part of a commercial product etc. (Koenig 2004)

Subscription is a little different license based model than optimization and dual licensing. Subscription means for example in Red Hat's case that the company is investing more in services (Weber 2004, pp.200-201). Red Hat does not collect separate license revenues from the Red Hat distribution. The license revenues are included in

maintenance, consulting and other services. (Koenig 2004) On the other hand, consulting as a business model is even purer service than subscription before. For example, a company called 10X Software provides enterprise integration consulting for popular open source software including MySQL, Apache and Eclipse (Koenig 2004).

Patronage means that a company invests a lot to open source. Companies contribute time, energy, developers and code to open source organisations. These contributions also include leadership and consistency. (Koenig 2004) For example IBM and HP do this, which could be seen in chapters 3.2.1 and 3.2.2 between IBM and Eclipse. According to Koenig (2004), IBM does this because of the driving standards adoption and cracking entrenched markets. This way IBM eliminates competitors for example. This means using open source software as the key technology engine (Weber 2004, p.203).

ASP (application service provider), transaction and advertisement are parts of hosted service approach. This means that, for example companies like Google, Amazon and Salesforce.com are hosted service companies which use open source software as the cornerstone of their IT platforms. For example Google is rumoured to run more than 100 000 Linux servers, and the main business revenues still come from advertising through a search service. (Koenig 2004)

Hosted services are part of hidden service business models. It is said that service providers have much to gain from open source. Like in Google's and Amazon's cases, using open source allows them to lower the costs, and still their quality of services remains reliable. (Koenig 2004)

The final model is the embedded model. From a Finnish perspective, Nokia's Internet Tablet is a great example. Internet Tablet is a Linux-based device, while Nokia acts as a hardware vendor (Nokia 2005).

2.4.4 Network models

Seppänen et al. (2007, p.2) point a very relevant comment related to this whole thesis. They say that "the openness and availability of the source code further mean that the value in open source projects is created for the network, not for individual companies or other entities or individuals". This statement is a great foundation for this chapter. It summarizes the necessity of the following theories about the models of community structures, the roles in communities and the network models of open source.

As stated in the chapters above, networks consist of different players. In open source networks one player is a community. Nakakoji et al. (2002, p.76) define open source community as a core, without which open source projects are not likely to be successful. It is a group of people who share the same interest, the same goal, and communicate

with each other to achieve that goal more effectively (Goldman & Gabriel 2005, p.52). They continue by emphasising distinctly the differences between a community and a user group, which is just a bunch of people using the same software without communication. Community is a group of motivated, creative and talented people. Community is usually built around a source code.

Nowadays many companies, which deal with open source, have their own communities. Those communities differ from the communities introduced here. Pavlicek (2000, p.63-64) points out the biggest benefit of communities compared to commercial ones; open source communities are growing so fast that commercial communities cannot match. The size of associated communities is a huge benefit.

A common way to describe an open source community is a layered structure, known as the “onion model”. Goldman & Gabriel (2005, p.52-53) introduce a model which includes four different stages. These are the code, core developers, other developers and users. According to this approach people start as users, where they start to advance towards the code. Although this classification is hierarchical it is useful and simple enough when explaining community structure to someone who is not familiar with it.

Also Nakakoji et al. (2002) have studied community structures. Their study is from a point of view of a for-profit company, and because of that the structure they present is more relevant for this thesis than the structure presented by Goldman and Gabriel (2005).

In figure 8, Nakakoji et al. (2002, p.80) present the general layered structure of open source software communities. There are eight different roles in the community: the project leader, the core member, the active developer, the peripheral developer, the bug fixer, the bug reporter, the reader and the passive user. The structure of the community is based on the collaborative relationships those different roles have. The roles are defined based on the personal interest the members have in the open source projects, while in commercial communities the roles are defined by the task the company assigns.

The project leader is the person who is responsible for the overall direction of the project. He is also often the person who has initiated the project. The core members, sometimes called as maintainers, are the ones who take care of coordination and guiding of the development. Their contribution for the project is very significant, and they have been involved with the project for a long time. (Nakakoji et al. 2002, p.79)

Next are the active and peripheral developers. Their role differs a lot, or at least their contribution to the project differs. Active developers are the ones who regularly contribute to new features and fix bugs. They take care of the major development, while peripheral developers contribute only occasionally to new functionalities and features. Their period of involvement is short and sporadic. (Nakakoji et al. 2002, p.79)

Bug fixers' and reporters' work is quite close to each other. Reporters discover and report bugs. They are like testers in the traditional software development projects. Bug fixers fix the bugs which they or reporters have discovered. Reporters do not have to read the source code, but fixers have to, at least in some level. (Nakakoji et al. 2002, p.79)

Readers and passive users are the furthest ones in the structure. Readers are active users of the software. They also try to understand how the solution works, while passive users use the open source solution as they use the commercial ones. (Nakakoji et al. 2002, p.79) Although the influence of the readers and passive users to the project is less significant than the influence of the developers that are close to the core, their role should not be underrated. According to Nakakoji et al. (2002, p.79), the existence of passive users creates motivation and encourage other more active members to work. It should also be remembered that most of the members in open source projects are passive users.

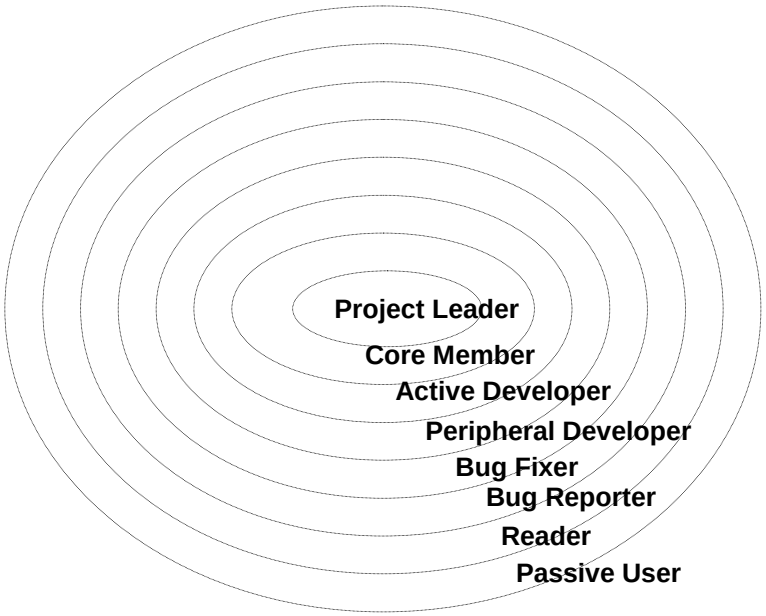

Figure 8. General Structure of an OSS community (Nakakoji et al. 2002, p.80)

The structure presented above is just one example of how structures and roles of open source communities could be studied. Different open source communities have different kinds of structures. When studying networks the structures and the types of roles are even more different. But in this thesis figure 8 offers a relevant base for the analysis in chapter 3.

In addition to community analysis, chapter 3 also introduces the analysis of companies involved in the open source networks. The following models and role classification are selected from the companies' perspective.

Figure 9 (“Different OSS user types have varying needs for OSS management framework”) presents the framework of the OSSI project. The OSSI -project developed a management framework by examining the phenomena from the perspectives of business, sociology and technology. The next figure provides answers to companies’ practical challenges such as how to optimally utilize open source software and when to go and not to go into OSS business. The OSSI framework is developed based on the main outcome presented in the figure.

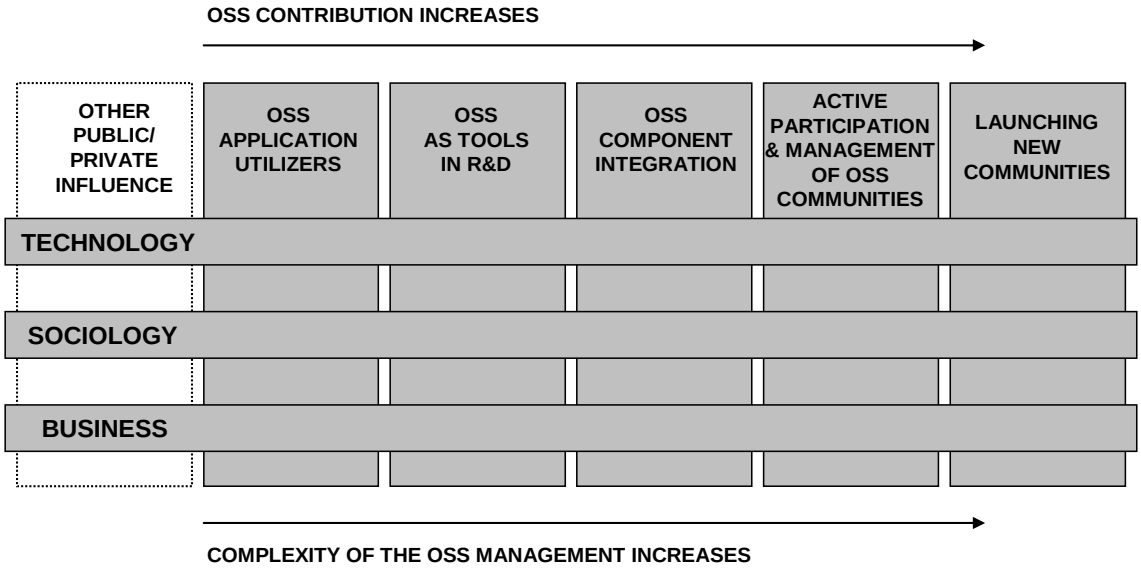

Figure 9. Different OSS user types have varying needs for OSS management framework (modified from the OSSI Research Group 2007, p. 7)

The technology aspect takes a stand to the impacts of the open source software on software architectures and projects. The purpose of the sociology aspect is to examine personal and social features of the developers and their motivational structure. The business perspective is the main aspect behind this thesis. The business perspective is further divided in the research project to economics, business models, competitive strategy and value networks.

In addition to aspects there are also some roles, which differ when the contribution of company to the open source software increases. The contribution increases when moving towards user type, which launches new communities. At the same time also the complexity of the open source software management framework increases. These roles are divided based on how the user types utilize open source. For example, some might use open source software tools in research and development, while others are open source software component integrators.

The roles might be difficult to separate from each other. For example, it could be hard to define the differences of company that is open source software application user and company that uses open source software as tools in research and development. It might also be confusing to compare the roles of companies to the aspects in the x-axel,

because usually the aspects go hand in hand. In addition, roles must be studied in a more detailed level, like is done in next chapters.

Seppänen (2006, p.7) defines more deeply the roles of the companies in the open source development. He presents six different roles to clarify what kind of types of involvement a company might have. The roles, which are the observer, the user, the adapter, the integrator, the engine and the promoter, are presented in table 1.

Table 1. Some aspects on the different involvement types (i.e., roles) (Seppänen 2006, p.7)

Type of involvement	**Primary target**	**Sacrifices**	**Benefits**	**Community**
Observer	Keeps distance, follows development	Does not get benefits	No investments, timing advantage	May follow discussions
User	Picks raisins from bun	Cannot guide development	Benefits others investments	May follow discussions
Adapter	Efficient usage	Cannot guide development	Ability to guide development toward own interests	Has a weak link
Integrator	Integrates with its own development	Possible imago lost	Taps others brain	Typically has stronger connection
Engine	Leads development	Investments	Gets own ecosystem	Has committed oneself to certain community
Promoter	Brand benefits with engine role	Large investments, imago	Own brand and ecosystem	Maintains and contributes selected communities

Observers keep distance and follow development. According to Seppänen (2006, p.7), the target level and timing are the most important issues to be considered; they try to find the right moment to advance their understanding.

The roles of the user, the adapter and the integrator emphasize usability and exploitation (Seppänen 2006, p.7). The involvement with communities increases; the integrator for example typically has a strong connection to communities, while the adapter only has a weak link to communities. Seppänen (2006, p.7) continues by saying that from the integrators' point of view, decisions which are made according to certain open source solutions are strategic. It is the first stage where imago lost is possible.

The engine and promoter typically manage and govern the communities (Seppänen 2006, p.8).This means large investments, as table 1 shows. Since the companies in this position invest quite substantially to the open source and to different communities, they are strongly linked to communities; they may even launch their own communities, as in figure 9.

Although figure 9 and table 1 present the characteristics of one company, they do not take into account how different companies are linked to networks. Figure 10 presents the "Open source software value chain" by Räsänen (2004), which takes into account the company's perspective as a member of a network. Companies form the basic economic actors in open source networks from business perspective and for that reason it is an important aspect to be taken into account (Helander & Rissanen 2005, p.846)

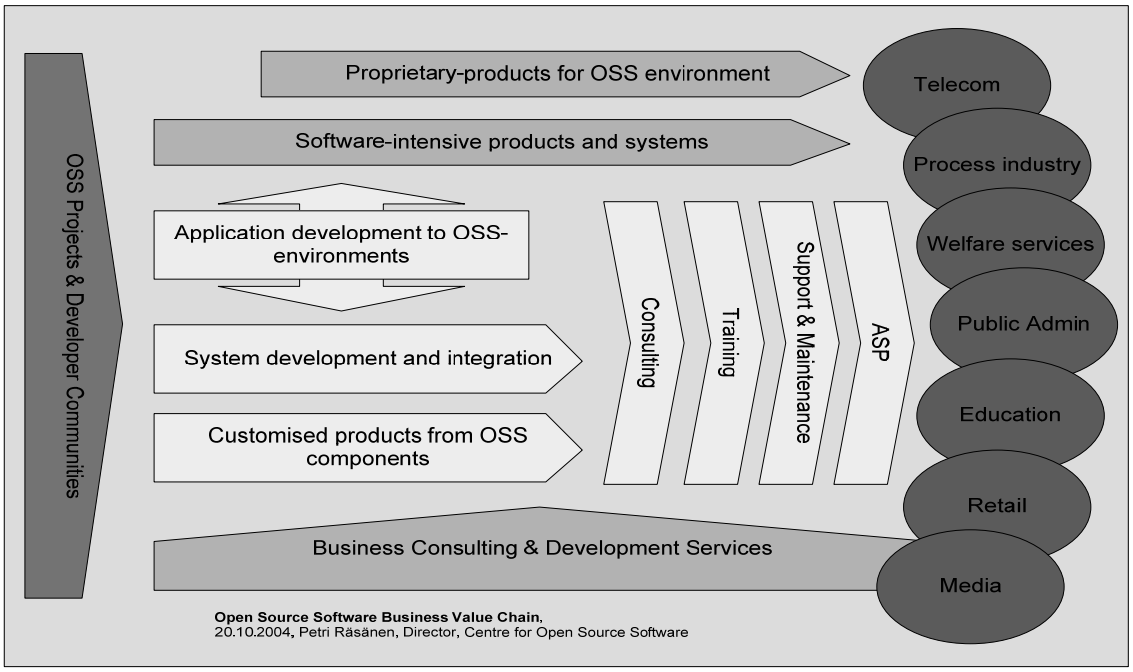

Figure 10. Open source value chain (Räsänen 2004).

In the figure there are different kinds of actors that participate in open source networks. On the right there are customers, which utilize open source solutions and products. On the other side there are open source communities and projects. Like Helander & Rissanen (2005, p.846) say, the utilizers, which represent for example different industrial segments and private and public organizations, are seldomly directly connected to communities. Intermediators between customers and communities are needed.

According to Helander & Rissanen (2005, p.846) there are intermediators like companies which operate in the open source field as developers, integrators, service providers or as pure consultants. Helander & Rissanen (2005, p.846) continue by identifying companies which operate in traditional software business, but are producing software products and systems that are used in the open source environment.

Figure 10 is not as complex as it might appear to be. The main purpose of the figure is to present the variety of different kinds of actors which open source networks consist of. The figure also takes into account how value is formed in open source networks and so

it is a crucial step towards understanding the concept of open source value networks. This concept is discussed in more detail in chapter 2.5.

Goldman & Gabriel (2005, p.36) have developed a model of community structure from a business perspective. The model does not take into account how value is created but it presents, for example, how you include various interested groups into your project. The model also emphasizes the importance of the relationship between company's business model and communities. In Goldman & Gabriel's (2005, p.35) words: "company's business model must include a community focus".

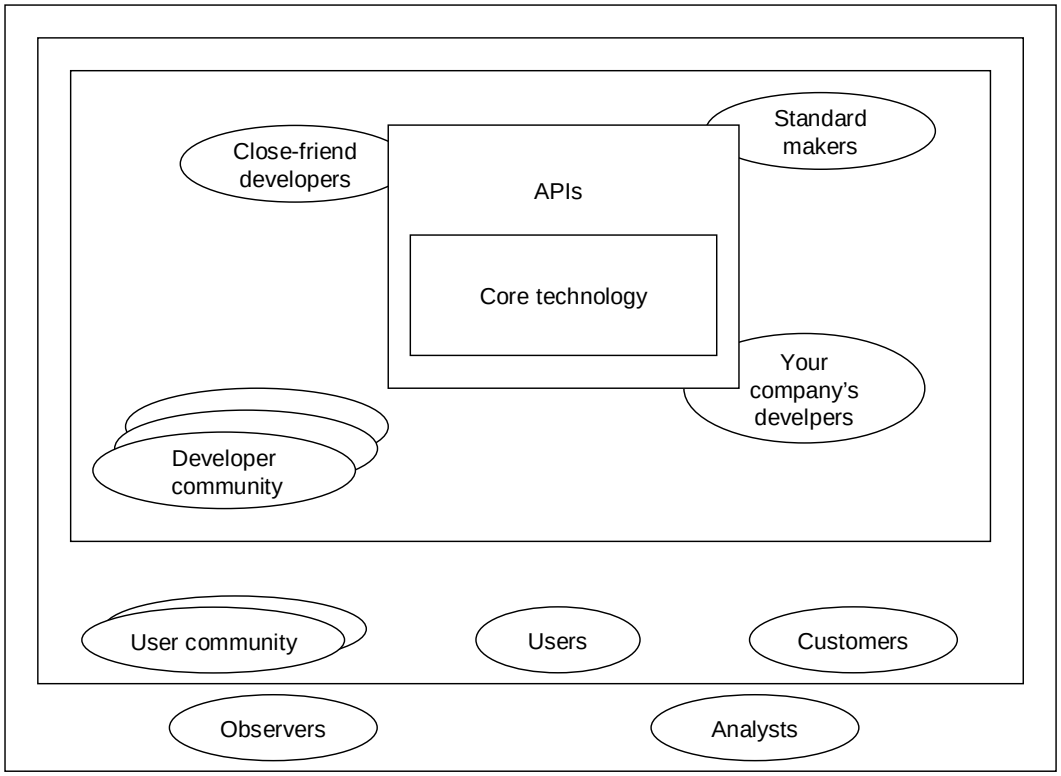

Figure 11. Community structure from a business perspective (Goldman & Gabriel 2005, p. 61)

In figure 11 there are several actors identified: standard makers, close-friend developers, company's own developers, developer community, user community, users, customers, observers and analysts. As in the onion model, also in this one the source code is in the centre. Some developers are closer to it than others which is quite normal. How close their developers are depends on the company's investments. For example promoters might have hired developers to work as close to the code as possible, while adapters might have employees in user groups and in user communities.

The model is dependent on the business model of the company, and in figure 11 identified actors are just possible constituencies. Still, as Helander & Laine (2006, p. 53) say, "it offers a useful way to group both the individual and organizational level actors in order to achieve more meaningful management of the whole network".

2.5 Open source software business as value networks

The purpose of this chapter is to summarize the theories presented before. Previously, the concepts of value networks and open source software were introduced. Value networks were introduced through some relevant models like ARA, which is actually a basic network model, and the Value-Creating Networks. Value network theories relating to this thesis were summarized in chapter 2.3.2.

The open source theories were presented from the network's point of view. For example, technological and sociological aspects were discussed quite shortly, while the main emphasis was on understanding some of the common features of open source. Even if not mentioned quite exactly earlier in the text, a conscious reader quite easily finds links between open source and traditional software engineering. In the next paragraphs when linking value networks to open source, it is done by comparing traditional software engineering with open source.

When discussing open source software it is often related to traditional software engineering. For example, most of the open source references used in this thesis started to explain the idea behind open source by referring to the differences between open source and traditional software engineering. This is of course quite a relevant and understandable way to do it.

Helander (2004) discusses in her doctoral thesis value networks from the software component business's perspective. Helander (2004, p.124) actually presents quite a functional and understandable model of value-creating networks. She has used a previously presented model of value-creating networks (Kothandaraman & Wilson 2001) as a basis for her model. The core building blocks in Helander's model are perceived end customer value, core competencies and relationships. These same blocks are discussed in this study as well.

Around those blocks Helander (2004, p.124) made four different stages which must be considered if one wants to understand how value is created in business networks. These stages or questions are:

1) Who is the customer?
2) What activities are needed to create the value?
3) What resources are needed to carry out the activities?
4) Who (=actors) are able to utilise these resources?

The subjects of these questions were discussed in chapter 2.3. These questions are important to understand when talking about value networks in general, but when discussing open source value networks those questions are not very relevant. For example, question 1 is quite difficult in open source. Helander and Laine (2006) and

Dahlander and Magnusson (2005) deal with this subject in their works. When working with communities the purpose of developing some software just for the customers is not so obvious. Customer segmentation is not considered in open source communities. Open source developers that work in communities seldom think about specific customers in their projects. It is typical of other kind of value networks. (Helander & Laine, p.54)

Actually Babcock (2007) points out a relevant question that open source developers could ask: is the result of this open source project a solution for the problem my colleagues and I am dealing with? This is something companies should consider when working in open source value networks. Developers must also be treated as end users, because, as Goldman & Gabriel (2005, p.55) put it, communities are usually built around common interests.

As concluded in chapter 2.4., there are many different kinds of actors and roles in open source networks. Together these actors (developers) form a large network that consists of lots of different skills. Helander and Laine (2006, p.54) add an interesting point to the discussion about open source developers. They say that the discussion about open source competencies has to be taken down to the level of individual actors, because the competencies of an individual actor play such a remarkable role in open source. Typically, in industrial networks value creation is observed from the viewpoint of the organizations, as in figure 6.

Dahlander and Magnusson (2005, p.481) say that the striking feature of open source is that the knowledge needed to generate a software is not controlled by companies. It resides within communities that co-exist with companies. Companies could, though, control the competencies in open source communities by hiring employees to work inside them. Also companies can launch their own communities, as, for example, Seppänen (2006) pointed above.

Different kinds of ownerships, questions about resources and relationships, and the roles of customers are hard to figure out in open source networks, and especially when discussing open source value networks. Figure 6 in chapter 2.3.2 offers one point of view to observe the value creation in networks, but in the case of open source that general model does not work. Activities, resources and core capabilities are hard to separate from each other, for example, because of the amount of different players the open source environment consists of. In figure 6 the role of customers was also quite clear, but in the open source environment it is hard to say whether the customers benefit from the value or not. Also, because of the amount of players, the value capturing is quite confusing.

The statements concerning figure 6 and the theories presented previously in chapter 2 were the basis of figure 12 “creating and capturing value in open source network”. The

figure takes into account how value is created between different actors in open source network. It also points out who benefits from the value made in the network. The inspiration for the figure was taken from Helender & Laine's (2006) thoughts. The concept of open source value network is based on figure 12.

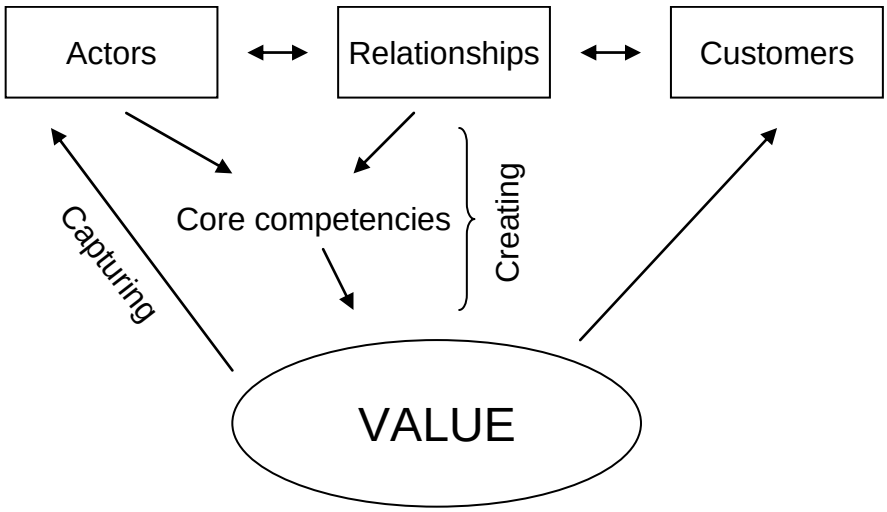

Figure 12. Creating and capturing value in open source network

In the figure there are same points as have been under discussion during this whole thesis. Still, the meanings of those terms vary a bit. Actors mean developers, which re mostly developers in open source communities. Relationships mean the web of companies, which participate in creating value. These relationships are the intermediators between communities and customers. Actually, the same analogy could be seen in the open source value chain made by Räsänen (2004).

Relationships are needed to connect the needs of the customers and, on the other hand, the needs of the developers. As stated before, they are both end users, and therefore they may both have different expectations of the network and the value it creates. Helander and Laine (2006, p.54) define value as a trade-off between the benefits and the sacrifices the players make in the network. They (ibid.) say that value needs to be created as well as captured by the whole network, not just by the customers.

In the figure the value is created by actors and the companies they have relationships with. Core competencies in the figure represent the resources (skills, knowledge etc.) those players integrate to produce the best value as possible.

Together the developers, companies and customers form the open source value network, in which everyone's core competencies are used for value creation. The purpose of the open source value network is to create the value which meet the requirements they asset together.

In the next chapter two different kinds of communities and five different companies are used as examples of analysing open source value networks. The goal of that analysis is to clarify how companies can operate in open source value networks. In chapter 3.4.1 the value networks of the case communities are based on the model presented in figure 12.

3 EMPIRICAL ANALYSIS OF THE OPEN SOURCE VALUE NETWORKS

3.1 Data gathering and analysis

In this study the themes of the interview are built to support the research questions (see Appendix 1: Interview themes and questions). The themes are also based strongly on the theory presented in chapter 2, and the studies conducted earlier during OSSI project.

The themes are built to support both community and company questions. From the point of view of the companies, the themes could roughly be divided into background and history; company's open source strategy and role; cooperation, relationships and knowledge sharing; and business model. The community themes are: background and history, role and relationships, cooperation and knowledge sharing, and benefits and value.

The interviewees are the key persons from the open source communities and from five selected companies. The companies are F-Secure, IBM, Nokia, Novell and Plenware. The communities were selected in cooperation with other OSSI researchers because the researchers had their own interests concerning different communities. To avoid overlaps, the interviews were done in cooperation with other OSSI researchers. The companies were selected based on their different relation to open source.

The specific communities were already included in the OSSI-project. Interviews with the key persons of the communities were executed mainly through e-mails. Laika was an exception with the interview done face-to-face with the interviewee. The interviews took place between March and May in 2007. There was mainly one person from each community except from MySQL there were two persons, and this was due to their own voluntariness. The interviews with the key persons of the communities were like conversations and this helped the interviewer to make sure that the interviewees understood the questions and answered the way the interviewer wanted. The purpose of some questions was to ensure or check the researcher's pre-existing assumptions about the subject, but to some questions there were no previously collected answers.

Interviews with these accurately selected companies took place between March 30th and April 11th. The interviewees are connected to the OSSI project so they were familiar with the subject. The company interviews were all face-to-face situations. These interviews were taped and lettered afterwards. The themes of the questions were the same in each interview, but the order of the questions was sometimes changed.

In this chapter the purpose is to analyse the value networks of two of the selected case communities, Debian and Eclipse, though there were three more communities that were

studied during the OSSI (MySQL[3], Gnome[4] and Laika[5]). Debian and Eclipse communities were chosen for this analysis based on the results of the community typology analysis (see figure 13), in which the Eclipse and Debian communities are identified as different ends of the continuum of voluntary vs. professional open source software development. MySQL works as a traditional company; it gets, for example, incomes from selling commercial license (Seulamo 2007), and therefore is not as suitable for this study as the selected communities. Gnome represents almost the same type of community as Debian, and the activity of Laika is decreased remarkably. Actually, the operation of Laika is almost finished. The purpose is to analyse value networks of two different types of open source communities.

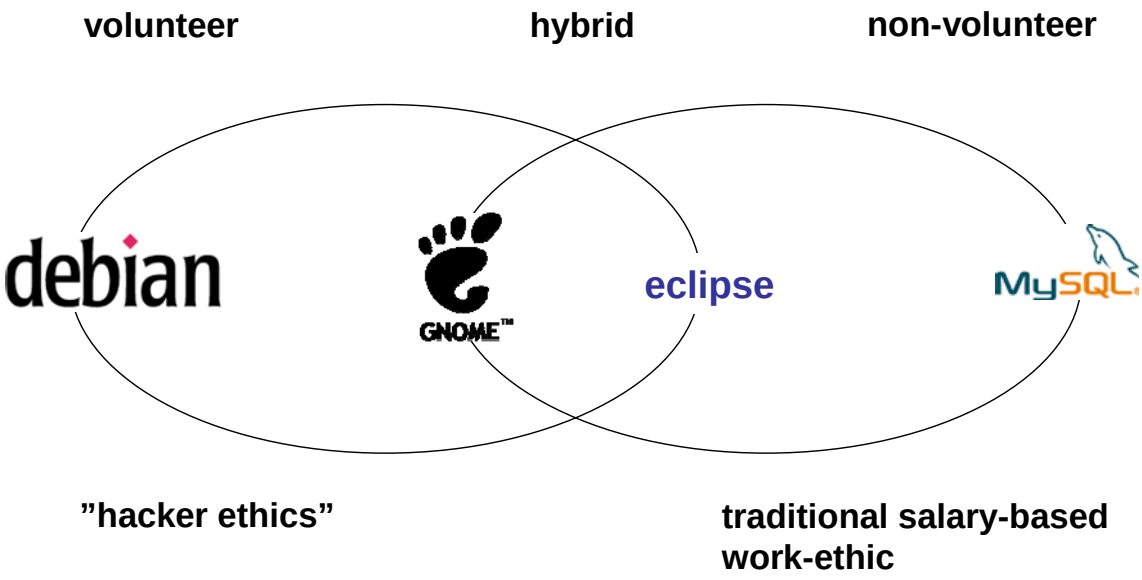

Figure 13. Community typology (modified from OSSI Research Group 2007, p.14)

In this chapter, the networks of these two case communities are first analysed separately. The chapter continues with a short introduction of the five interviewed companies. The analysis of the companies is based on the theory presented earlier, in figure 9 and table 1. After the separate community case analyses and the company analysis, the chapter continues with a comparative analysis of the two community cases. In this chapter the open source value networks of these two case communities are formed. In the end of the chapter, conclusions and guidelines are presented as to how companies can operate successfully in the open source value networks.

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[3] MySQL is one of the most popular open source SQL database management systems, and it is supported, developed and disturbed by MyQSL Ab. It has over 300 employees in over 25 countries and is one of the largest open source companies worldwide. More information: http://dev.mysql.com/doc/refman/5.0/en/what-is-mysql.html (MySQL 2007)

[4] The Gnome project is an effort to build a free software desktop environment and desktop applications for Linux, for example. More information: http://www.gnome.org/about/ (Gnome 2006)

[5] Laika is a Eclipse plugin organized by Technology university of Tampere. More information: http://www.cs.tut.fi/~laika/ (Laika 2006)

Practices and processes used in the networks are discussed only in broad outline. For example, Ilkka Luoma (2007) discusses practices and processes more thoroughly in his Master Thesis.

The value network analysis presented in this chapter is based on a research data that comprises a series of qualitative interviews, a quantitative survey and secondary data such as material gathered via internet. Especially when introducing the communities of Eclipse and Gnome (e.g. the present structures of organisations) the secondary data plays a major role, which is almost fundamental (see Appendix 2). The survey utilized in this value network analysis was carried out earlier in the OSSI project by Mikkonen, Vainio and Vadén (2006a).

The survey was done on free/open source software (FOSS) communities; the terminology was explained in key definitions and in chapter 2.4.1. Vainio and Vadén (2006) say the terms overlap, but Debian is more like free software community and Eclipse is more like open source community. The questions asked during the survey were similar to both communities, and therefore, the communities could be compared to each other quite easily based on the questions although they have a slightly different basic ideology.

As the key definitions in chapter 1.5 explain, the major difference between the open source and the free software is that open source is more business-oriented that free software. In the following chapters to refer to the survey the term open source is used instead of the term FOSS.

3.2 The analyses of the case communities

3.2.1 Eclipse network analysis

Eclipse is an open source community whose projects are focused on building an open development platform. In other words, it is a platform of independent software framework for delivering so called rich-client applications.[6] It was originally created by IBM in November 2001 and supported by a consortium of software vendors. Eclipse platform became open source when IBM released it in 2004. Also in the beginning of 2004 Eclipse Foundation was created. (The Eclipse Foundation 2007)

Eclipse is composed of many different software projects; it could be called as an umbrella project. It is described as "*an open source community whose projects are focused on providing a vendor-neutral open development platform and application frameworks for building software*". Eclipse hosts nine major open source projects that

[6] According to Luoma (2007, p.33) rich-client applications (RCP) are ”applications that resemble fat clients (applications that store data and perform data processing locally), but are also easily portable, a feature often missing from fat clients”.

include a total of over 50 subprojects and it is estimated to have about 500 developers. Eclipse hosts the projects with the support of over 115 member companies. (based on The Eclipse Foundation 2007)

Eclipse's organization structure is quite hierarchical (see e.g. Eclipse.org), at least from the view point of an outsider. Eclipse is a group of projects and top level projects. Top level projects are managed by the Project Management Committee, which include for example different kinds of councils. Inside one project there are project leads, development teams, subsystems and project plans. Eclipse Foundation is in the top of this whole organisation. (based on The Eclipse Foundation 2007)

The next figure presents the structure of the Eclipse community and the main players inside the community from industrial perspective. This refers to the companies that already belong to the community, in other words, the companies that have already earned the membership of Eclipse. The figure clarifies the relationships of the main players who have the power to make decisions in Eclipse. The figure does not take into account the structure and organisation of Eclipse Projects, which are too specific topics for this thesis. These topics are introduced in more detail in www.eclipse.org and in Luoma's (2007) thesis.

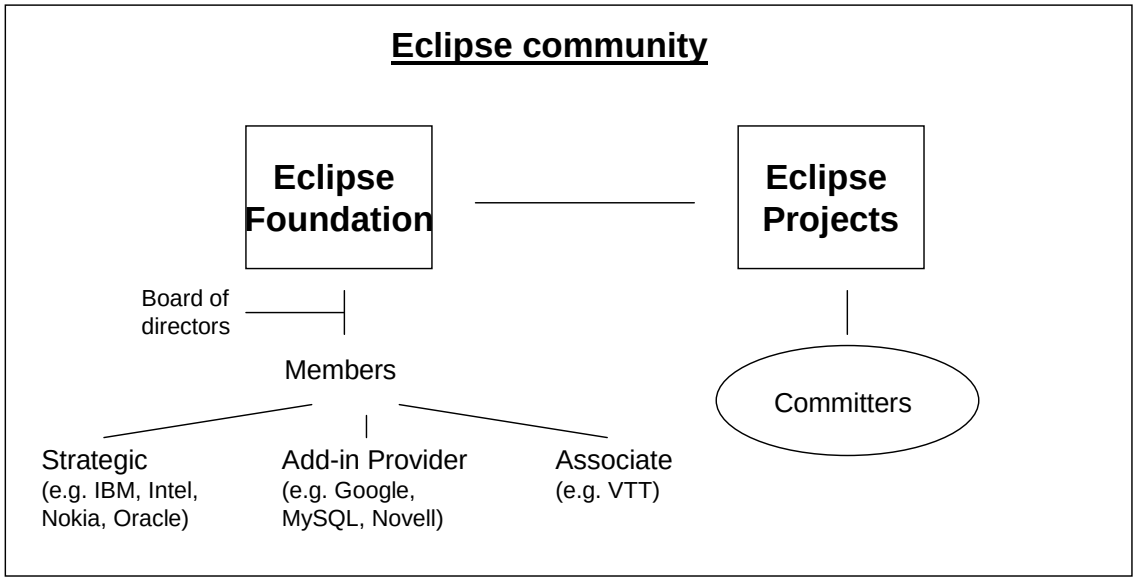

Figure 14. The structure of Eclipse community

The Eclipse Foundation is a not-for-profit member supported corporation that, for example, hosts the eclipse projects. The foundation acts as a steward of the Eclipse community. It is supported by organisational members and governed by the board of directors. The members could be strategic, add-in providers or associates. Strategic members are willing to invest the developers and financial resources in the development; in this sense, developer resources could be either developers or consumers. Add-in providers want to participate in the development of the Eclipse ecosystem, which means they see Eclipse as an important part of their corporate and

product strategy. Associates, on the other hand, are, for example, universities and research institutes that also participate in the development of the Eclipse ecosystem. In the board of directors the strategic developers and the strategic consumers hold seats, as do representatives elected by the add-in providers and the open source committers. (The Eclipse Foundation 2007)

The foundation does not employ the open source developers, which are called as committers, but instead the foundation employs a full-time professional staff to provide services to the community. Committers work on the projects of Eclipse; they are trusted individuals who have write access to the source repository. They are typically employed by organisations or are independent volunteer developers. (based on The Eclipse Foundation 2006 and Luoma 2007, p.37)

The committers are mostly from different organisations (a.k.a. companies). The survey (Mikkonen et al. 2006a) conducted in 2006 shows that 60,0 per cent of the developers (or committers in this case) get most of their salary from Eclipse and Eclipse is their main job. 58,7 per cent of the respondents identify themselves professionally as software engineers, and all of the respondents are highly educated which means they have university education. Most of the respondents get their income from software development (70,5 per cent).

Table 1 shows the difference of the roles in communities. These roles have been selected based on the model of General Structure of an OSS community, which is presented in chapter 2.4.4. In Eclipse the developers consider themselves closer to the center: 90,9 per cent of the respondents see themselves as a project leader, core member or active developer. This means that the developers do not just develop the code; they also take part in the decision making. It could be said that they have a larger radius of influence. But because there are so many projects running in Eclipse, the proliferation of leader roles is expected, like Mikkonen et al. (2006c, p.26) point out.

Table 1 also takes into account other communities[7], which were studied in the OSSI project, except Laika which was also neglected by other researchers. The results of Debian are analysed in the next chapter. It is important to note that the respondents had only one option to choose.

[7] More about the results in Gnome and MySQL's cases could be found from Mikkonen, Vadén and Vainio (2006b).

Table 2. Roles in the community (Mikkonen et al. 2006c, p.26)

		Community			
		Debian	Eclipse	Gnome	MySQL
Roles in community	project leader	2	9	5	1
		2.4%	20.5%	10.2%	7.1%
	core member	2	17	12	4
		2.4%	38.6%	24.5%	28.6%
	active developer	37	14	12	3
		44.6%	31.8%	24.5%	21.4%
	peripheral developer	28	3	10	2
		33.7%	6.8%	20.4%	14.3%
	bug fixer	8	0	2	1
		9.6%	0%	4.1%	7.1%
	bug reporter	4	1	5	2
		4.8%	2.3%	10.2%	14.3%
	reader	2	0	1	1
		2.4%	0%	2.0%	7.1%
	passive user	0	0	2	0
		0%	0%	4.1%	0%
Total		83	44	49	14
		100.0%	100.0%	100.0%	100.0%

As stated before, the developers consider their roles in Eclipse as those who are close to the core (over 90 per cent of the respondents: project leaders, core members and active developers). Still, when participating in proprietary software development the answers varied a lot (Mikkonen et al. 2006a). Over 60 per cent have had the previously mentioned roles, but every role had support, for example, bug fixer got almost 14 per cent of the answers. But concerning these questions it is remarkable that developers could choose more than one option. The results of these two questions cannot be

directly compared to each other, although there are a remarkable number of answers that are close to the core.

This could be explained by analysing Eclipse developers' attitude towards the companies participating in the open source communities (Mikkonen et al. 2006a). Almost every respondent think that it is good that companies give support to open source projects. The same number of respondents (~95 per cent) thinks that companies' support is harmful, and almost 90 per cent disagree with the claim that companies should not hire employees from open source communities.

Money divides opinions, when the respondents were asked for the reason why they participate in open source projects. Less than 50 per cent say that they participate in open source projects because of money, and almost 30 per cent of answers are neutral. Some of the most interesting conclusions of the survey are the facts that Eclipse developers participate in open source projects because they want to make programs better, they want to learn new skills and they want to share their knowledge and skills.

The survey proves that the developers have face-to-face contact with other Eclipse developers almost every day. There are no studies on how often other communication methods (such as mailing lists, phone, and conversation forums) are used, but in this era those methods could be assumed to be used more often than "traditional" face-to-face conversations. The number of contacts depends on the subgroup (or –task) the developer is working on. The sizes of these groups vary from a couple of persons to hundreds.

Kidane and Gloor (2005) have studied the Eclipse community by analysing open source teams' creativity and productiveness. They studied the 33 Eclipse communities that the whole Eclipse includes, by analyzing mailing lists. Kidane and Gloor (2005) define creativity in this sense of "the amount of feature enhancement carried out by eclipse component development groups". The main conclusion was that the groups that are centralized are found to be less creative when compared to the decentralized ones. The groups that have higher communication density seem to be better performers than those with low density.

Figure 15 takes into account the communication in Eclipse from a larger point of view than for example Kidane and Gloor do. The main purpose of the figure is to clarify how companies are connected and could be connected to Eclipse. While figure 14 took a stand on what is inside Eclipse, this figure pays also attention to companies that are not so strongly linked to Eclipse, in other words are not members of Eclipse. The directions of interaction could also be seen in the figure, although it is not the main point. Of course, the cooperation (or communication) works in two ways, but only the main directions are described in the figure.

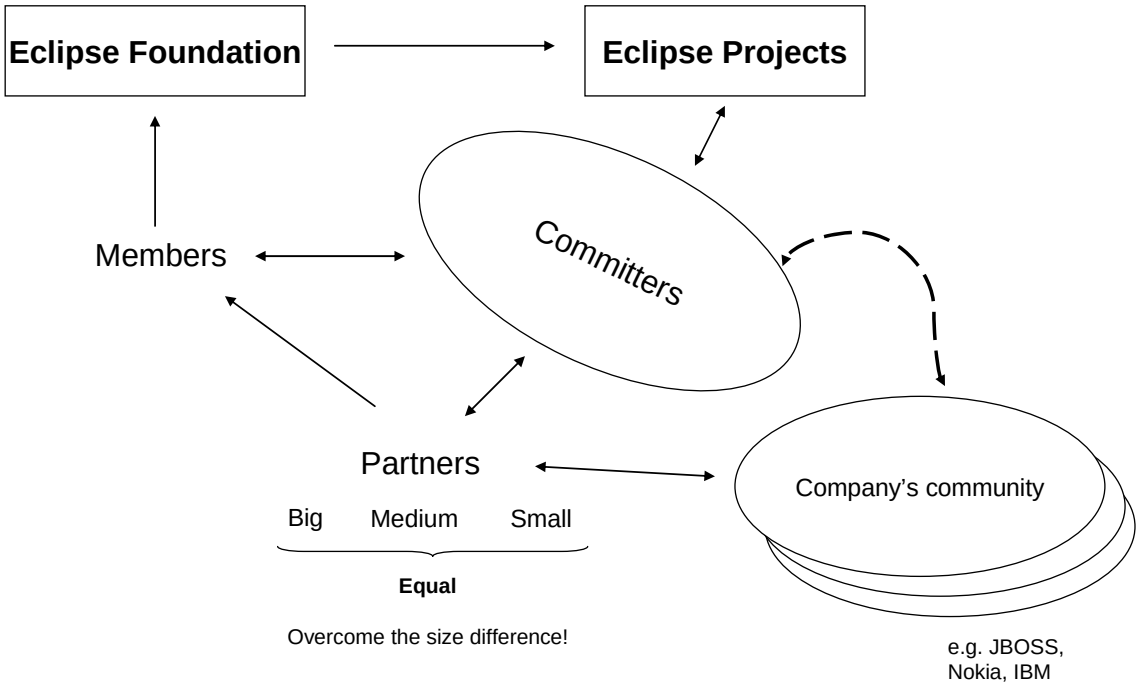

Figure 15. The Partner network of Eclipse

The researcher's analysis, based mostly on www.eclipse.org and Cunningham's (2006) interview, reveals that there are two main ways for companies to benefit from cooperation with Eclipse. The ways mentioned above are to become a member of Eclipse Foundation or to support Eclipse projects (e.g. employing committers to community). And of course, these two ways are not necessarily separate from each other.

Support or cooperation is not so much dependent on the size of your community. Eclipse creates a project environment where a small company could be equal with IBM itself (Cunnigham 2006). Cunningham continues that Eclipse evens out the size difference between the partners, and that is where all foundations that care about commercial software should aim at. This is a relevant claim if compared to what has been stated previously about the communities. In the open source value network value is not only created to potential customers, but also the developers of the communities are the end users. Overcoming the size difference is something that fits to the ideology of a traditional open source developer.

Another way to cooperate with Eclipse is through the company's own community. For successful companies such IBM, Nokia and JBOSS, which Cunningham particular mentioned, it is common that they have their own communities. For example Nokia works closely within communities to develop software; their engineers take part in the community work. Chapter 5.3 will discuss further how Nokia and other companies are related to Eclipse. So far it is important to note, that through the communities of companies the companies could offer more completed products to committers for further development. The committers could also be used as testers etc.

3.2.2 Debian network analysis

Debian is a free operating system which uses the Linux kernel[8], but most of the operating system tools come from the GNU project[9]. This operating system is called Debian GNU/Linux, but in this study it is shorten simply as Debian. Debian project, on the other hand, is a group of individuals who create this free operating system. In this context the word free refers to freedom, not to free of charge. (SPI 2007a)

The project started in August 1993 on voluntary basis and still remains so, making it the oldest of the four in the OSSI project. The Debian community does not produce software in the narrow sense of the word; instead it focuses on packaging existing free/open source software to integrate it in the Debian operating system. At the moment, Debian consists of 19 000 packages, which are maintained by approximately 2000 maintainers. The distribution is popular as a server operating system but it is being used also in workstations and embedded devices. (based on SPI 2007a)

Debian has surprisingly clear organizational structure although it is a community based on voluntarity. As a matter of fact, the structure seems to be like in any other industry. Debian has some responsible roles, which are worth mentioning in this study. These are the Debian Project Leader, which is the official representative of the Debian; The Technical Committee, which is the body that makes the final decision on technical disputes in the Debian project; the Project Secretary; and developers. There are also people who are named to take care of work tasks like distribution, publicity, support and infrastructure, and custom distributors. (based on SPI 2007a)

While Debian is the oldest community under investigation, it is also the largest community, if measured in developers. It had almost 1000 voting members in 2005, but there could be more: Debian mailing list had over 2000 members when the survey took place, so it could be said that there are 2000 maintainers. (based on SPI 2007a)

The survey shows that approximately 50 per cent of the respondents consider Debian as a hobby, but still almost the same number of developers (51,2 per cent) have a full-time job. 25,6 per cent are full-time students. But professionally they identify themselves more versatile than for example Eclipse's developers: almost 24 per cent are software engineers, 12,9 per cent are consultants and the rest are divided into students, programmers etc. The developers are not as highly educated as in Eclipse. Approximately 70 per cent have a university education, but in addition, about 20% of the respondents are highly graduates.

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[8] The Linux kernel is a Unix-like operating system kernel (the central component of Linux operating system). Linus Torvalds is the creator of the Linux kernel. (Linux Kernel Organization)

[9] The GNU Project is a free software project, which develops the Unix-like operating system, but is free as distinct from Unix it is free. (Free Software Foundation 2007c)

The roles of Debian developers, according the survey, are not so close in the center as the roles in Eclipse, as can be seen in table 2. Most developers (nearly 80 per cent) think they are active or peripheral developers. The active developers regularly contribute new features and fix bugs, while peripherals contribute only occasionally. This fact strengthens the view that participating in Debian is more of a hobby than a profession for the developers. But because the sample in the survey was quite small, one cannot make completely reliable conclusions. In the case of Debian the returning rate was 4,2 per cent , while the Debian's list had 2024 subscribers and 83 respondents. This could be explained by the number of active developers which could be smaller than the number of subscribers, as Mikkonen et al. (2006b) explain.

Like in the case of Eclipse, also the roles of Debian developers differ in the community and in proprietary software development. Almost 35 per cent have been project leaders and core members in a proprietary software development, while only less than 5 per cent have these roles in the community. This could be explained by the fact that companies appreciate the Debian developers more than they imagine. The developer's knowledge has been found useful in the managerial duties of proprietary software development. Also one fact is that Debian is just a hobby for developers while they get their salary from somewhere else.

The attitude of the Debian developers toward companies' participation in the projects of the communities is comparable to the attitude of the Eclipse developers. It is good that private companies give support to open source projects (94,1 per cent). Over 90 per cent of the respondents disagree with the claim that the support is harmful, and they are not against the fact that companies hire employees from open source communities (almost 90 per cent). But it should be recognized that in the case of Debian the support from companies is more like donations if compared to Eclipse. Still, Debian has partner programs, which include the roles of development or service partner.

Though Debian has this partner program, and it has many huge companies as partners (e.g. HP, Sun, Simtec Electronics), Wirzenius (2007) names the upstream developers and the users as the main cooperative partners of Debian. The upstream developers are the main developers, who are expected to fix bugs and maintain as well as develop their software. Still according to Wirzenius (2007), Debian expects to receive reports from the users concerning problems. Figure 16 presents the Debian community and the main players around it. The boxes in figure 16 around Debian reflect the level of the cooperation in Debian. In other words, the closer the box is to the center, the deeper the level of cooperation is. Classification is mostly based on Wirzenius' interview and the secondary data collected from the internet.

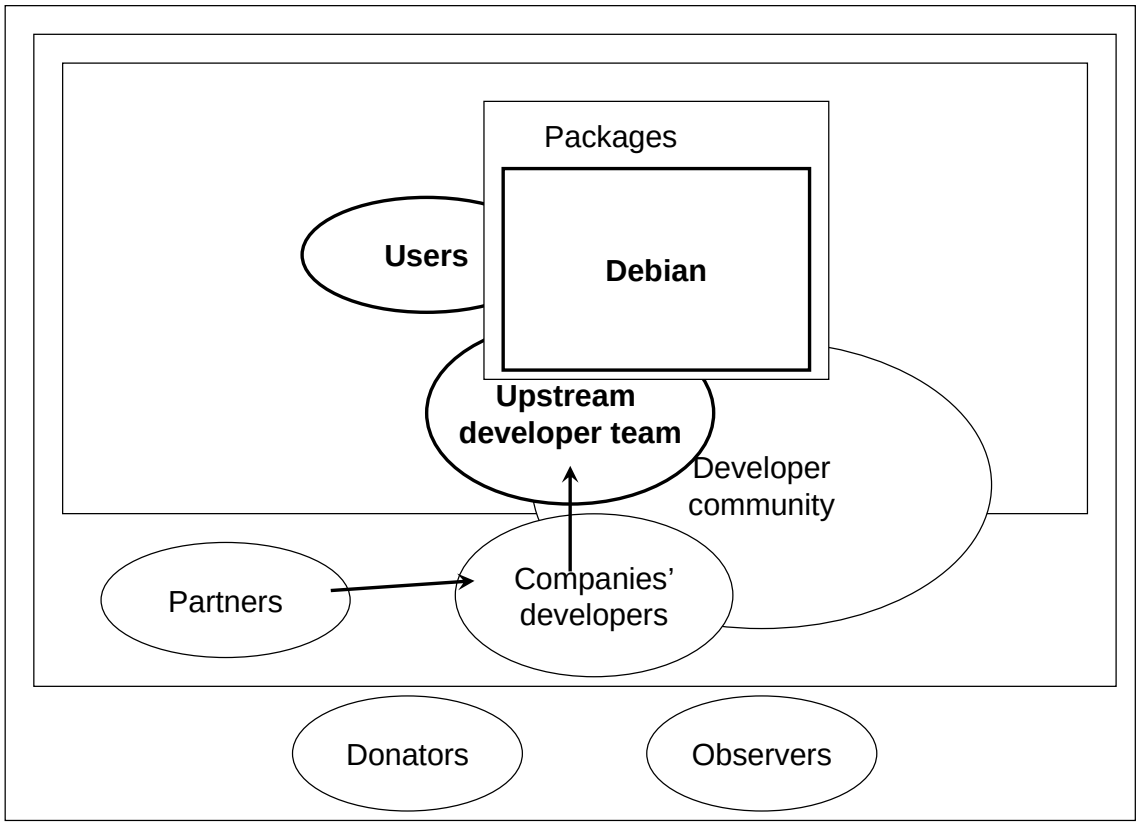

Figure 16. The levels of cooperation in Debian

In this figure, Debian presents the core technology of Debian. It comes with the packages, which are precompiled softwares - sometimes also referred to as technological architecture – which the social organisation of Debian is built on. Each package has a maintainer or sometimes few maintainers that has the primary responsibility for it. The common packaging rules, guidelines and principles have been compiled into guides such the Debian Policy Manual. But not only technical decisions are being regulated like this. The most important values of Debian have been codified into the Debian Social Contract. This document, together with its appendix Debian Free Software Guidelines, defined the value basis and goals of the project. The Social Contract emphasises freedom of the software and promises to keep Debian fully free, transparent and to give back to the free software community. Software packages in Debian have different licences, but all of them need to meet the requirements of Debian Free Software Guidelines to be included in the distribution. (based on SPI 2007b)

The main cooperation partners of Debian are users and upstream developer teams. The responsible roles mentioned above (e.g. the Debian Project Leader, The Technical Committee) are included in the developer community and in the upstream developer teams. The purpose of the figure is not to separate the developer community, upstream developer teams and the developers of companies from each other. The intention is to clarify the players that exist in the developer community, and one part of it (upstream developer teams) is the “cell” which is a more important cooperation partner to Debian than others.

According to SPI (2007a), Debian works close to its partners for ensuring that it understands the needs and concerns of the partners, and vice versa. Debian expects, for example, promoting and advertising from the partnership. And as a compensation for partnership, Debian recognizes partners officially and maintains a good working relationship with them. Donators are not so close to Debian in figure 16, though their input is also remarkable. But as Debian (SPI 2007a) defines “donations to the Debian project do not qualify an organization for partner status, donations will be recognized separately”.

The arrows in the figure reflect the way companies can affect the cooperation with Debian. One way is through a developer community by employing some developers of companies to work with Debian. Upstream developer teams are in an important position in the decision-making, and their work for packages is remarkable, therefor it is important for the companies to get their employees in those kind of positions. Contacts with the upstream developer teams may be considered to be the most important contacts from the point of view of the partners (and the companies).

The survey proves that Debian developers have no face-to-face contacts with each other. Only 27 per cent of the respondents had face-to-face contacts more often than once a month. This fact is supported by the official websites of Debian; the communication is mainly done through e-mail and irc (SPI 2007a). The number of contacts depends on the subgroup (or –task) the developer is working on. The sizes of these groups vary from a couple of persons to hundreds, like in Eclipse. 50 per cent of the respondents have contacts because they work on the same subtask, and almost 24 per cent have contacts because they are friends.

While the previous figure presents the levels of cooperation, the next one (figure 17) also describes the directions of interaction, which the arrows symbolize. The players in the figure are almost the same as in figure 16; expect SPI (Software in the Public Interest). It is a non-profit organization formed to help other organizations create and distribute free/open-source software and open source hardware. Debian uses it for handling money donations. Observers, which were included in the previous figure, are not included here. Their contribution for Debian is not relevant for this thesis.

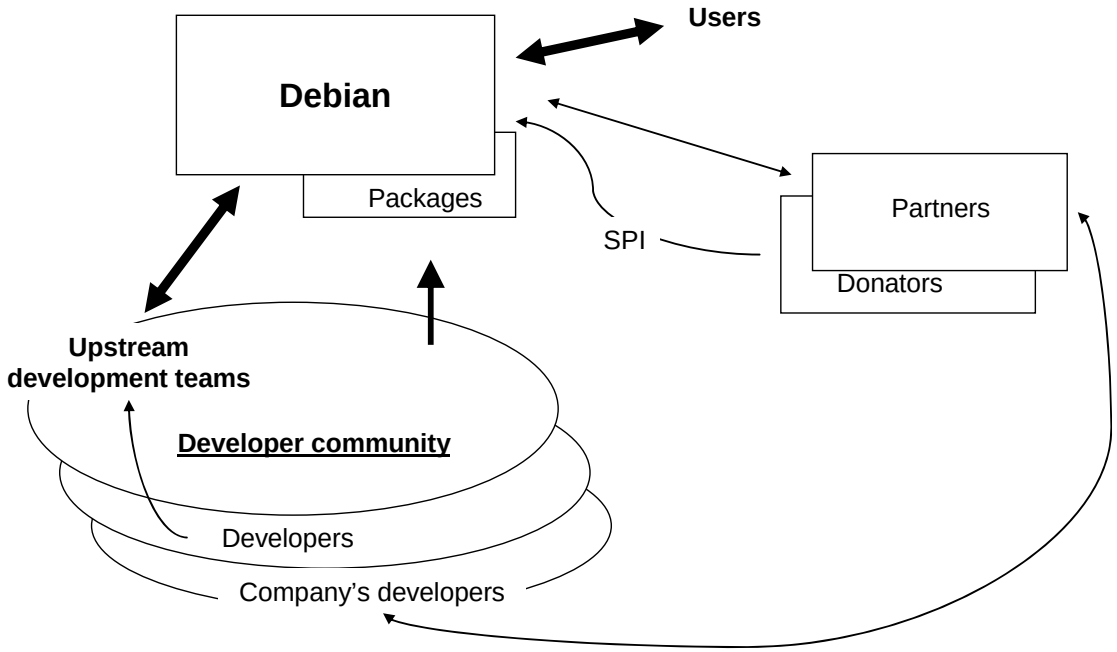

Figure 17. Direction of interaction between major players in Debian.

The same analogy that presented in figure 17 could be seen in Kothandaraman and Wilson's (2001) figure "Model of value-creating networks (see figure 5 on page 18). Analogy means the interaction between the core "players". Although the figure is for understanding the value creating process and its links to the core capabilities of the firms in the network, it could also be used in the case of Debian.

The main software development is done by upstream developer teams. These teams could be seen as the main competencies of Debian. The value it produces is created by these teams. The value strengthens the relationships between Debian and the developers. It also strengthens the relationships between Debian and other players. For example, users who, for example, report from bugs, define the relationship to Debian according to the kind of value or benefits they get from it.

The users are separated from the developers in this figure. These users mean users outside the community. The reason they are separated is because Wirzenius (2007) particularly mentioned those as important partners.

The same analogy could be seen between the partners and Debian. The support the partners give is compensated by the value they get. It is also very common that companies' own developers are a part of the Debian community. Consequently, the support the companies give is also compensated through community to Debian, as presented in figure 17. The support the companies give can be donations. SPI is the way the donators support Debian. In this case the cooperation could be considered to occur in only one direction rather than interactively as in partnering.

3.3 The analyses of the case companies

As stated before, the company analysis is based on the interviews made during the spring 2007. In addition to the interviews, the material was gathered form the internet and from other secondary sources. The companies under analysis were F-Secure, IBM, Nokia Networks, Novell and Plenware. In this chapter these companies are shortly introduced in alphabetical order and the main results are presented. The companies are analysed based on the roles and user types Seppänen (2006) and OSSI Research Group (2007) present (see figure 9 in page 31 and table 1 in page 32).

Chapter 3.3.6 presents some general thoughts concerning the table and model utilized in the company analysis.

3.3.1 F-Secure

F-Secure was founded in 1988. Its headquarters are in Helsinki, but it has regional offices around the world. F-Secure "protects consumers and businesses against computer viruses and other threats from the Internet and mobile networks". It has customers from different kinds of branches: banks, teleoperators, software firms etc.

Traditionally, F-Secure produces programs against computer viruses; their business is based on licensing, but they are moving more and more towards "software as service" – world, where software is sold more like services. The company is not very interested in utilising traditional open source. They are interested in how they can integrate their services to "community –thinking" and to open source environment as a whole. F-Secure does not make open source products, but it is a part of their business.

F-Secure is more of a follower when it comes to open source. This means, for example, participating in research projects. Everything F-Secure does is based on the company's strategy, and business comes first though the company does not have any specific written open source strategy.

Community –thinking is part of the strategy of F-Secure. They want to move away from the traditional antivirus producer's role towards services. But still, F-Secure participates in open source with small investments. They have 10 employees working with open source software. The activity of the employees towards open source communities is not known, although Linux-related employees could be seen more active than others. F-Secure actively uses products based on open source software, but the use is not centralized. In other words, it is not managed, and it is not part of their everyday work.

F-Secure utilizes open source software applications, and, at some level, open source software could be seen as a tool in research and development. F-Secure is interested in communities, but not enough to be considered as actively participating in the

management of the communities etc. Actually, F-Secure is interested in improving knowledge of solutions that are not created only for open source customers but also for the developers of open source communities. Therefore the company is interested in developing the communities.

Comparing F-Secure with the role aspect introduced on chapter 2.4.4, their type of involvement is on the level of observer or user. It is hard to place F-Secure to a certain role because of the information presented in this chapter. The observer follows open source development, but user uses the applications that it finds more valuable to its business. In the case of F-Secure, open source is not the main thing because they are interested in communities.

3.3.2 IBM

IBM is one of the largest information technology companies in the world. It was founded in 1911 and in Finland it has been operating since 1936. The company has over 350 000 employees. IBM's purpose is to create and develop innovative technologies for industrial needs. Their products and services are composed of computer systems, softwares, network systems and so on. From these products the consult- and service organization of IBM build data processing solutions for supporting customer business needs.

Because of the size of IBM, there are different approaches for IBM corporation and for the interviewee's Finnish business unit concerning open source strategy. The corporation sees open source as an opportunity for growth; utilizing open source expands the markets for information technology services. Open source releases resources (e.g. money) for purchasing services. A business unit's open source strategy could be considered from an economical and innovative viewpoint. It is a tool for cost efficiency, it offers competitive and price advantage. It is also a great way to teach and learn about open innovative operations.

The business unit does not invest in open source, it utilizes open source applications. The unit benefits from the work the communities do. But the corporation invests, for example, money to communities and in exchange they get some software development (information, technology etc) from communities. IBM also releases copyrights and patents to communities.

IBM works in every aspect that was presented in figure 9. The Finnish business unit works as an application utilizer or component integrator, which could be concluded from above. The user type for the business unit is also the integrator, while the corporation is the promoter. It is typical for promoters to invest in communities, in the case of IBM investing means money and patents. But in this case the business unit

benefits, while the corporation invests. At least this is the viewpoint of IBM and for example in the case of Nokia, the roles are the other way round.

IBM maintains its own internal open source network. It supports people in using open source, which could be used like tool as component. 10 per cent of Finnish employees (approximately some hundreds) belong to the users of the network. Dozens of these employees work actively with open source.

Eclipse is closely related to IBM (see chapter 3.1.1). Some of IBM's employees are the final users of Eclipse. Cooperation with Eclipse is self evident, because during the interview Eclipse was not mentioned in the group of most important partners. Actually the Finnish business unit does not have any managerial contacts to Eclipse. Instead, the main partners are universities and some research projects (like OSSI and COSS[10]). This reflects the view point of the observer, the business unit has different contacts than the corporation.

3.3.3 Nokia Multimedia

Nokia is one of the leading mobile phone manufacturers. Actually, Nokia calls itself as "the world leader of mobility, driving the transformation and the growth of the converging Internet and communication industries". Nokia Multimedia is part of Nokia. It is one of the three business groups of Nokia; others are Mobile Phones and Enterprise Solutions. One part of Nokia is also Nokia Siemens Networks, which started on April 1st 2007. In this analysis when referring to Nokia it means the whole corporation, Nokia Multimedia is mentioned separately.

According to Nokia's home pages Nokia Multimedia "gives people the ability to create, access, experience and share multimedia in the form of advanced mobile multimedia computers and applications with connectivity over multiple technology standards". For example it takes care of the open source software operations of Nokia.

Net sales in Multimedia were almost 8000 million euros in 2006, which was 32 per cent more than in 2005. This is 19 per cent of Nokia's total net sales. Nokia Multimedia had approximately 3400 employees (5 per cent of Nokia) in 2006. There are no statistics on how many people work with open source but according to the interviewee the number of employees who work for Nokia, but are part of some communities, is substantial.

Nokia is an important player in the field of open source software. Of course, if measured in the scale of Finnish industries Nokia is in its own class. In 2003 Nokia was not even in the left end of the framework (cf. figure 9). Nowadays in sociology and

[10] COSS (The Finnish Centre for Open Source Solutions) is a national development agency for open source business ecosystem. It promotes the development and adoption of managed and sustainable open source solutions in various industries. COSS works in a close relationship with OSSI. (COSS)

technology aspects they work in every level. Nokia does not launch communities but they work on all the other levels in the business aspect. This means that Nokia does not launch any open communities for outsiders.

Nokia does not have any specific open source strategy (or at least is not available to anyone outside the company). Still, open source software is used as much as possible because the main purpose is to produce value to customers, and Nokia understands the possibilities the open source can offer. Flexibility, speed and cost savings are the reasons for using open source.

Like in the case of IBM also Nokia is hard to handle as the whole corporation. Nokia is the user or adapter if considered from the points of view of the user types (cf. table 1). Nokia uses browsers which are based on open source software. The unit of the interviewee could be seen as the integrator, because it uses the Linux operating system, or the engine, because Gnome is an important partner, or the promoter, because it has developed the maemo.org[11].

The most important partners of the business unit of the interviewee are Linux (actually kernel.org) and Gnome. Some important industry partners are IBM and Novell, with which Nokia has plenty of interaction. Daily interaction is handled through wikis and mailing lists. And as all the other companies included in the study, also Nokia takes a part iin different kinds of conferences.

3.3.4 Novell Finland

Novell Finland is part of an American software corporation called Novell Inc. Novell designs, develops, maintains, implements, and supports proprietary and open source software for use in business solutions. Novell offers IT-infrastructure softwares for open data processing environments. They call themselves as a market leader supplier of Linux-soled, open source software -based enterprise operating systems. They supply these solutions directly or through their partners. Solutions work in both open and closed source software environments. In addition, there are approximately 5100 employees world wide.

Open source is both strategic and tactic for Novell. They have used open source components for years in some of Novell's own products; components from MySQL, JBoss etc. Actually, Novell develops open source software as a part of their business, which is unique in the business world according to the interviewee. The company has tried in every possible way to be a part in communities and to support the idea that open source is a central way of distributing and developing programs. In general, this can

[11] Maemo.org provides an open source development platform for Nokia Internet Tablets and other Linux-based devices. Maemo is open for outside developers. (Nokia 2007b)

also be considered from Novell's investments concerning open source: they have released their products, maintained the conversation of open source in many ways etc.

Novell Inc. has a wide partner network. They have 900 training partners and over 5000 partners overall. Novell is a so-called "anchor-brand", in other words Novell is well-know everywhere and they make themselves famous all over the world. For example, visibility concerning open source is something Novell expects also from the most important Finnish partners. The interviewee accentuated importance of image and brand, therefore, at least, for an outsider Novell wants to be as a promoter.

The most important partners in Finland are COSS, Finnish public sector and the opensource.fi –community. Novell also cooperate with universities and communities. To communities that are linked to the OSSI-project Novell is interacted worldwide but not in Finland. For example in Gnome, Novell's developers are actively involved; they are so called code contributors which are compared to core members or active developers in the classification of Nakakoji et al.(2002, p.80) (cf. figure 8).

There are no open source software user types that Novell does not fill (cf. figure 9. For example, Novell uses lots of different wikis and other social communication tools. For example, Novell uses wikis in documentation. In addition, Novell has its own internal developing community. Besides maintaining its own community, Novell works closely with communities, which is typical for a promoter. According to the interviewee, besides Red Hat and IBM, Novell has most open source developers in different kinds of community projects in the world.

3.3.5 Plenware

Plenware is an information technology company that provides software development services for top companies in the industrial, telecommunication, and media sectors. Plenware's business is based on subcontracting. It is a development partner for larger companies like Nokia and Sandvik. It started operating in January 1999. Its revenue was over 30 million euros in 2006.

Subcontracts are typically huge projects that involve dozens of people and last many years. Open source is included in some contracts and in some it is totally forbidden. Plenware has strict goals of how much of new business has to come from open source, but it is important to note that customer-specific expectations affect a lot. It could be said that everything Plenware does happens on the terms of the customer.

Plenware has about 430 employees, who are located mainly in Finland. Approximately 50 of them are connected to some communities. The main cooperation partner of

communities is Asterisk[12]. To other communities the cooperation is casual; through hobbies, for example. Actually, inside Plenware have been studied the role of open source among employees. It proves the voluntariness of employees towards open source.

Plenware has a clear strategy concerning open source; it is a new strategic object for them. They have used open source components randomly in certain projects, but during the last few years they have invested more in open source. Because of the previous statements, Plenware is a user or an adapter. The integrator's role is also one option (cf. Asterisk), and because of the voluntariness of employees towards open source.

Plenware utilizes open source software from technology and business perspectives. In this case those perspectives cannot be separated. According to figure 9 Plenware is a component integrator; employees use open source in their work and they also use open source tools in development, for example MySQL.

3.3.6 Conclusion of the company analyses

Every interviewed company sees open source as a possibility to do business. They have all invested in it, for instance, IBM, Nokia and Novell have invested quite a lot. It is typical for the companies to be interested in following the discussion around open source. All the companies included in the study take part in conferences related to open source and are part of some open source group, like COSS.

The companies saw the role of open source from different perspectives; they have different interests. Plenware does subcontracting, and their investments in open source go hand in hand with the customers. F-Secure emphasizes the importance of community-thinking that they are interested in, while IBM and Nokia have already launched their own communities. Novell, in the other hand, develops open source software as a part of their business, which is quite unique.

The interviewed companies contribute open source in every aspect presented in figure 9, which could be concluded from above, though the companies found it difficult to place themselves in the model. In the cases of IBM and Nokia the model was difficult because the companies were analyzed from the viewpoints of the whole corporation and the business unit the interviewee was a part of.

The sociology aspect was found difficult and even strange. For some companies it is related to the business aspect, and for example one company considered it to be a knowledge related aspect. Also other aspects were found confusing. Technology and

[12] Asterisk is an open source software implementation of a telephone private branch exchange. It runs on a wide variety of operating systems including Linux and Mac. It also supports Voice over IP in many protocols, which is the one reason why Plenware is interested in it. (based on Digium 2007)

business are hard to separate from each other. The roles were difficult to compare, and the roles do not take into account the interest of companies towards communities, which on the other hand table 1 does.

Although figure 9 was a bit confusing for the companies, table 1 was really easy to understand. The interviewees found it quite easy to place themselves into it. The only deject of table 1 is that it does not take into account IPR (immaterial property rights) sacrifices.

For the researcher, together these models offer a great way of analysing the companies. Figure 9 offers some relevant aspects (like business and technology) that lay the basis for analysing the roles presented in table 1. The analysis of the roles of the companies corresponds to the positioning of the interviewees at almost every level. Only in one case the interviewee underestimated his company's role.

The following figure illustrates the OSSI framework where the case companies are added. The position of the companies is based on the interviews and the analyses made previously. For example, F-Secure does not contribute open source in a way it is analyzed from the point of view of sociology. Actually, it was difficult to place Plenware on the sociological axel. Nokia was positioned as a whole corporation, not from the point of view of Nokia Multimedia.

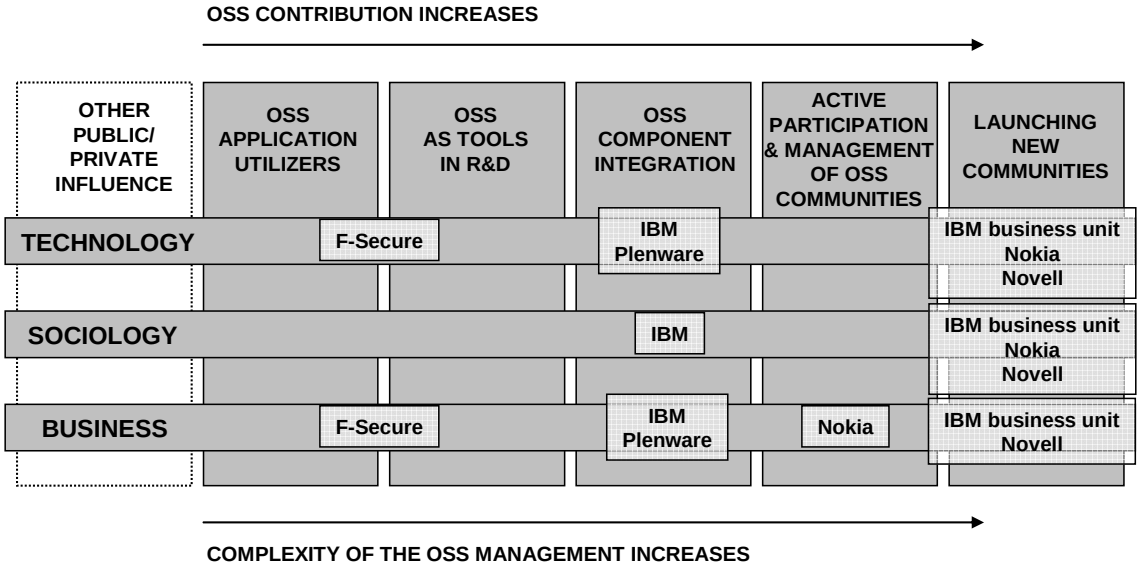

Figure 18. Position of companies in the OSSI framework

In addition, table 3 introduces another summary of the company analyses. In this table Nokia is analyzed from the viewpoints of the whole corporation (as Nokia) and Nokia Multimedia. As in the previous figure, IBM is analyzed from the viewpoints of the corporation (as IBM) and the business unit.

Table 3. Involvement types of the case companies

Type of involv-ement	Primary target	Sacrifices	Benefits	Community
Observer	Keeps distance, follows devel	Does not get s	No investments, timing advantage	May follow discussions
User	Picks raisins from bun	Cannot guide developm	Benefits others ents	May follow discussions
Adapter	Efficie	Cannot gu development	o guide development toward own interests	Has a weak link
Integrator	Integrates with its own development	Possible ima lost	Typically has stronger connection	
Engine	Leads development	Investments	Gets own ecosystem	Has committed oneself to certain community
Promoter	Brand benefits with engine rc	Large inves imag	Own brand and	Maintains and cor ted co

F-Secure
Plenware
Nokia
IBM business unit
IBM
Nokia Multimedia
Novell

Dahlander and Magnusson (2005, p.482) state that there are numerous factors which explain the differences in the performance of companies dealing with open source. One is that certain firms just have superior capabilities, they have superior products, or they are better in their exploitation activities than others. But one reason might also be that some companies have better relationships to open source communities.

In the next chapter the roles mentioned above are connected to the value networks of the case communities. These roles are mostly discussed on a general level without going into any details of a certain company's characteristics. The chapter also takes a stand on the relationships formed between communities and companies.

3.4 The value networks of the case communities

Previously in chapter 3.2 were presented the communities of Eclipse and Debian. Some of the most important facts concerning the structures of both communities were presented. On the other hand, the chapters do not take into account very deeply how value is created in the networks. Actually, the figures only present the actors and relationships that exist in the networks of these communities. In the following figures 18 and 19, the value networks of these two open source communities are presented. These figures take into account how value is created, what the main competencies of these communities are, and who benefits from the created value. After the discussion on value creation, the relationships between the communities and companies are taken under deeper investigation in chapter 3.4.2. The chapter also discusses the different ways to operate in the open source value networks.

3.4.1 Differences of the case networks

Figure 19 presents the value network of Eclipse. Eclipse is more business oriented than Debian, which can be seen in the figure, too. The main players are the committers of Eclipse, the partner companies and their communities, and the customers.

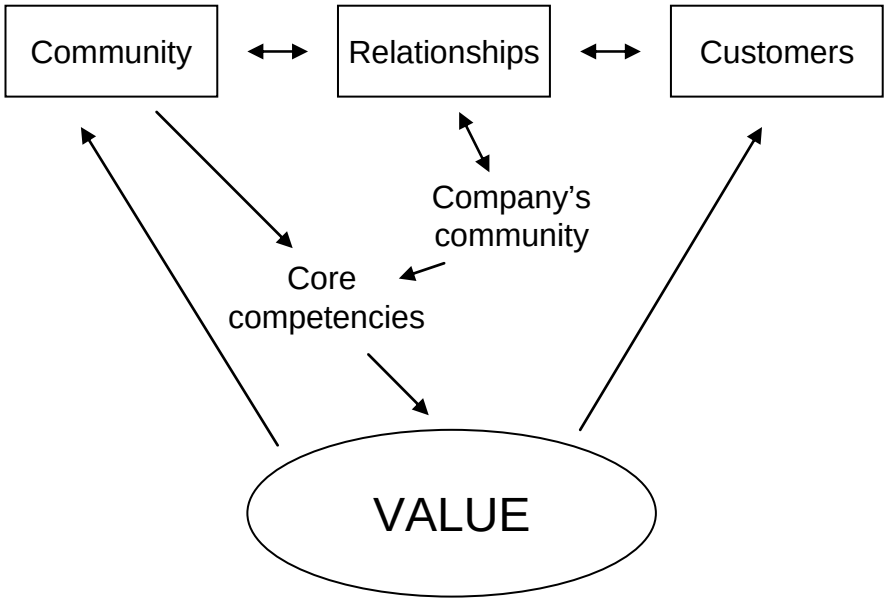

Figure 19. Value network of Eclipse

The value network of Eclipse has same characteristics as the model of creating and capturing value in open source network on page 37 which was made from the perspective of the companies. The models are similar because Eclipse acts very professionally as a community, which has been proved already in this study. Only the community and the company's community are different. It is also important to note that there are no previous mentions about the customers in the network of Eclipse but they were added to this figure because of the value network of Eclipse is so business oriented and in business networks the companies always take those into account.

The community includes the developers of Eclipse. Those developers are typically employees from some organizations or independent developers. They work closely with the companies. The relationships represent the web of partners, members and other companies. Although the member organizations of Eclipse invest a lot in Eclipse, they are not mentioned separately in this figure. This is because Eclipse evens out the size difference between the companies, and so all companies have the same possibilities to affect Eclipse.

The purpose of the company's community is to emphasize a way how companies can interact with Eclipse. Although there are no studies on how these communities work with Eclipse, it is clear that successful companies have their own communities. According to the survey made in 2006, over 80 per cent of the developers of Eclipse

that participated in the survey thought that companies should employ their own developers to open source projects. Therefore, it could be concluded that if the company has its own community, the relationship to Eclipse could be more efficient.

Together the community of Eclipse and the companies form the core competencies which create the value of the network. The conclusion that people are the main competence in communities and, in this case in Eclipse, could be drawn based on several sources (e.g. the Survey, and Goldman & Gabriel 2005). Thus, the willingness of the developers of Eclipse and also the developers of Debian, to develop themselves, to help each other and to share their knowledge is crucial.

Although the people in both Eclipse and Debian are willing to share their knowledge and to help each other, it is strange that the communication in their case is totally different. There are no face-to-face contacts between Debian developers. Of course, one explanation is that Debian is more like hobby to developers, and the communication is handled besides other tasks.

According to the survey over 85 per cent of the respondents of Debian developers thought that companies should employ their developers to open source projects. Also according to the websites of Debian, the community aims to work in a close relationship with its partners. The partners are highly appreciated. Actually, figure 20, where the value network of Debian is described, takes into account these facts. The main players in this figure are the developer community of Eclipse, the relationships, the users, the customers and the upstream developer teams.

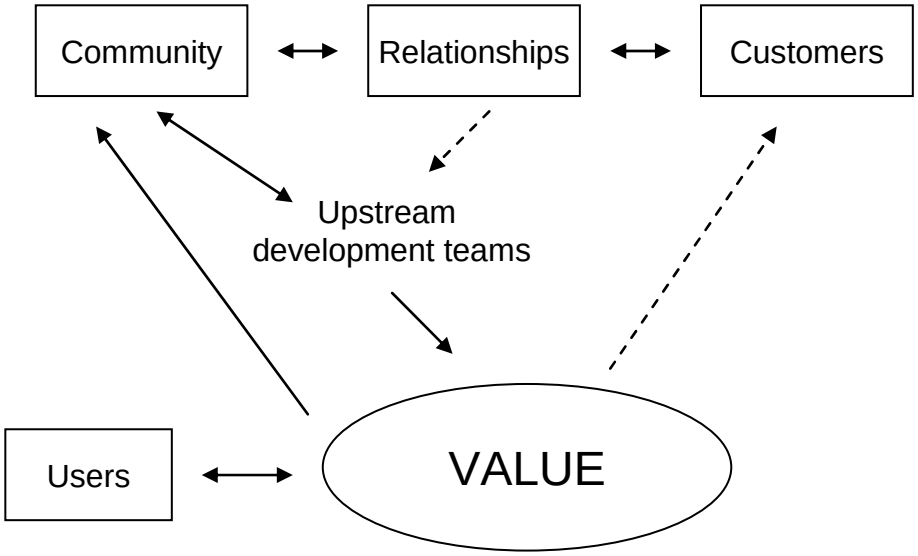

Figure 20. Value network of Debian

Like in the case of Eclipse also in this figure the relationships are formed between the partner companies and other companies which are interested in it. The relationships also include donators, which Debian appreciates. For example, the survey proofs that the

developers of Debian thought that donations are a useful way for companies to collaborate with Debian.

The arrows from relationships to upstream developer teams, and also from value to customers are dashed because of the uncertainty of the roles of the companies and the customers in the value creation of the value network. In chapter 3.2.2 it is stated that the upstream developer team forms the core competency of Debian and the teams are the main actors who create the value. The companies interested in Debian should be emphasized directly, not just through the community. There is no certainty if companies already do this, but the results of the survey and the interview of Wirzenius do not support this statement very strongly.

Like in the value network of Eclipse, Debian does not create value to the customers, at least not so visibly. Because Debian is based on voluntariness, the developers create value mainly to themselves and to the end users. In figure 19 the users are separated from the customers and community developers because of their importance to Debian. Debian does not work as professionally as Eclipse, and that is why its end users are not the same ones with customers.

Based on the fact that the Eclipse developers have larger influence on the community and they take part in the decision-making, and reciprocally the Debian developers base their interest towards their community on voluntariness, one could draw a conclusion that approaching the developers of Eclipse is more certain or safer from the business perspective.

As mentioned before, one reason for Eclipse being more business oriented than Debian, is their different ideologies. Approximately 60 per cent of Debian developers said that they develop software because it should be free. On the other hand, over 60 per cent of Eclipse developers disagree with the claim. It seems that the developers of Debian follow the same ideology the free software was based on, though like argued above there are facts that support doing software business more professionally in Debian.

Dahlander and Magnussen (2005, p.489) noticed that norms and values cause challenges between communities and companies. Actually, they (2005, pp.489-490) noticed that there are some managerial issues that are critical to attend to in relation to the community from the perspective of the company. Their challenges are easily linked to this thesis, because in the case of each challenge there are similarities to the analysis of this study. They (ibid.) base their study on observing the case studies of Nordic open source companies. More about these challenges and in general, the ways to operate in open source value networks are in the following chapter.

3.4.2 Challenges of operating in open source value networks

One challenge is about the value and norms which were mentioned already. Firms that have key individuals within projects have the possibility to handle the boundaries between communities and companies. Also Dahlander and Magnusson (2005, p. 489) mention that companies that have established communities have greater influence to communities. O'Mahoney and Ferraro (2004) (in source: Dahlander & Magnusson 2005, p.489) emphasize the importance of face-to-face interactions in managing the boundaries of open source.

Some of the case companies, which are called promoters, have their own communities or they maintain and contribute to some communities. But the company does not have to be the promoter or engine type of the company to overcome this challenge. The integrator or even the adapter could guide the development of communities, if not by itself, at least in cooperation with its partners (cf. subcontracting in chapter 3.3.5).

Another challenge is handling the different licenses. Although the license issues have not been studied very deeply in this thesis, they are important because the licenses affect the ownerships of open source projects and also have symbolic value (modified from Dahlander&Magnusson 2005, p.489). According to the survey made by Mikkonen et al. (2006a), Eclipse developers prefer CPL (almost 60 per cent) while Debian developers almost unanimously prefer GPL or LGPL (over 80 per cent). Companies which are used to develop commercial software might find it hard to use the open source licenses, especially GPL.

Licenses are one solution for the control and ownership issues. Dahlander and Magnusson (2005, p.490) point out the business model MySQL chose to resolve this problem. MySQL used dual licensing to make a difference between paying users and non paying users. It could be said that licenses, and from a broader perspective, business models, direct the relationships with companies and communities. For example, IBM uses a patronage model with Eclipse.

On the other hand, Debian developers prefer GPL, and also the fact that Debian is more like a free community, supports the use of certain models and licenses with it. But still, it is hard or almost impossible to say that a certain type of company (cf. the roles on table 1) must use a certain business model when dealing with the case companies. Plenware is a good example. The company is identified as a user or an adapter, but with some partners it develops communities to certain directions and the role of integrator could be used. The roles, in general, are dependent of the business model and, therefore of, the license the company uses.

Nowadays although there are communities like Debian, the contributions the companies make to open source assist to form communities like Eclipse. Open source is moving

towards a more professional way of doing business, and more and more actors appear to the open source networks. This means that the existing companies in the open source networks must improve their relationships to the communities they deal with.

So far value is created, for example in Debian, to developers and users, while in Eclipse it is done more strongly to customers. One challenge that also Dahlander and Magnusson (2005, p.489) have figured out, is the different interests when it comes to the nature of the work between companies and communities. Companies want to create value to customers while communities prefer to create it to themselves. Actually, this is something that has already been discussed in this chapter when the reasons behind the structure of the value network of Debian (cf. the dashed lines in the figure 19) were considered.

The case companies do not have any specific conflicts with the communities. Even though some misunderstandings exist on the ideological level, there are no conflicts that could be connected to a certain role that were presented in table 1. Two of the challenges Dahlander and Magnusson (2005) present are related to the previous statement. One is about control and ownership that occur especially with the firms that are active in creating new projects, and another is about avoiding direct conflicts with the communities (modified Dahlander & Magnusson 2005, p.490). When considering the conflicts within communities it should always be noticed that communities consist of thousands of people who all make up their minds independently. The most popular communities cannot have only supporters, as the CEO of MySQL Mårten Mickos (2007) states it.

The interviews show that there are problems inside the companies neither. There was no user type that has problems with the activity of the developers towards open source. Actually, some of the case firms were surprised by the voluntariness of their employees. This is actually a contradiction to Dahlander and Magnusson's (2005, p.489) study, which claims that one challenge is to attract developers to contribute and users to use the software or the product.

This might be a challenge when employing outsiders from communities for the development, but when employing own developers to work with a certain community there should not be problems. Though, the open source environment offers so many and so different kinds of programs and techniques to developers and users which compete with the company's own methods that this challenge is not so hard to imagine.

In value creation, resources are essential. In the previous chapter the employees were presented as one resource that companies could use to affect the communities. Resource consumption related to community development is a challenge mentioned by Dahlander and Magnusson (2005, p.489). This is something that the promoters of this study have noticed as well the investments to open source and to communities must be significant.

Besides time and money, those types of companies have released patents and given up copyrights etc. In return for the investments the promoters capture the benefits from value creating. But large investments are not the only way to cooperate with communities. For example, donations to Debian are an easy way to affect the development done in Debian and by donations the jump to partnering is not so long. Debian has admitted that partners are highly valued.

4 CONCLUSIONS

4.1 Results of the study

The aim of this study was to discover the structure of value networks that are formed in the open source software field. Based on the aim, the research questions were made. The purpose of chapter 4.1 is to evaluate the results of the study by answering to the research questions.

What kind of open source value networks exist? And how do they differ from each other?

Open source value networks are comparable to value networks that are formed in the field of traditional software engineering. The main players, like actors and customers exist in both networks. The building blocks of the networks are value, relationships and core competencies. In chapter 2.3.2 the model of value network was presented. This model refers value network on very general level but in open source networks there are some characteristics that change the meaning of some players and emphasize the relationships. These differences are taken into account in figure 12 “creating and capturing value in open source network”.

The main players in open source value networks are actors, relationships and customers. There are many different kinds of actors in open source value networks but in this sense, actors mean mainly the developers of open source communities. Relationships, on the other hand, mean the web of companies, which prticipate in value creation. These relationships could be the intermediators between communities and customers. Their role is significant because they link the needs of the customers and developers.

Together the companies and the communities form the core competencies which they use to create the best value possible. The value is created based on the requirements set by the players in the network. It is important to notice that in an open source value network the customers’ role is different than in other value networks. The developers of open source value networks must also be treated as the end users. In some communities their role is even more important than the role of the customers’.

The open source communities under analysis were Eclipse and Debian. The value network analyses of these communities are presented in chapter 3.4. Because the case communities were selected based on their different background and ideology, the value networks (cf. figures 18 and 19) were different enough to be compared though the main building blocks of these value networks are almost similar.

The building blocks are based on the theoretical model presented in chapter 2.5. The most noteworthy differences between the value networks of the case communities and the theoretical model are in the value creation process and in the case of customers.

Eclipse is more business-oriented than Debian, which affects to the structures of the value networks. In the case of Eclipse, value is derived from customer needs, while Debian developers create value for themselves. Customer segmentation is not the main point for Debian developers. This is because Debian is considered as a hobby among the Debian developers. Eclipse, on the other hand, is a main source of income for the most of the developers.

The professional differences between the communities support the statements concerning communication differences, different roles in decision-making, differences in education etc. Although Eclipse is considered more professional in this study, there are facts that represent Debian's willingness to a move towards more professional network. These facts show that also Debian is devoted to partnering, and like the developers of Eclipse, also the developers of Debian are keener to work with the companies.

What kinds of roles are there in open source networks and what kind of relationships are there between different participants?

Chapter 2.4.4 presented some user roles which are used during the whole thesis. These roles are the observer, the user, the adapter, the integrator, the engine and the promoter. The roles were separated based on the company's primary target in the open source environment, the benefits and the sacrifices the companies get from open source, and the relationships to open source communities. The role classification complemented the framework of the OSSI project where some of the user types were presented. Together these roles and user types helped the researher to analyze the companies.

The role classification made by Seppänen (2006) was found quite useful. The characteristics of the case companies were easily identified as compatible with the theoretical role classification. The case companies represent every type of role. On the other hand, the framework was found a little confusing in some cases.

The biggest case companies were the ones who have most influence on the communities while the smallest ones were the ones that follow the discussion. This does not have to be the situation because, for example, Eclipse evens out the size difference between the partner companies, and with Debian the donations could be done by even smaller companies. As a conclusion, the involvement type does not depend on the company's size, but in this thesis the biggest companies were the most active in working in open source environment.

Some of the case companies were figured out the best ways to be connected with communities. One of the ways is to employ developers to work with certain communities. For the companies who are not so strongly linked to the communities, this is a important way to, for example, follow the discussion about open source. The company does not have to be a promoter or a user because there are employees who voluntarily operate with the communities. Another way is to through the company's own community which could actually be typical of the promoters. The case companies have their own communities which they have either managed or launched, but there are no visible links between the companies' communities and associated communities, like Eclipse and Debian.

The cooperation with open source communities sets some challenges to the companies. These challenges, based on Dahlander and Magnusson's (2005) research, were studied in chapter 2.5. One of the most important issues for companies to notice is to understand the value differences with communities. In the case of Debian this is even more important than in the case of Eclipse because Debian is not so customer-oriented as Eclipse. The customers do not always come first and this might lead to some misunderstandings.

The other important challenges which were easily linked to this thesis are the license issues, the control, ownerships and consumption of resources, and the roles of the customers. Still, there were no spesific challenges that could be linked to a certain role or to a certain case company.

How do companies operate in open source value networks?

The value creation in open source value networks is tightly linked to the business models and licences the companies use. For example, GPL seems to fit to Debian, and CPL to Eclipse. Licenses are one way to handle, for example, the ownership problems. The selected business models, on the other hand, regulate the relationships between companies and communities, and therefor affect the whole value creation process.

The statements mentioned above represent the whole open source environment; the number of different licenses and business models connected to the huge number of different participants set numerous different possibilities for companies to operate. In the next paragraphs the guidelines of operating in open source value networks for companies are discussed based on the same analogy the figures in chapter 3.4 are derived. The main competencies of the networks and the benefits can be observed through the value creation process.

In open source value networks, value creation is usually centered to some communities. In the case networks value creation is different because the values and norms of the participants differ from one another. Because of that, Eclipse community seems to be

most approproate for companies who are willing to develop the code in the sense of making money. Debian, on the other hand, which is a much larger community than Eclipse, is closer to the basic ideology of the whole open source concept and, therefore, regulates the development of the open source movement in general.

In the case of Eclipse, the customers play a more important role than in Debian. This is supported by the statement that in the network of Eclipse the value is created to the customers, while in the network of Debian the value is created to the developers and the users. This is partly because of the different values and norms the developers have in the case communities.

In both case communities, the developers are one important part of the core competence that contributes to the value. Diverse backgrounds and skills are the richness of the communities. This is what all the participants should understand. No company can lead the communities by itself in open source value networks because there are too many playes involved. Together the developers, companies and also customers form the open source value network, and they set the requirements for the value which they create together.

The developers and the companies form the core competence in the value network of Eclipse. This emphasizes the importance of the relationships between communities and companies, in general. The study shows that the promoters get the best benefit out of open source because they have made the largest investments. They have, for example, launched their own communities. By emphasizing the relationships between the own communities of the companies and the communities (like Eclipse and Debian) the best benefit can be achieved. In the case of Debian, the upstream developer teams are the core competence that every type of companies should be connected to. By interacting with the communities, the companies could more efficiently follow the discussion concerning open source, and at the same time share the knowledge of the firm. Actually, the survey proves that the developers of both case communities are willing to share and adapt the knowledge. This is something the firms that are interested in open source should consider, for example, when the companies want to increase the awareness of the company among the communities.

4.2 Assessment of the study

The best way to assess the study is to compare the results to the aim of the study. The answers to the research question and to the sub-questions are presented in the previous chapter. The questions are almost in the same form as those in the summer of 2006 when this whole process started. The aim of this study has been almost the same, but some limitations and arrangements have been made in the timetable.

In the beginning of the process, the researcher defined the purpose and research limitations and set the timetable together with the director of this thesis. The OSSI – project also set some limitations, but those limitations were only chronological; the thesis was supposed to be ready in the beginning of the summer of 2007. The deadline was later postponed to the end of the summer, mainly because of the researcher's other obligations.

Although the timetable was postponed, it did not affect the lead-in of this thesis. The theoretical and empirical parts of the study were done as planned. The main emphasis is on the empirical part of the study and the theory was conducted to support it. It was quite difficult to write the theory because the number of the studies concerning open source value networks is limited. Because of that some parts of the theory were modified afterwards.

However, the most important part of the theory, the description of open source value networks, was done successfully before starting the analysis of the case networks. This part of the theory was found quite relevant in the empirical analysis. The value networks of the case communities were formed easily based on the theory.

Besides the theory, also the gathered material influenced the empirical analysis. Actually, when assessing the study, the collected material plays a critical role. For example, Hirsjärvi and Hurme (2004, p.185) say that the reliability of the interview material is dependent on its quality. The quality of the interview material depends on the questions, the researcher, the interview methods, the lettering etc. The lettering, for example, should be made as quickly as possible after the interview situation, and preferably by the researcher himself (Hirsjärve & Hurme 2004, p.185).

Compact research material is quite typical of the action-oriented approach (Olkkonen 1994, p. 73). For example, the latest literature (books, journals) was used in the theoretical part. On the other hand, the data for the empirical analysis of this study was gathered from different sources. In the case of the company analyses, the data was mainly collected by interviews which were lettered right after the interviews by some colleagues from the Institute of Business Information Management. The internet was also one source for the data. In the case of the communities, data was gathered from the interviews of the key persons of the selected communities, the internet and the survey made by the colleagues of the OSSI project. The literature sources and the data collected for the empirical analyses were selected thoroughly and with the guidance of the director.

Of course, more reliable and extensive results would be achieved if more material was included in the analysis, but in this case it was not possible or even relevant. Although the collected material is based on one employee's opinion in the case of the interviews, the answers were common enough to enable the researcher to draw relatively reliable

conclusion. It is also important to note that open source is quite new as a way of doing business, especially when dealing with the open source value networks. There is only a certain amount of data to be discovered.

The reliability of the thesis could also be assessed by observing the results of the study. According to Yin (1994, p.36) the reliability means that the same results could be achieved again by another researcher if the researcher follows the same procedures exactly as the original researcher did. This is actually quite difficult because, for example, the answers the interviews give are dependent on the interview situation. Also, typical of a qualitative research is that there is a lot of researcher's own interpretation.

In addition to reliability, observing the validity of the results is one way to assess the study. The validity means the ability of the results to measure what they are supposed to measure (Olkkonen 1994, p.39). This means whether or not the collected material, the research methods and the results of the study justify the presented claims. The validity in this study means, for example, that the interview questions and themes are based on the theory and previous OSSI researches, and the questions are not just written on impulse. Measuring the validity of this qualitative research is quite challenging. Actually, Mäkelä (1990) says reliability and validity do not fit to the methods of assessment when it comes to a qualitative research (in the source of Eskola & Suoranta 2005, p.211). Eskola and Suoranta (2005, p.211) continue by saying that the main criterion of reliability in a qualitative research is the researcher himself, and the assessment process must concern the whole research process.

4.3 Recommendations for further study

In the previous chapter were presented some ideas and criticism against this thesis. The criticism against the study forms the base for the future research on open source value networks. For example, the criticism concerning the amount of case material could be utilized in further studies. Now there were only two communities under analysis, while expanding the number of studied communities the models presented in chapter 2.5. could be generalized. For example, the differences between the professional and voluntary based communities presented in this thesis would get support by expanding the research to concern the other communities under investigation in the OSSI-project (Gnome and MySQL). In the case of MySQL, the network consists of a huge number of different partners, which all affect the value creation in a different way. By expanding the research, for example, to channel resellers or independent software vendors the results would be quite different. Of course, by investigating the communities outside the OSSI-project, the results would be even more reliable and generalizable, but it would be very challenging and time consuming.

This study was focused on analysing the different roles the companies have in open source value networks. During the interviews it was discovered that some individuals'

contribution to open source is significant. There was, for example, a person who considered himself as a godfather to open source in Finland. The analysis of these types of individuals would bring the analyses of open source value networks to a completely new level. Actually, this is something that has already been discussed in this thesis. In chapter 2.5 Helander and Laine (2006, p.54) pointed out the importance of taking the analysis to the level of the competencies of the individuals, due to their huge contribution concerning open source.

As stated in chapter 4.1, the business models and the licenses affect the relationships formed between the different participants in open source value networks. The analysis could be deepened by linking the business models and the licenses to the value creation. For example, one interesting point of view that came up during the interviews was to study the services that are focused on the communities. These service oriented business models could open a brand new way of doing business with communities.

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APPENDICES

APPENDIX 1: Interview themes and questions of communities

1. Background and history:

- What is your history in your community?

2. About role and relationships:

- What role have you been mostly playing in open source communities? Was that your original plan or were there some real-life changes?
- Why did you choose your community?
- Would you make something different if you could start all over?
- Have you had any conflicts between your community and companies you are dealing with?
- Are you often contacted with potential utilizers (customers)? How do you communicate with your customers?

3. About cooperation and knowledge sharing:

- Who do you consider your most important cooperative partners?
- Who else do you do business cooperation with?
- What do you expect from cooperation with your most important partners?
- What about with other partners?
- What kind of cooperation do you do?
    - How often are you in contact?
    - How do you communicate? (meetings, email, telephone, chat, im)?
    - What kind of things do you talk about?
- How do you determine the goals of the cooperation?
- How does the cooperation affect your own operations?

4. Benefits / value:

- What do you get from OS-network? (monetary, non-monetary benefits)
- What do you give to the community?
- Which are your competencies?

APPENDIX 2: Interview themes and questions of companies

1. Background and history:

- What is your history in your company?
- Why/how did you go open source in the first place? What made your decision?
- Was it part of your strategy or did it just happen naturally?
- Do you have previous history in open source? Or does your company have?
- Why do you choose your community your dealing with? What were the most important reasons for selecting a given community?
- Would you make something different if you could start all over?

2. Company's role and strategy:

- What do you/your employer expect from open source?
- Does your company have some strategy for open source?
- How much effort does you/your company give to os?
- Have you had any conflicts between your company and the non-paid developers in the community?
- Are you often contacted with potential utilizers (customers)?

3. About cooperation, relationships and knowledge sharing:

- Who do you consider your most important cooperative partners?
- Who else do you do business cooperation with?
- What do you expect from cooperation with your most important partners?
- What about with other partners?
- What kind of cooperation do you do?
    - How often are you in contact?
    - How do you communicate? (meetings, email, telephone, chat, im)?
    - What kind of things do you talk about?
- How do you determine the goals of the cooperation?
- How does the cooperation affect your own operations?
- How is all this affected by the fact that you're operating in the open source domain?
- How will you involve the various groups that have interest in your project?
- How many other employees from your company are involved in the same community, and what are their positions in the network?

4. Benefits / value:

- What do you/your employer expect from open source?
- Does your company have some strategy for open source?
- What do you get from OS-network? money, non-monetary… What is the value?

APPENDIX 3: Empirical Material

a) Qualitative interviews
    - Company interviews:
        - F-Secure / Janne Järvinen: 5.4.2007
        - IBM / Juha Hulkkonen: 30.3.2007
        - Nokia Multimedia / Ari Jaaksi: 10.4.2007
        - Novell Finland / Kim Aaltonen: 5.4.2007
        - Plenware / Pauli Kuosmanen: 11.4.2007

    - Community interviews:
        - Debian / Lars Wirzenius: between 23.-25.5.2007
        - Eclipse / Ward Cunningham: 17.5.2006
        - MySQL / Mårten Mickos: between 9.-19.4.2007

b) Quantitative data
    - Mikkonen, T., Vadén, T.& Vainio, N. 2006a. FOSS survey.

c) Secondary data

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