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*The importance of network economy
for businesses*

MSc in Innovation and Entrepreneurship

Alexandru Stanoi

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Abstract

This thesis is an exploratory research into the importance of network economy for technology businesses. The methods to evaluate the value of a network for the members of the network and for the businesses themselves are analyzed, and new methods are proposed. The theoretical approach is exemplified by a case study analyzing the importance of network economy for Opera Software. In the end, conclusions are drawn from the theoretical exploration and from the case study, proposing a framework which can be used by other businesses to better understand their network, to evaluate its value and to improve it even more.

Keywords:

Opera Software, network economy, network externalities, online communities, network value, economies of scale, positive feedback, Beckstrom's Law, Reed's Law, Metcalfe's Law, Sarnoff's Law, Noriaki Yoshikai

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List of acronyms

ATM = Automated Teller Machine

CPC = Cost per click

CPM = Cost per thousand

CSS = Cascading Style Sheets

HTML = HyperText Markup Language

ICANN = Internet Corporation for Assigned Names and Numbers

IEEE = Institute of Electrical and Electronics Engineers

LAN = Local Area Network

NDA = Non-Disclosure Agreement

NOK = Norwegian Kroner

SNF = Institute for Research in Economics and Business Administration

Wintel = Windows + Intel

1 Introduction

Network economy is a relatively new field of study, although the theoretical principles have been studied and applied for several hundreds of years already. The interconnectivity of railroads for instance, is a good example of how network economy has been affecting the business life over the century: some companies were choosing not to have compatible railways in order to keep control of a region, while others were choosing to have compatible railways in order to increase their reach into other regions.

The principles of network economy have been studied in depth in recent years, applying new theories of graphs and different formulas to calculate the value of networks. With the advent of Internet, network economies are more important than ever. The sheer size of contemporary social networks is challenging long-standing theories and pushing for the introduction of new formulas to calculate the network value.

Many companies are realizing now that they need to consider managing and increasing their network of users if they want to enter into a demand-side economy of scale. The job is only half-done with the selling of a product – the existing relationship with the customers must be managed through product support, maintenance and possible future product purchases. The products must be compatible with existing products on the market so that the critical mass can be reached faster (or to be reached at all). Some companies decide to go against the current and make their products incompatible with existing technologies, to control the market. This is a risky move which may have huge advantages if the company manages to control the market in a state of monopoly.

This thesis is an analysis of current network theory research together with a case study of a company employing network economy principles to maintain and grow its base of customers

(users). I have chosen the company Opera Software for the case study because I worked there for some time and I've seen from up-close how the company interacts with its community.

1.1 Motivation

My interest in network economy and online communities started when I was working for a Norwegian open-source software development company. The source code we produced there was used by a considerable number of people, who all the time criticized my company on online forums and chat. At that time I didn't know the importance of this group of people, thinking that they are just useless people with no interest in our products, and with the sole mission to disrupt our work and make themselves known to other people by raising their voice.

As time went by, I began to understand that this online community had an important say in many of my company's decisions, and I realized that they were a huge part of the customers of my company and the end-users of our products. Their criticism was actually helping us develop better products.

The second time network economies were part of my work was when I had an internship in a start-up company dealing with a new invention in cosmetics packaging. Working there with social media and social networks made me realize the importance of having a large network of consumers which can provide feedback and also attract new people to the company's products.

The third time I ran into network economies was on my marketing internship at Opera Software. I realized there how useful a community is when I got a chance to see how the company uses the community to attract more users (and thus more revenue). I was impressed

that people in the community would organize events and promote Opera products without being rewarded with anything.

Thus when I was exploring the different directions in which I can write my master thesis, it was a natural choice to analyze the field of online communities. I had a real interest in this field, and I had the support of Opera Software for which I worked as a marketing intern. And Opera Software is an interesting case study to analyze, as they are competing with strong players in the browser market, such as Google, Microsoft, Apple and Mozilla.

1.2 Research problem

According to Forrester Research, the online business industry will be worth nearly USD\$250 billion by 2014 (Erick Schonfeld, 2010). More and more companies are targeting this segment by trying to set a foothold. Even traditional businesses with physical shops ("brick and mortar" businesses) are trying to get on the online bandwagon by employing techniques such as online advertising, social media and collaboration platforms. Often the advertising spending is huge compared to the benefits gained from it. Some of these companies often fail because they don't understand the concepts of online business and don't allocate enough resources for "being online". But some will succeed with a clever allocation of resources, not spending too much money on advertising and employing their communities of users (customers) to help spread the word about their products and bringing in more customers.

Here are some famous examples of companies using their communities to help them grow, gain more customers and ultimately earn more revenue (source: Wikipedia.org):

- Mozilla Foundation: not-for-profit organization, responsible for the Firefox web browser. Its revenue comes from sponsorships and deals with content providers. Its community helped it grow, by creating browser extensions, testing the browser and

spreading the word about the browser (word of mouth). In contrast, companies like Google and Microsoft must rely on expensive advertising to promote their web browsers, while Mozilla Foundation relies on the size and devotion of its community.

- Zappos.com: an online shoe retailer. Has increased its customer base and revenue by relying on its community, via word of mouth. It became very successful and was ultimately acquired by Amazon.com for about USD\$1.2 billion.
- Wikimedia Foundation: responsible for the online encyclopedia Wikipedia.org. Its huge community writes, reviews and corrects the articles (crowdsourcing), which would have been an expensive task if employed people would have done it. Its revenue comes from donations from the community and sponsorships from other companies.
- Facebook: a huge social networking platform, its revenue comes from advertising deals (bigger community = more revenue). Its community is active and attracting other people to join the site. The company made it easy for people to join by providing tools to the community to invite friends and import contacts from e-mail addresses. It has had a huge social impact worldwide, being used by 600 million people.

This thesis is a study of the importance of communities of users (customers) for companies, and how can they benefit from these communities to help their business grow. A literature review of existing research in this field will be performed, together with a relevant case study in the network economy field.

1.3 Research objectives and questions

The objectives of this thesis are to identify the key concepts of network economies such as positive feedback, network externalities and demand-side economies of scale, and to assess

the importance of the network economy for businesses by analyzing success factors of networks and methods to calculate the value of a network.

The research question posed in this thesis is "*how can companies assess and improve the value of their network?*". This falls into the business-to-consumer (B2C) market.

The target group of this thesis are small and mid-sized companies with a starting or established online presence, who want to successfully increase their online presence in order to grow their business.

The thesis will involve the case study research method. The single case study will be on the Norwegian software company Opera Software. The company will be analyzed from its user community perspective. Study points are:

- size of Opera Software's community
- how Opera Software benefits from the community
- how the community is used in attracting more users (customers)
- metrics of the community (relationship between regional branch office and size of community in that region, dynamics of regional communities, number of employees involved in the dialog with the community etc)
- historic community data (growth rate, connection with company growth, connection with special events like new company products etc)

Other concepts related to communities will be touched upon in the master thesis, such as collaboration and crowdsourcing.

From the literature review and the case study the author aims to sketch a framework or theory, which can be useful for other similar companies in creating and maintaining their own communities with business growing objectives in mind.

The author hopes that the conclusions from this thesis will help existing small and mid-sized companies to successfully enter the online market and succeed.

1.4 Overview

The first chapter **Introduction** introduces the research questions and objectives of this thesis, and the motivation behind this area of study.

In the second chapter **Literature review** the thesis explores current research in network economy. The most important works are analyzed, together with important concepts of network economy and formulas for calculating the network value. The theory is analyzed critically, pointing out gaps in the literature (if any). Important concepts which are defined include: positive feedback, demand-side economies of scale, network value.

The theoretical framework needed for the case study in this thesis is introduced in the third chapter **Methodology**. This chapter contains one important case study in network economy, Opera Software. The theory identified in the previous two chapters will be applied and the formulas used to calculate the network value will be applied with the values from Opera Software's network, giving the value of the network and its importance for Opera Software.

The results from the case study are presented in the fourth chapter **Discussion**, where they are compared with the research questions and objectives defined in the introduction. This chapter further analyzes the implications of the findings of this thesis. It also proposes a framework

for companies needing to define their strategy for creating and maintaining a community of users. This framework is based on the best practices identified in the case studies and theory analyzed in this thesis.

The final chapter **Further research** proposes possible research papers which can be written in the network economies field, as extensions of the results from this master thesis.

2 Literature review

This chapter is a review of the research done over the past 30 years (1980-2011) in the field of network economy. This timeframe was chosen as in the 1980s communication networks began being used on a large scale, and new research was being done on networks, graph theory and network value.

I began my search in marketing journals, IEEE publications, ICANN publications and SNF publications. My literature search started with the terms "network economy", "online communities" and "social media", limited to the last 30 years. I included the terms "Metcalfe's Law", "Beckstrom's Law", "Reed's Law" and "Sarnoff's Law" after I found out about these concepts while reading the articles I found.

There were some recent developments (less than 3 years old) in the network economy (e.g. Beckstrom's Law) which are not yet published in important journals. For these topics I used general search engines (Google) to find websites and conferences as citable sources. When I needed to state some quick facts (for example the revenue model of Facebook) I used Wikipedia.org as a source.

The most important source of information for my research in network economy is the book "*Information Rules: A Strategic Guide to the Network Economy*" (Carl Shapiro and Hal R. Varian, 1999). It has several flaws though:

- At the moment of writing this thesis (2011) some of the information presented in the book is outdated, as new concepts evolved over the 12 years since its publication, and several developments happened since then, such as the dotcom bubble in the beginning of the first decade of the 21st century

- The book touches only on some formulas used for the calculation of the network value, not mentioning others (such as Reed's Law, Sarnoff's Law and Beckstrom's Law, some of which emerged in the 12 years since the publication of the book)

Another book which was valuable for finding examples of online communities was "*Wikinomics: How Mass Collaboration Changes Everything*" (Don Tapscott and Anthony D. Williams, 2008).

The concepts *network effects*, *network externalities* and *demand-side economies of scale* all refer to essentially the same idea: it's better to be connected to a bigger network than a smaller one for users of the network (Carl Shapiro and Hal R. Varian, 1999, p. 174-175). A growing network needs to reach its *critical mass* to become more profitable and attract more users, which might be attracted to larger networks until then.

2.1 Network effects

In economic theory it is common to distinguish between increasing returns on the supply side and on the demand side, as illustrated in the following table from a 2010 paper on the economics of social networks titled "*The economics of social networks: The winner takes it all?*" (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

	Scale	Scope
Supply side	Decreasing average costs	Gains from joint production
Demand side	Network effects	Complementarities

There are *economies of scale on the supply side* if the average costs fall when each single product or service is produced in large volumes. There is little doubt that the economies of scale are significant for digital content and digital communication services in general, but this

feature is probably not a significant obstacle for an entrant in the market for social networks (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

Likewise, there are *economies of scope on the supply side* if it is cost efficient to produce several different products or services within one and the same firm. For social network services the potential for supply side economies of scope is limited, according to the mentioned paper (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

2.2 Social networks

Social networks are online communities of people designed to provide members with services for interaction between them. An important study in network economy related with online social networks is a recent paper published in 2010 titled "*The economics of social networks: The winner takes it all?*" which explores the economics of social networks. The paper asks if there is a "winner" in the battle of social networks, namely the social network used by the most people (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

The paper identifies uses of social networks among young people especially, such as sharing content and keeping in touch with friends. As social networks don't charge their members money in exchange for their services, their revenue comes from other sources, such as advertising (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

The paper compares social networks with online newspapers, which have a similar business model. Both online newspapers and social networks may be described as two-sided platforms; the providers need to ensure that both users and advertisers are on board. On the one side, the advertisers benefit from the presence of users of social networks. The more users, the higher is the advertisers' willingness to pay for ads. On the other side, users of social network

services may dislike the presence of ads. This feature of a two-sided market is found in other advertising financed media markets such as television and newspapers, and indicates that most social networks will not charge their members even in a matured market. Since advertisers prefer a large number of members, this may further strengthen the winner-takes-all characteristic (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

An important role for whether a social network becomes a success or not is played by *super-users*, which have a role as trendsetters and moderators. Light users of social networks follow where the super-users go. The super-users would have a large impact on the other users' behavior. The paper also observes that social networks, in particular social networks for teenagers, try to make super-users more loyal by giving them a more official role as (unpaid) moderators (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

A talk in a 2010 conference analyzed also the role of super-users, expressed as an index called LSI (Leadership Strength Index), which is an estimate of the leaders' involvement in an online community obtained from its social network (S. Tsugawa, H. Ohsaki and M. Imase, 2010).

2.3 Positive feedback

The concept of positive feedback is explored in the book "*Information Rules: A Strategic Guide to the Network Economy*" (Carl Shapiro and Hal R. Varian, 1999).

Consumer expectations are critical; the product that is expected to become the standard will become the standard. Self-fulfilling expectations are one manifestation of positive-feedback economics and bandwagon effects (Carl Shapiro and Hal R. Varian, 1999, p. 14).

Positive feedback should not be confused with growth. If a technology is on a roll, positive feedback translates into rapid growth: success feeds on itself. This is a *virtuous cycle* (Carl Shapiro and Hal R. Varian, 1999, p. 176). If the products is seen as failing, those very perceptions can spell doom. The virtuous cycle of growth can easily change to a *vicious cycle* of collapse. A death spiral represents positive feedback in action: the weak get weaker (Carl Shapiro and Hal R. Varian, 1999, p. 176).

When two or more firms compete for a market where there is strong positive feedback, only one may emerge as the winner. Economists say that such a market is tippy, meaning that it can tip in favor of one player or another. It is unlikely that all will survive (Carl Shapiro and Hal R. Varian, 1999, p. 176). In its most extreme form, positive feedback can lead to a winner-take-all market in which a single firm or technology vanquishes all others (Carl Shapiro and Hal R. Varian, 1999, p. 177). The same is also expressed in Fjell's paper (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

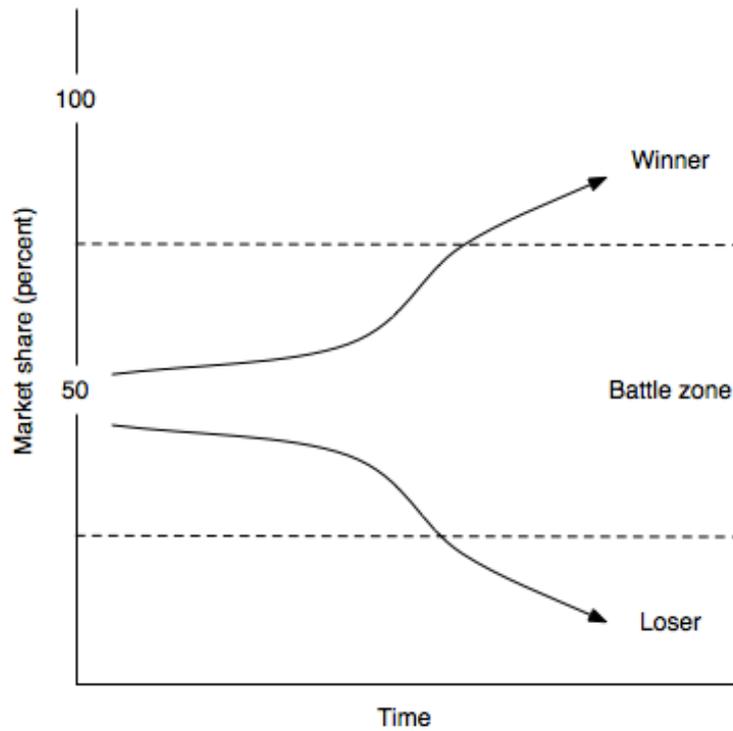


Figure 1. Positive feedback

Figure 1 shows how a winner-take-all market evolves over time. The technology starting with an initial lead grows to near 100 percent, while the technology starting with a lower lead declines to 10 percent. These dynamics are driven by the strong desire of users to select the technology that ultimately will prevail – that is, to choose the network that has (or will have) the most users (Carl Shapiro and Hal R. Varian, 1999, p. 177).

The biggest winners in the information technology are companies that have launched technologies that have been propelled forward by positive feedback. Successful strategies in a positive-feedback industry are inherently dynamic (Carl Shapiro and Hal R. Varian, 1999, p. 177).

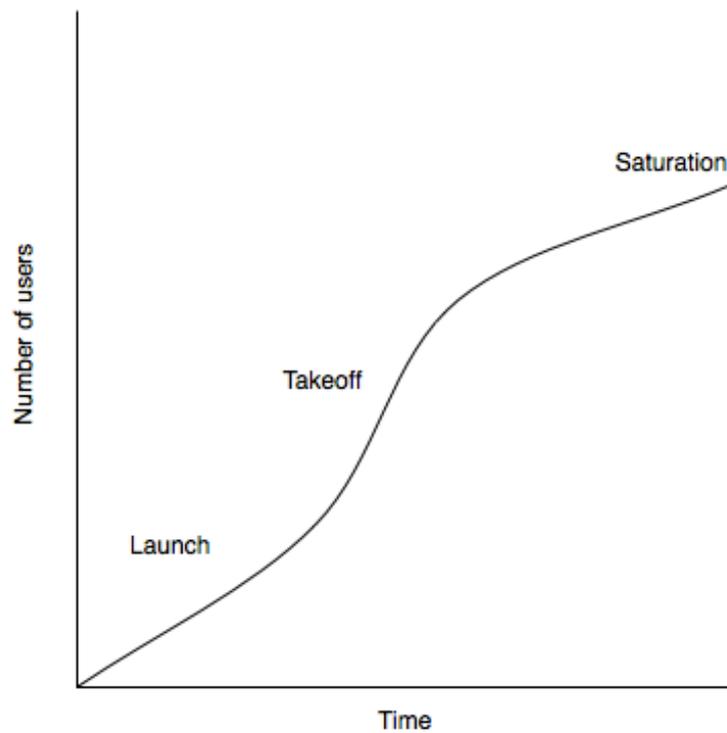


Figure 2. Adoption dynamics

Positive-feedback systems follow a predictable pattern similar with the spread of biological viruses, as seen in Figure 2. Adoption of new technologies follow an S-shaped curve with three phases (Carl Shapiro and Hal R. Varian, 1999, p. 178-179):

1. flat during launch
2. a steep rise during takeoff as positive feedback kicks in
3. leveling off as saturation is reached

Fjell's paper also talks about *snob effects*, which are negative network effects: consumers want exclusive products or services, so they might leave a network when it becomes a service for the masses (after saturation) and move to a new exclusive network (Kenneth Fjell, Øystein Foros and Frode Steen, 2010). So new and innovative networks have a chance to succeed and gain critical mass even when the market is dominated by established networks.

2.4 Demand-side economies of scale

The concept of *demand-side economies of scale* is explored in the book "*Information Rules: A Strategic Guide to the Network Economy*" (Carl Shapiro and Hal R. Varian, 1999).

Information economy is populated by temporary monopolies. Hardware and software firms vie for dominance, knowing that today's leading technology or architecture will, more likely than not, be toppled in short order by an upstart with superior technology (Carl Shapiro and Hal R. Varian, 1999, p. 173).

Economies of scale in production mean that larger firms tend to have lower unit costs (at least up to a point). Traditional economies of scaled are referred to as supply-side economies of scale (Carl Shapiro and Hal R. Varian, 1999, p. 179).

Traditional economies of scale based on manufacturing have generally been exhausted at scales well below total market dominance. For this reason, markets like the automobile market are oligopolies instead of monopolies. Positive feedback based on supply-side economies of scale ran into natural limits, at which point negative feedback took over. These limits often arose out of the difficulties of managing enormous organizations (Carl Shapiro and Hal R. Varian, 1999, p. 179).

In the information economy, positive feedback has appeared in a new, more virulent form based on the demand side of the market, not just the supply side (Carl Shapiro and Hal R. Varian, 1999, p. 179-180).

The positive relationship between popularity and value is illustrated in figure 7.3. In a virtuous cycle, the popular product with many compatible users becomes more and more

valuable to each user as it attracts even more users. The vicious cycle is a death spiral in which the product loses value as it is abandoned by users, eventually stranding those diehards who hang on the longest, because of their unique preference for the product or their high switching costs (Carl Shapiro and Hal R. Varian, 1999, p. 180-1).

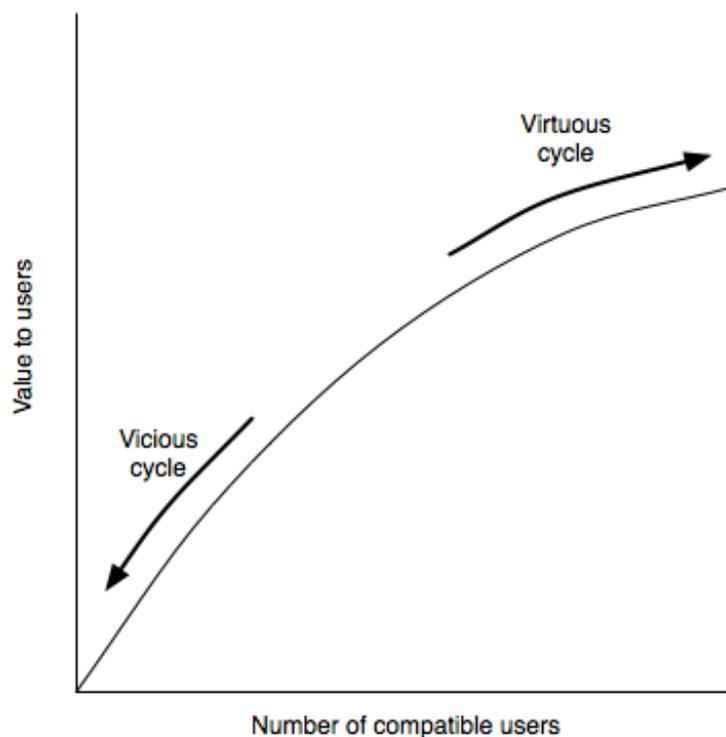


Figure 3. Popularity adds value in a network industry

Suppose your product is poised in the middle of the curve in figure 3. Which way will it evolve? If consumers expect your product to become popular, a *bandwagon* will form, the virtuous cycle will begin, and consumer's expectations will prove correct. But if consumers expect your product to flop, your product will lack momentum, the vicious cycle will take over, and again consumers' expectations will prove correct. The beautiful if frightening implication: success and failure are driven as much by consumer expectations and luck as by the underlying value of the product (Carl Shapiro and Hal R. Varian, 1999, p. 181).

Marketing strategy designed to influence consumer expectations is critical in network markets. The aura of inevitability is a powerful weapon when demand-side economies of scale are strong (Carl Shapiro and Hal R. Varian, 1999, p. 181).

Demand-side economies of scale are the norm in information industries. In consumer electronics, buyers are wary of products that are not yet popular, fearing they will pick a loser and be left stranded with marginally valuable equipment. As a result, many information technologies and formats get off to a slow start, then either reach critical mass and take off or fail to do so and simply flop (Carl Shapiro and Hal R. Varian, 1999, p. 181).

Positive feedback based on demand-side economies of scale is not entirely novel. Any communications network has this feature: the more people using the network, the more valuable is to each one of them (Carl Shapiro and Hal R. Varian, 1999, p. 182).

Supply-side and demand-side economies of scale combine to make positive feedback in the network economy especially strong (Carl Shapiro and Hal R. Varian, 1999, p. 182).

Both demand-side economies of scale and supply-side economies of scale have been around for a long time. But the combination of the two that has arisen in many information technology industries is new. The result is a "double whammy" in which growth on the demand side both reduces cost on the supply side and makes the product more attractive to other users – accelerating the growth in demand even more. The result is especially strong positive feedback, causing entire industries to be created or destroyed far more rapidly than during the industrial age (Carl Shapiro and Hal R. Varian, 1999, p. 182).

2.5 Network externalities

When the value of a product to one user depends on how many other users there are, economists say that this product exhibits network externalities, or network effects (Carl Shapiro and Hal R. Varian, 1999, p. 13).

Positive feedback and network externalities are not a creation of the 1990s. Network externalities have long been recognized as critical in the transportation and communications industries, where companies compete by expanding the reach of their networks and where one network can dramatically increase its value by interconnecting with other networks (Carl Shapiro and Hal R. Varian, 1999, p. 175).

Network externalities are not confined to communications networks; they are also powerful in "virtual" networks, such as the network of Macintosh computers: each Mac user benefits from a larger network since this facilitates the exchange of files and tips and encourages software houses to devote more resources to developing software for the Mac (Carl Shapiro and Hal R. Varian, 1999, p. 174-5).

It is important to distinguish between direct and indirect network effects. For instance, we have direct network effects between owners of telephones: the more people that have installed a telephone, the greater its value. An example of indirect network effects: a large number of PlayStation 3 users imply that there will be a large demand for PlayStation 3 compatible games. This in turn tends to generate a large variety of PlayStation 3 games, which increases the user value of the PlayStation 3 console. For both direct and indirect network effects, market size – the number of users – increase the value (and the willingness to pay) for being connected to the network (Kenneth Fjell, Øystein Foros and Frode Steen, 2010).

2.6 Switching costs

Switching costs refers to the costs incurred on a person to switch from using one technology to another one, for example from using a Wintel platform to using a Mac platform. It includes the technology costs, but also hidden costs such as training in the new technology (Carl Shapiro and Hal R. Varian, 1999, p. 103-11).

Network externalities make it virtually impossible for a small network to thrive. But every new network has to start from scratch. The challenge to companies seeking to introduce new but incompatible technology into the market is to build network size by overcoming the collective switching costs – that is, the combined switching costs of all users (Carl Shapiro and Hal R. Varian, 1999, p. 184).

2.7 Critical mass

High-tech networks are like real-life networks such as telephone networks: networks of compatible fax machines, networks of compatible modems, networks of e-mail users, networks of ATM machines, the Internet (Carl Shapiro and Hal R. Varian, 1999, p. 174).

In virtual networks, the linkages between the nodes are invisible, but no less critical for market dynamics and competitive strategy. We are in the same computer network if we can use the same software and share the same files. For example, in the case of Apple (circa 1999), there is effectively a network of Macintosh users, which is in danger of falling below critical mass (Carl Shapiro and Hal R. Varian, 1999, p. 174).

A method for achieving critical mass is to assemble a powerful group of strategic partners, such as customers, complementors or even competitors. Having some large, visible customers aboard can get the bandwagon rolling by directly building up critical mass. Having

competitors on board can give today's and tomorrow's customers the assurance that they will not be exploited once they are locked-in (Carl Shapiro and Hal R. Varian, 1999, p. 15-6).

2.8 Network value

In a 2000 conference talk, David P. Reed has mentioned communities of value as a new "killer platform" (David P. Reed, 2000). The value of connecting to a network depends on the number of other people already connected to it (Carl Shapiro and Hal R. Varian, 1999, p. 174).

This section will identify different measures which can be used to calculate the value of a network for the customers. The network value calculated by the presented formulas is based on the number of its members, with the exception of Beckstrom's Law which is based on the transaction values between its members.

The network value is a theoretical measure of how valuable a network is for its users. The value is not used in practice, but it can be used as a reference when comparing similar networks. More often than not, the networks are compared by size (e.g. Network A has 5 million members, Network B has 7 million members).

A potential user who wants to join a network will often choose between competing networks of varying sizes. The choice is not always the network with the most people, as smaller networks experience growth as well. The point of studying the different formulas of calculating network value lies in trying to understand why a potential user would choose a smaller network, when a bigger network is probably better. I will analyze all the network value formulas and try to see if there are missing factors when calculating network value,

which might explain why potential users choose networks with smaller perceived value (as based on the number of their members).

2.8.1 Sarnoff's Law

David Sarnoff states that the value of a broadcast network (one-way network) is proportional to the number of viewers. This concept was introduced in the 1940s, when David Sarnoff made contributions in the development of radio and television (Kelly Hlavinka and Rick Ferguson, 2006).

2.8.2 Metcalfe's Law

Metcalfe's Law was formulated by George Gilder in 1993, and attributed to Robert Metcalfe in regard to Ethernet. It states that the value of a telecommunications network is proportional to the square of the number of connected users of the system: (N^2). As opposed to Sarnoff's Law which addresses only broadcast (one-way) networks, Metcalfe's Law addresses two-way communication networks (Kelly Hlavinka and Rick Ferguson, 2006).

$$V \sim N^2$$

This formula has had its share of criticism, especially after the dotcom bubble of the 2000s. The magazine IEEE Spectrum, in the paper "*Metcalfe's Law is Wrong*", argues that the value of a network does not grow as the square of the number of its users, $V \sim N^2$, but much more slowly, $V \sim N * \log(N)$ (Robert Metcalfe, 2006):

$$V \sim N * \log N$$

Since this curves upward (unlike Sarnoff's Law), it implies that Metcalfe's conclusion – that there is a critical mass in networks, leading to a network effect – is qualitatively correct. But since this linearithmic function does not grow as rapidly as Metcalfe's law, it implies that many of the quantitative expectations based on Metcalfe's law were excessively optimistic (Bob Briscoe, Andrew Odlyzko and Benjamin Tilly, 2006).

Metcalfe discusses about this in a paper in 2006 and compares these effects with the network effects of LAN networks. Figure 3 shows how the value of a network of compatibly communicating devices grows as the square of their number, and how the value in dollars becomes higher than the cost of the network after the number of devices reaches a critical mass (Robert Metcalfe, 2006).

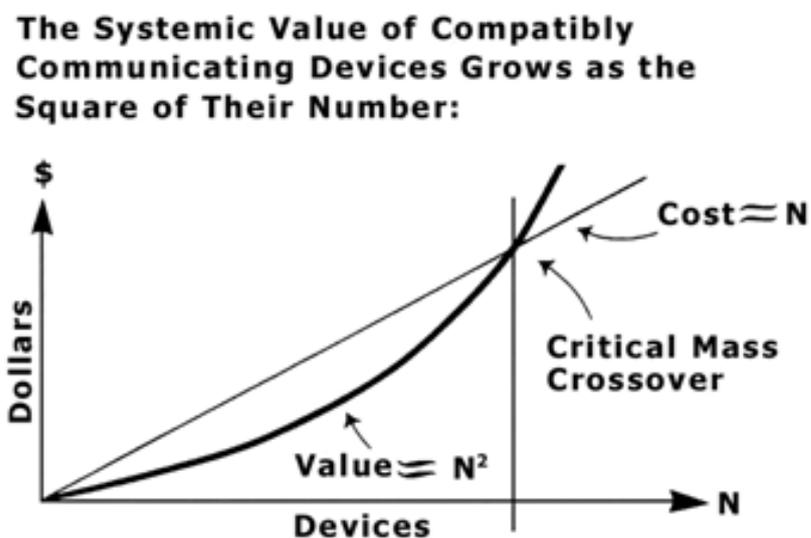


Figure 4. Metcalfe's Law

2.8.3 Reed's Law

Reed's Law was introduced by David P. Reed in 1999 (David P. Reed, 1999). He asserts that the value of large networks, particularly social networks, grows exponentially following the formula:

$$V = 2^N - N - 1$$

where N is the number of nodes in the network.

In an article from 1999, Reed criticizes Metcalfe's Law as being too conservative, and an exponential formula is needed for today's networks (called "Group Forming Networks" by Reed in his 1999 article). He also touches upon the value of 2 interconnected networks, and compares Metcalfe's Law with his formula. Both laws give a powerful bonus to interconnection; mergers and partnerships of networked companies should be able to extract a premium resulting from these laws. He argues that when we combine two networks together so that users of one network can connect seamlessly to users of the other, Metcalfe's Law tells us already that substantial new value is created:

$$(M + N)^2 = M^2 + N^2 + 2MN$$

This bonus term, 2MN, is substantial – up to 100% of the value in the original unconnected networks. Thus there is an enormous incentive to find ways to interconnect networks, since the members of each network can access a much larger set of potential transaction partners. With Reed's Law, interconnection is even more powerful, creating many new potential groups that span the two networks (David P. Reed, 1999):

$$2^{M+N} = 2^M * 2^N$$

As it can be seen, for large values of N (even hundreds or thousands) this formula leads to very big numbers. This suggests that this formula might not be practical for big networks (more than a thousand users), and it yields a very different value compared with the other formulas presented in this thesis.

In a conference talk from 2000, David P. Reed concludes that "gateway partnerships among communities of value may be the most efficient ways to create value", which supports the idea of combining two networks in order to gain more value (David P. Reed, 2000).

2.8.4 Beckstrom's Law

Beckstrom's Law is a relatively recent formula, introduced only 2 years prior to the writing of this thesis. Although recent, it already has its share of criticism. Compared with the other laws which take into account only the number of nodes in the network, Beckstrom's Law calculates the network value based on the value of transactions between the nodes in the network (Rod Beckstrom, 2009).

Beckstrom's Law states that the net present value (V) of any network (k) to any individual (i) is equal to the sum of the net present value of the benefit of all transactions minus the net present value of the costs of all transactions on the network over any given period of time (t). The value of the entire network is the sum of the value to all users, who are defined as all parties doing transactions on that network j (Rod Beckstrom, 2009):

$$\sum_{i=1}^n V_{i,j} = \sum_{k=1}^m \frac{B_{i,k}}{(1+r_k)^{t_k}} - \sum_{l=1}^p \frac{C_{i,l}}{(1+r_l)^{t_l}}$$

Where:

The sum of all $V_{i,j}$ = value of a network j to all users

$V_{i,j}$ = net present value of all transactions to user i with respect to network j, over any time period

i = one user of the network

j = one network

$B_{i,k}$ = the benefit value of transaction k to individual i

$C_{i,l}$ = the cost of transaction l to individual i

r_k and r_l = the discount rate of interest to the time of transaction k or l

t_k and t_l = the elapsed time in years to transaction k or l

n, m, p = maximum number of individuals i and transactions k and l

This formula seems to approximate the value of the network better than the other formulas presented in this thesis, since it takes into account the transaction values between the individuals in the network and not only the number of individuals. The formula is quite complex, since it can be a tedious task to calculate the sum of all transactions in a network with lots of users.

2.8.5 Noriaki Yoshikai

In an article from 2009, Sarnoff's Law, Metcalfe's Law, Reed's Law and Noriaki Yoshikai's model are compared in an attempt to create a customer network value model based on complex network theory (Rong Liu, Jun Ma and Jiayin Qi, 2009).

Noriaki Yoshikai's model is applicable in technology and social networks. It gives the same network value as Reed's Law, i.e. 2^N . It differs from Reed's Law when it is used to calculate the value of two merged networks (2^{N+M} according to Reed's Law):

$$V = \sum_{k=1}^M \frac{N(N-1) \cdots (N-k+1)}{k(k-1) \cdots 1}$$

where N and M are the number of nodes in the 2 merged networks (Rong Liu, Jun Ma and Jiayin Qi, 2009).

3 Methodology

This thesis is an exploratory research, involving a literature review of the methodologies and current research in communities, supplemented by a case study. The conclusions this thesis aims to draw from the review and the case study are to answer the research question and to propose a new framework or theory and directions of further research. Another aim is to find gaps in the literature and to propose further studies.

This thesis employs an inductive and qualitative approach, collecting qualitative data and trying to understand the meanings humans attach to communities. The final aim of an inductive approach is to propose or build a new theory (Jonathan Wilson, 2010).

The thesis takes an subjective view on the subject (thus falling into the interpretivism epistemology) by trying to understand the social world around the subject of communities of customers (Jonathan Wilson, 2010).

3.1 Ethics and law

As required by the master thesis guidelines presented by the thesis supervisor, the ethics and the law will be respected in regards to the parties involved in this master thesis. This is in concordance with the ethics and law guidelines introduced in the book "*Essentials of business research: a guide to doing your research project*", the reference material for the master thesis (Jonathan Wilson, 2010, p. 79-101).

In particular, the trade secrets of Opera Software, the object of the case study analyzed in this master thesis, will not be disclosed. When I met with the company, I let them know that the master thesis will be publicly available, so I signed a non-disclosure agreement (NDA) with Opera Software, which prohibits me from disclosing any sensitive information. Only

information coming from publicly available sources will be used in the master thesis. Furthermore, the competitors of Opera Software won't be affected by my case study.

The master thesis won't affect the image of the University of Oslo, its employees or its relations with the parties mentioned in this master thesis, or any companies mentioned as examples within. Parties outside of the scope of this master thesis won't be affected either.

In the data collection and analysis sections of the master thesis I will use several assumptions, by approximating some sensitive values which are protected by the non-disclosure agreement, such as the cost-per-thousands users (CPM). These approximations are based on my knowledge in the online media, and they are not the real numbers used by Opera Software. These numbers are purely for exemplification only.

3.2 Case study

This section will analyze the company Opera Software, in regards to its network economy. I will try to apply the theory identified in the previous chapter and exemplify it with actual data from Opera Software. Opera Software is a Norwegian software company founded in 1994 in Oslo as a research project in Telenor. Its main product is the Opera web browser (Opera Software, 2011). The main object of my case study will be on the Opera Software's social network My Opera.

3.2.1 Objectives

The objectives of this case study are:

- Identify the success factors of Opera Software's network economy
- Calculate the value of the network with the formulas identified in the literature review, both for the users of the network and for the company itself

The study points of this case study are:

- The business model of the company
- The importance of its network for Opera Software
- The value of the network, both for its users and for Opera Software

From the literature review I identified several key numbers which are important to analyze in the case study. I will use these numbers to analyze the network value of My Opera network:

- *Network size*. I will calculate the network value of My Opera network. As most of the formulas are based on the size of the network, I will collect the network size from Opera Software and apply it in the formulas.
- *Transaction value*. There will be only one average value for the "transaction value", instead of one value for each user. I will use this number to calculate the network value of My Opera network using Beckstrom's Law. As this is a sensitive number for the company (and I signed an NDA), the real number will not be disclosed, but it will instead be approximated.
- *User-generated content*. As Opera Software's revenue model depends on Internet traffic, having user-generated content can increase the Internet traffic and thus the revenue. I will analyze the number of user-generated content items (blog posts, photos, widgets etc). I will also analyze the impact of super-users (the most active users which generate a lot of content and have lots of followers), as this is quite important to the overall network value in my opinion.
- *Network development methods*. I will try to analyze the number of man-hours allocated by the company to develop and maintain its network.

I have decided that the other metrics which I noted down in the Introduction section as possible study points (growth rate of the community, metrics of the branch offices etc) are not needed in my research into the importance of My Opera for Opera Software.

3.2.2 Assumptions

My objective is not to calculate an exact number for the network value. Therefore there will be some sensible assumptions made in regards to some economical values:

- Hourly wage for an employee will be considered 200 NOK on average (Statistisk sentralbyrå, 2010)
- CPM (cost per thousand impressions) will be considered minimum \$0.25 (1 NOK) (Google AdWords, 2011)

User-generated content will be expressed in man-hours, using these assumptions of how many man-hours does it take for a skilled employee to create one item. These assumptions are based on my 7 years work experience as a web designer and software developer:

Item	Man-hours
Browser extensions (add-ons)	5
Desktop widgets	10
Opera Unite applications	10
Opera browser skins	2
Speed dial backgrounds	2
Wallpapers	2

The calculation of Beckstrom's Law is complex and requires knowledge of the value of all transactions in the network. To simplify things, I will assume an average value for all the transactions in the network.

Specifically, I will simplify the calculation of Beckstrom's Law by assuming these values:

Formula term	Value
Average transaction benefit	5
Average transaction cost	1
Average number of transactions for each user every year	10
Discount rate for transactions	0.3

These values were based on my existing knowledge of online communities. Let's say that a typical user of My Opera is creating a wallpaper and uploads it his blog on My Opera. The cost of this transaction will be the expenses paid by the user to his Internet provider for the time he was online while uploading the wallpaper. Since the wallpaper was uploaded without any monetary reward to the user, apparently there isn't any benefit for doing it. But the user will gain an advantage from the uploaded wallpaper in time, as more people download his wallpaper and he gets more visitors, becoming a more respected member of the community. In time the user will earn (benefit) from the uploaded wallpaper as he will be able to attract other people possibly wanting a business deal with him (for wallpapers or other things) and/or convert the number of visitors into money earned through advertising. I will also assume that a typical user has 10 transactions on average in a year (upload pictures, write a blog post, write a forum post etc), and that the discount rate for transactions is 30%.

3.2.3 Data collection

The data needed for the case study of Opera Software was collected from a number of sources. Most data was extracted from secondary sources such as the company's websites and published annual reports. Other data was collected from sources outside the company, for example from the purehelp.no website, which provides financial results for companies over the years. As I spent 2 months working as a marketing intern in Opera Software, there was data collected from that time as well, although most of it won't be published in this thesis because of a signed non-disclosure agreement.

Secondary sources

From Opera Software's online resources, some raw numbers can be gathered which will be used in analyzing the company's success factors in developing its network.

Business model

Opera Software has two basic revenue models (Opera Software, 2011):

- For enterprise products, such as the Opera mobile browser preinstalled on a mobile phone or a set-top box, Opera Software receives revenue as a mix of engineering fees, maintenance fees and shares of sales income. The balance varies from contract to contract. This model accounts for the majority of Opera's income.
- Opera Software also derives revenue from its free products through revenue sharing with partners. For example, several search engines make usage payments to Opera Software for searches made by the Opera web browser users. This is the major source of income for Opera's desktop browser, with revenue shares also in place on a variety of mobile products.

Products and services

Opera Software's flagship product is the desktop web browser, used by more than 160 million people (Opera Software, 2011). The company's experience in developing the browser extended to other markets, by the introduction of the mobile browser.

The main competitors of Opera Software in the browser market are Google (Chrome), Microsoft (Internet Explorer), Mozilla (Firefox) and Apple (Safari). The market share of the Opera web browser is smaller compared with its competitors, having less than 2% of the market compared with Internet Explorer which controlled almost 45% of the market in April 2011 (StatCounter Global Stats, 2011).

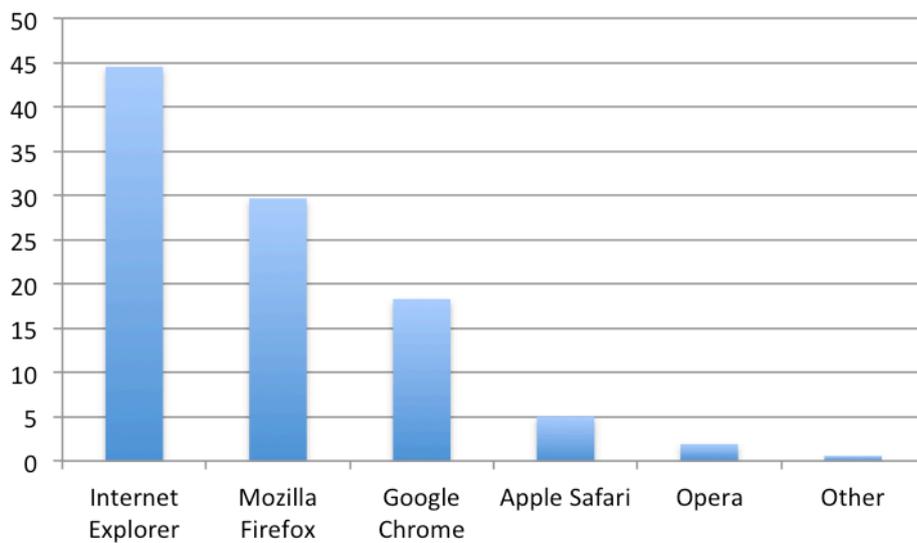


Figure 5. Web browser market share April 2011

The Opera web browser introduced several innovations over the years, ahead of its competitors:

- Turbo: web pages are loaded faster by being compressed through Opera's servers
- Tabs: see multiple web pages in the same browser window. This has become a standard in all other browsers
- Mouse gestures: navigate using the mouse. Some other browsers implemented this as well after Opera Software

This continuous innovation of the web browser is one of the reason the Opera web browser is chosen by people (Opera Software, 2011).

Campus crew

Opera Campus Crew is Opera Software's platform to engage students in introducing web standards in their universities. This is achieved by allowing the students to promote the Opera browser and organize events related to web standards. The students do this voluntarily,

without payment. Opera Software provides resources needed for the events and promotions, such as marketing materials (posters, t-shirts etc) (Opera Campus Crew, 2011).

My Opera

My Opera is an online community where members can communicate with their friends, share pictures, write blogs and participate in groups and discussion forums. It is used by around 6 million people, and it is comparable with huge social networks such as Facebook and My Space, although on a smaller scale and with a different purpose (Opera Software, 2011).

The employees at Opera Software are members of the community as well, and they communicate with other members of the community through blog posts and forums. New versions of the web browser and new features are announced by the employees on their blogs, and these news are sent forward by the members of the community, with the potential of reaching the whole community in a short time. In this way My Opera is used as a broadcast network, and the members of the network which forward the news play the role of broadcast nodes. Without this network it would have been difficult for Opera Software to reach as many users with the news of new versions of the web browser or with new features being introduced in preview versions of the browser (My Opera developer blog, 2011).

According to Opera Software's website, there are several networks of users connected with the company. These are not divergent networks (i.e. there are some users which appear in one or more networks), but each network requires a different approach for developing and maintaining it (Opera Software, 2011).

Network	Members
Opera browser users	150 million
Opera Mini browser users	90 million
Opera Mobile browser users	15 million
My Opera online community	6 million

I decided to concentrate my research on the My Opera network. As I've noticed while collecting data, this network is the most important network of Opera Software. It is a social community where users interact with each other, sharing content (pictures, banners, widgets etc) and whose members use the Opera web browser the most, and recommend the browser to their friends. In this network the super-users can be seen attracting new members, and the employees of the company have their own blogs and act as super-users of the network.

Opera Software benefits from having an involved community. The members of the community create user-generated content (browser extensions, widgets, banners, logos and other materials) which would have taken the Opera Software employees a lot of man-hours to create.

Item	Number of items
Browser extensions (add-ons)	473
Desktop widgets	1772
Opera Unite applications	49
Opera browser skins	20
Speed dial backgrounds	19
Wallpapers	1210

These elements (which are available for free) are one of the reasons people choose the Opera web browser, as the basic functionality of the browser is extended (for free) to their own needs (for example, one of the most downloaded extension is the Adblock extension which blocks advertisements when opening a web page, thus saving bandwidth by not downloading extra page elements, and also making the web page easier to read). The number of the user-generated content found on My Opera is quite low compared with the content created by the users of the competition (Google, Mozilla), but it is still large enough to attract more users to the community.

In addition, the My Opera network is a good source of driving Internet traffic to the Opera Software's website. The users of this online community interact through writing blog posts, discussing on forums and uploading pictures. A lot of this user-generated content relates to the Opera web browser (announcements of new versions, articles for tips and tricks about the web browser etc). Users reading these articles will most likely try the web browser themselves, helping grow Opera Software's installed user base (My Opera developer blog, 2011) (some figures are approximate):

Content	Items
Blog posts	100000
Forum topics	200000
Groups	10000
Uploaded pictures	10 million

My Opera has an **affiliate program** in which users recommend the download of the Opera browser and gain points in return. These points don't have a monetary value, but they can show the users' involvement in the community. There are 116 721 users promoting the download of the Opera browser, and the top 10 users of the affiliate program have generated more than 500 000 downloads, saving Opera Software money which would have been spent on advertising (My Opera affiliate program, 2011).

In fact, Opera Software spends very little money on advertising compared with their competitors in the browser market (Google, Microsoft, Apple). In a 2011 video, Opera Software boasted that they spend USD\$8,000 to create an expensive marketing campaign, ironizing its competitors who spend many times more than that (Opera Software marketing video, 2011).

A fairly new product of Opera Software is a platform for developing and deploying mobile applications, called Opera Appcelerate. The target reach of this program is 100 million users,

which is among the top 10 mobile applications stores in the world. Opera Software is using its network to reach many users and attract new ones through positive feedback and demand-side economies of scale (Opera Appcelerate, 2011).

Internship

I spent 10 weeks working as a marketing intern at Opera Software's main office in Oslo. The objective of the internship was to write the specifications for a community marketing project.

During this internship I was involved in the marketing operations at Opera Software, attending meetings and learning the ways the network of users is helping Opera to attract more users and generate more income.

Many of the employees of the company are engaged with the community, writing blog posts and social media announcements, for example for each new version of the browser. Social media campaigns are used to generate buzz about an upcoming feature.

Since I signed a non-disclosure agreement (NDA), I'm not at liberty of publishing the other insights I got during my internship there.

Interviews

After signing a non-disclosure agreement (NDA), the director of marketing for consumer products answered some of my questions related to the My Opera online community. I'm not at liberty of publishing the answers unfortunately, but after the interviews I understood better how Opera Software is using its community and how important it is for the company.

3.2.4 Data analysis

After collecting data from Opera Software I started analyzing it, in regards to the objectives set when I began writing the master thesis, and connected with the theory I identified in the literature research phase.

Network value for users

With the assumptions made earlier, I can now calculate how valuable is the network My Opera for its users, using the formulas identified in the literature review. The size of My Opera is approximately $N = 6$ million members.

Formulas	Network value (millions)
Metcalfe's Law: $N * (N - 1) / 2$	15.00
Sarnoff's Law: proportional with N	60.00
Reed's Law: $2^N - N - 1$	Huge number
Beckstrom's Law: sum of transactions	184.62

As Reed's Law is an exponential formula, the value calculated with its formula is too big to be represented on a computer, in the order of 2 to the power of 6 million.

These numbers don't say much by themselves, as the values calculated are only used as a comparison value for similar networks, with which a potential user can decide which network is the most attractive for him/her. The numbers can be expressed in money (e.g. NOK) to quickly asses the value of a network in terms of money.

For example, if an Internet user is in the process to decide between My Opera and a competing network X, the user will most likely join the network with the highest number of users. Although this is not always the case, as smaller networks are also growing, sometimes faster than bigger networks. The network value is only a factor in the selection process of a

user when deciding which network to join. Other factors must also be considered to calculate more accurately the network value of Opera Software.

Network value for the company

With the assumptions made earlier, I can now calculate how valuable (in Norwegian Kroner or NOK) is the network for Opera Software.

User-generated content

After adding up the man-hours needed to create the user-generated content identified in section 4.3, I get the number **20653** man-hours.

Item	Man-hours	Number of items	Total man-hours
Browser extensions (add-ons)	5	473	2365
Desktop widgets	10	1772	17720
Opera Unite applications	10	49	490
Opera browser skins	2	20	40
Speed dial backgrounds	2	19	38
Wallpapers	2	1210	2420
Total man hours			20653

Considering that a full-time employee works around 2000 hours per year, we can see that Opera Software effectively saved the wages of 10 full-time employees for a year by allowing its online community to create the user-generated content and share it with the other users in the community. In money, this value is 4 million NOK, a considerable amount considering that in 2009 Opera Software's profit was 28 million NOK, a savings of 14% (purehelp.no, 2009).

Super-users

As I discussed in the previous section, My Opera has an affiliate program in which users recommend the download of the Opera browser and gain points in return. These points don't have a monetary value, but they can show the users' involvement in the community. There are

116 721 users promoting the download of the Opera browser, and the top 10 users of the affiliate program have generated more than 500 000 downloads.

These top 10 users (and some of the following ones in the top 50) are the super-users as defined by Fjell's paper from 2010 (Kenneth Fjell, Øystein Foros and Frode Steen, 2010). These users are active on the blogs and forums, they promote downloads of the web browser, they upload content and they provide the community with information about the browser and the company. Most of these users are on the top of the My Opera community in their own countries (Serbia, India etc), allowing Opera Software to gain market share in those markets without even having an office there.

I will try to estimate how much Opera Software has saved in advertising money through the use of its affiliate program, for the 500 000 downloads generated by the top 10 super-users. According to Google AdWords, the total cost of an advertisement campaign on Google depends on the keywords chosen to promote the downloads (e.g. "web browser"), the chosen CPC (Cost per click) value (minimum USD\$0.01) and the daily budget (Google AdWords, 2011).

I wanted to do a test and I entered those values in the Google AdWords calculator to estimate the total cost of a campaign to get those 500 000 downloads:

- Keywords: "web browser"
- Max CPC: USD\$1
- Daily budget: USD\$1,000
- Location: all countries

With these values I got from Google AdWords that I will get an estimated 109 clicks every day, at the price of USD\$69.56 daily. So in 4587 days (almost 12 years!) I would have those 500 000 downloads, paying USD\$34,780 in total.

Since this would take too much time, I changed the values to the following:

- Keywords: "web browser"
- Max CPC: USD\$10
- Daily budget: USD\$10,000
- Location: all countries

With these values I got from Google AdWords that I will get an estimated 634 clicks every day, at the price of USD\$2,765.44 daily. So in 788 days (a little over 2 years) I would have those 500 000 downloads, paying USD\$2,179,166 in total, or 16 million NOK.

So we can see that the super-users save Opera Software a lot of money which would have been spent on advertising. The role of super-users is thus important in a network economy.

Opera Campus Crew

The Opera Campus Crew program allows members of My Opera to promote the Opera web browser through seminars and events about web standards in universities. The cost and the benefits of this program can't be disclosed though, as they are protected by an NDA which I signed.

Revenue

The value earned by Opera Software through advertising contracts is secret. But with the assumptions made earlier, I can approximate the company's revenue through advertising.

Since there are 150 million users of the Opera browser, with an assumed CPM value of USD\$0.25, the revenue potential is USD\$37,500 for 150 million ad impressions. Assuming that there are 10 million ad impressions every day, Opera Software's ad revenue could be USD\$75,000 every month, or 5.4 million NOK every year. These figures are only approximative.

4 Discussion

4.1 Case study results

As we've seen in this case study, Opera Software benefits from having a big network not only by earning revenue through advertising, but also by saving money through the content generated by its network, and the money saved in advertising their products by using the super-users of its network.

In the Opera Software case study we have seen that the network is valuable both for Opera Software and for the members (users) of the network.

Opera Software realized that in order to succeed against giants in the browser market (Google, Microsoft, Apple, Mozilla) it needs to have a good strategy, in which the online community plays a big part:

- Have a good product with innovative features, ahead of the competition
- Use the online community by allowing the users to share content
- Limit the use of advertising money
- Attract new users through innovative marketing methods such as the Campus Crew program and the use of social media

Concerning users, choosing a browser (which translates to choosing a network) is not as critical as for example choosing a platform between Wintel and Apple. Almost all browsers nowadays support add-ons and importing settings and bookmarks from other browsers, so a user can switch from one browser to the other (and from one network to the other) easy and without problems (low *switching costs*). The training time needed for the switch is minimal.

Often times, the choice of a browser depends on the user's respect for the company producing the browser, the user's friends using the same browser, the browser's features and other external factors. This is where Opera Software is trying to innovate and attract users.

Opera Software's vision is a future web with open standards (Opera Software, 2011). Users from other browser networks which might not have open standards are attracted to Opera Software because by this vision it will be easy to access any content without obstacles (often artificial) put up by the creators of content viewers (e.g. Adobe Flash), and furthermore all web pages will look as intended by their creators if said creators also used open standards (e.g. HTML, CSS etc).

Opera Software's network My Opera is a good example of a network of users useful for both the company and for the users themselves. It has a great value for its users, as they share content and get recognized by participating in Opera events and online discussions. It also of a great value for the company, as Opera Software saves a considerable amount of money by allowing its users to share their content and attract more users to the network through the super-users and employees' blogs.

My Opera is organized as an **integrated** and **compact** network, with everything inside: users' blogs, employees' blogs, groups, forums, photo albums, friends relations, affiliate marketing. This integration is what sets apart Opera Software from its competitors: Google, Mozilla Foundation, Microsoft and Apple don't have a similar integrated network for the users of their browsers. They have forums on one website, blogs created by super-users on separate websites, employees' blogs on yet another website etc. The competitors also don't have friends relations between the users.

Even though the network value as calculated by existing formulas is greater for all of Opera Software's competitors, Opera Software's network of web browser users growth rate is high for its small size, due to the high value of the My Opera network (Opera Software, 2011).

When looking at My Opera through the lens of the network economy concepts identified in the literature review, we can see that it enjoys a *positive feedback*, being in a *virtuous cycle* as more and more users are joining the network. The growth is fueled in part by the *super-users* of the network, the most active users, some of which are also engaged in the affiliate marketing program of My Opera. The network has reached its *critical mass*, being able to attract more users without struggling as in the beginning. The *switching costs* are low for most users, both when joining or when leaving My Opera to another network, because there are only a few items to transfer (blog, photo albums, friends relations etc); but the switching costs could be high for super-users, as they already have lots of blog posts, photo albums and friends relations.

4.2 Limitations of existing research

I realized that the network value formulas identified in the literature review do not take into account several factors in the calculation of the network value.

The first of these factors is the impact of *super-users*, the trendsetters in the network. A better formula is required to better approximate the network value, which should take into account the number of super-users and their impact in the network (measurable for example by their number of followers and the value of their user-generated content).

The second factor is the involvement of the company (the "*sponsor*") in their own network. As we have seen in the Opera Software case, the company invests some resources in the

network, such as money and manpower (for example employees' blogs, the Campus Crew project etc). This investment has the long-term effect of developing the network and increasing its number of users.

Other factors which might be useful in better approximating the network value are: the openness of the company (users are more likely to join an open network instead of a closed one), ethical and moral values (for example is the company running its business in a responsible way compared with its competition?) and other human factors. Most of these factors are difficult or even impossible to measure, but in my opinion they should be mentioned when calculating the network value.

The conclusions I have reached from analyzing the network value theory suggest that the theory is not complete and needs to take into consideration all factors when calculating the network value.

4.3 Network value

The network value is a measure of the total value of the network, which is used to compare networks. The literature review suggested that the network value depends on the number of the users in the network, and most formulas used to calculate the network value are based solely on this number. I identified different formulas used to calculate the network value, and noticed that some of them (in particular Reed's Law) are growing too fast (exponentially) compared with the other ones, making it unusable for large networks. I also noticed that Beckstrom's Law can give a better approximation of the network value by summing up the transactions between users, but it is a complex formula which is difficult to calculate. Also, it is still a new formula which has its share of opposition from the supporters of the other formulas.

A new user wanting to join a network is faced with a choice of competing networks, each with their own network value. At a first glance the user will choose the network with the highest value (i.e. the most users, according to the network economy literature). But there are still lots of users joining smaller networks (for example choosing to buy an Apple computer instead of a Wintel one). So the value of the network in regards to the user isn't based solely on the size of the network, but other factors come into play as well. I have tried to identify those factors in this master thesis, and I will list some of them again here:

- The impact of super-users, the trendsetters in the network. For example in the case of computer producer networks, bloggers and journalists (acting as super-users) are praising a network (Apple, Wintel) which in turn impacts the decision of some users to join a network or another.
- The impact of the company (the "sponsor") on its network. As we have seen in Opera Software's case, the company invests resources into maintaining its network through employees' blogs and the Campus Crew program, allowing it to attract more users.
- Openness of the network. As a company opens its products specifications and allows its users to create content (applications, widgets etc) based on these products, more and more users are attracted by this openness, increasing the size of the network.

These factors are not totally dependent on the size of the network, which implies that there are gaps in the literature in regards to the identified formulas used for calculating the network value. As I was calculating the value of Opera Software's network, I have also included the user-generated content and applications (which can be assumed to originate from super-users for the most part, and it is an indirect result of the network's openness) and the impact of the company on its network (the Campus Crew program). Taking into consideration these factors

as well when calculating the network value, I arrived at a better approximation of the network value for Opera Software.

In my opinion, the network value formula which is the closest to approximating the real value of a network is Beckstrom's Law. But as I have noted earlier, it is criticized by others, and it doesn't take into account other factors influencing the value of a network. Using the results from the case study, I can now approximate the network value of My Opera in Norwegian Kroner (NOK), starting from Beckstrom's Law and adding up the other values identified in the case study:

- My Opera network value as calculated with Beckstrom's Law (approximative): **184.62** million NOK
- User-generated content value (browser extensions, widgets etc): **4** million NOK
- Affiliate program (savings of advertising money for reaching 500 000 downloads): **16** million NOK

By adding these values up, I get the number **204.62** million NOK as the value of My Opera, which is a better approximation of the real value, in my opinion. This value is approx 10% higher than the value calculated using Beckstrom's Law, approx 13 times higher than the value calculated with Metcalfe's Law (15 million NOK), but much lower than the value calculated using Reed's Law (which is in the order of 2 to the power of 6 million).

This is only an attempt to better approximate the network value of My Opera. As I have noted earlier, there are other factors which should be taken into consideration in this calculation, but which are outside the scope of this master thesis.

4.4 Network strategy

There are many examples of businesses which had the biggest network in their industry and they didn't generate profit for a long time. Two of those stand out: YouTube and Twitter.

YouTube is the most used video sharing platform, with a market share of around 43 percent and more than 14 billion videos viewed in May 2010. The technology needed to handle this is expensive, and the cost of running the platform (servers, electricity, location etc) was more than \$5 million USD monthly in 2006. YouTube's business model is based on advertisement, not member fees or content fees (Don Tapscott and Anthony D. Williams, 2008). YouTube is running with huge loses, estimated at around \$174 million USD in 2009 (source: Wikipedia.org).

The second remarkable example is Twitter. Twitter is the most used micro-text sharing platform, with over 50 million users. The technology needed to run a micro-text sharing platform is not too expensive, as less hardware is required compared with YouTube. But again, the business model of Twitter didn't include ways to generate revenue from the members, and did not even include advertisements. Twitter was used by "everyone", but did not generate profit. The solution to this is a method to generate profit, or to be bought by another technology company which can change its business model to a profitable one (source: Wikipedia.org).

These two examples (out of many similar ones) show that even if a business has the biggest market share in its area, it still needs a good strategy to ensure that profit can be earned by capitalizing on the market share advantages.

If a business decides to increase its network, it must first ensure that its infrastructure will handle the increase in the network. This means to have a clear strategy for growing the infrastructure if needed. As the YouTube example showed, a huge increase in the network means huge recurring expenses to keep the infrastructure running at maximum capacity. There are lots of examples of businesses which failed because they didn't plan for an increase in their network of users.

The second thing a business must plan for is to have a clear business model, which will take advantage of the increasing network. The way to do this is dependent on each business, for example: membership fees, advertising, sponsorships etc. Without a clear business plan, businesses might develop beyond the critical mass and become leaders in their fields, without actually making money, as was the case with Twitter and YouTube. The business model must also include aspects of integration between users. As the My Opera example showed us, an integrated and compact network where users can share content, have friends relations and participate in discussions is more valuable than a disparate network with content in one place, discussions in another place, no friends relations etc.

The third thing a business must plan for is how to get to the *critical mass* of users. Especially if there are other established competitors in the market, it will be difficult for newcomers to gain a lot of new users. Example strategies for this include:

- offering free trials of the products
- giving rewards to users for refering their friends
- freemium products (the product is offered in a free simple version and a paid advanced version)
- partnerships with other companies offering complementing products
- sponsorships of events

- use of social media campaigns

Using "traditional" marketing methods like direct selling to customers might work as well in attracting new users. Word-of-mouth is a powerful tool for marketers, and this should be used to try to reach critical mass.

4.5 Conclusions

I started my research for this thesis with the intention to study the importance of network economy for businesses. My motivation came from having been in contact with online communities in my work life.

During the literature review I identified the most important concepts in network economy and how they influence businesses. One of these concepts was network value, which is used to value and compare networks. There were several formulas identified for the calculation of the network value: Sarnoff's Law (1940s), Metcalfe's Law (1993), Reed's Law (1999), Beckstrom's Law (2009), Noriaki Yoshikai (2009). All these formulas are based on the size of the network, with the exception of Beckstrom's Law which takes into account the benefits and costs of transactions between the users in the network.

I applied the theory in practice in a case study of Opera Software. This company has a good example of a community in the form of My Opera, which they use to build and retain their user base. After I collected and analyzed the data about this community I realized that the formulas for network value found in the literature review lacked several factors: the impact of super-users, the involvement of the company and the openness of the company. These factors weigh heavily in the Opera Software's network, as My Opera is apparently more valuable than it was calculated with the identified formulas, based on my analysis.

So as a conclusion to my research, in my opinion the existing literature in network economy is limited because it doesn't take into account these other important factors when calculating the network value. The most important factor in my opinion is the impact of super-users, which should be studied more in order to better understand the importance of network economy for businesses.

5 Further research

My thesis only touched upon the importance of network economy for businesses, identifying important concepts like network effects and different methods used to calculate the network value. One of the conclusions of the thesis is that the network value formulas are limited as they don't take into account the role of super-users, the openness of the network and the involvement of the company in the network. A possible research paper would be one which develops a theory for quantifying such factors into a unified formula for calculating the network value.

Another paper can be written to further study Beckstrom's Law, analyzing its usefulness and developing easier methods to calculate its value. Beckstrom's Law is a relatively new theory, and probably not understood fully because of the complexity of the formula. Even if it's only 3 years old, it already has had its share of opposition and criticism, which should also be analyzed by that paper.

Yet another research paper can be written on the psychology of the customers in the network economy. Understanding the customers, their needs and reactions to changes in the business environment can go a long way into understanding how to increase the profit of a business. Some companies might be already employing psychologists to help them understand their customers and create marketing campaigns suited to their needs. Not all these campaigns are successful, mostly because this area is not fully explored yet.

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