NTNU – Trondheim
Norwegian University of
Science and Technology

The Future of the Mobile Application Market

Andreas Jørgensen

Master of Science in Communication Technology
Submission date: May 2014
Supervisor: Jan Arild Audestad, ITEM

Norwegian University of Science and Technology
Department of Telematics

Problem Description

Name of student: Andreas Jørgensen

The future of the mobile application market.

A look into the future of the mobile market. Applications like Snapchat, Vine and others are subject to high valuations which seems to know no limit, and there will always be discussion on whether these valuations have roots in reality or if these are numbers way to high and will be victims of a market downfall, similar to the Dot Com bubble. The question whether these valuations are justifiable are looked into by combinations of valuation methods and prognoses of how the market will develope in the futue. While some applications put all their eggs into the ad-basket that might be profitable in the future, leaving high risks of failure, but also possibilites of great rewards, others focus on income from other services the application actually delievers to the users, like up front payment and in-app purchases.

Learning from history is important, so a thorough comparison of the dot com period and the situation today can be valuable in establishing some of these answers.

Assignment given:

Supervisor: Jan A. Audestad

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Abstract

The smartphone market and the mobile application market is booming up in tact with smartphone shipments estimated to double in 2016 and with approximately 100 000 new mobile applications being uploaded every month to Appstore and Google Play combined it is obvious that the mobile application market is emerging. Digital advertising is becoming smarter and more valuable and less extreme userbases are required to be able to profit from mobile advertising. But even though more and more applications enter the market only few will survive over time and only few will be able to generate revenue from advertising. Snapchat is a good example of one of the mobile applications with huge potential in terms of mobile advertising and was of the beginning of 2014 valued to over $3-4b, but might have a limited timeframe to live up to the high valuation as different risks exist and could influence the further development of the Snapchat userbase. History also plays a big part when it comes to analysing the future of Snapchat, and Snapchat can be seen as in the same category as many online social networks that have failed over time. The few apps that make it to the top almost always reside in the category of social apps (or anti-social apps as discussed in section 4.3) but there does not seem to emerge a Winner takes it all-market, mainly very often because of some sort of product differentiation between the different social or anti-social mobile applications, and because of different mobile applications enters different geographical markets at launch, and therefore already has a big userbase before entering markets with already existing similar applications. A good example might be the three very similar mobile messaging apps Viber, WhatsApp and WeChat, all having large userbases around the world. Games also seem to be in the top layer when it comes to revenue generation, but the market for games is clogging up and might give less opportunities in the future. Another conclusion from studying the mobile application market is that many users are fleeing from social networks (like Facebook and Twitter) to anti-social networks where users only connect with a few number of users. This might be one of the reasons that Snapchat has gained the popularity as it has and why Facebook deciced to acquire WhatsApp for $18b.

Sammendrag

Smarttelefon- og det mobile applikasjonsmarkedet vokser drastisk med et estimat at solgte smarttelefoner vil dobles i 2016, samtidig som det introduseres rundt 100 000 nye mobile applikasjoner hver måned til Appstore og Google Play. Digital annonsering blir smartere og mer verdifull enn før noe som krever en mindre ekstrem brukerbase for å kunne profitere fra mobil annonsering. Men selvom flere og flere applikasjoner introduseres i markedet, så vil bare noen overleve over tid og veldig få vil være i stand til å generere inntekt fra annonsering. Snapchat er et godt eksepmel på en mobil applikasjon med veldig stort potensial mtp. mobil annonsering og var i begynnelsen av 2014 verdisatt til $3-4b men kan ha en begrenset tidsramme til å leve opp til den store verdisettingen da forskjellige risikoer eksisterer som kan sterkt påvirke den videre utviklingen av brukerbasen til Snapchat. Historie spiller også en stor rolle når det kommer til analysering av fremtiden til Snapchat, og Snapchat kan ses i samme kategori som mange sosiale nettverk som har feilet over tid. De få applikasjonene som faktisk klarer å klatre til topps ligger som oftest i kategorien "sosiale apper" (eller "antisosiale apper" som diskutert i seksjon 4.3), men det viser seg at det ikke forekommer et marked hvor en aktør tar hele markedet, ofte på grunn av en form for produktdifferensiering mellom de forskjellige sosiale- eller antisosiale applikasjonene, og fordi de forskjellige applikasjonene entrer markedet på forskjellige geografiske lokasjoner. Et godt eksempel på dette er de tre lignende direktemeldingsappene Viber, WhatsApp og WeChat som alle har store brukerbaser rundt i verden. Spill ses også ofte å befinne seg i toppsjiktet når det kommer til inntektgenerering, men markedet for spill begynner å tette seg og det kan virke som det blir mindre muligheter her i fremtiden. En annen konklusjon fra å studere det mobile applikasjonsmarkedet er at mange brukere forsvinner fra de sosiale nettverkene og går over til antisosiale nettverk hvor brukerne bare kommuniserer med et fåtalls andre brukere. Dette kan være en av grunnene til at Snapchat har opplevd en slik økt populæritet og hvorfor Facebook bestemte seg for å kjøpe opp WhatsApp for $18b.

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Chapter 1
Introduction

The smartphone application market is gaining increasing economic importance in light of the rising numbers potential users and the vast number of new applications being uploaded every day. Even though many of the million new apps being uploaded during 2014 (see section 3.3) has low or no commercial value, some rise up to be valued as multi billion dollar applications. Also in these rare cases one will see the many disagreements on the valuation among investors and media because of the highly unstable market that is the app market. The team behind the photo sharing application Snapchat recently declined both offers from Facebook and Google ranging between $3b and $4b[2] and there are ongoing discussions on whether these valuations have roots in reality or if these are numbers way to high and will be victim of a market downfall, similar to the Dot Com bubble or a victim to the classic case where people are simply rejecting the service over time, bringing all the other users with them as well in the fall like some domino effect. The reasons for this scepticism, besides the unstable market situation, come from the fact that Snapchat is free for the end-user and has no advertising, and therefore has no current income. This thesis first brings up the risks related to the mobile application market trying to point out factors that contribute to the great scepticism among those who strongly disbelieve that the economic possibilities will outdo the risks. The chapter "Possibilities" focuses more on the fact that there are huge potentials in the market, often because of the heavy increase in smartphone shipments worldwide and the new and more valuable advertising options entering the digital world. Before, social networks were on the rise, but now many users are fleeing from the social network to the so called anti-social networks which comes with interesting properties that changes the market behaviour from the way social networks have formed it. This chapter discusses the anti-socal networks with an angle on how they change the market behaviour and why they are becoming more and more popular among end users. This thesis also investigates cetain openings in the application market typically in terms of uncongested app categories.

The chapter “Case study - Snapchat” combines the findings from the previous chapters to predict how Snapchat usage will develope, whether it will be able to generate revenue and discusses the valuation claim from different angles with focus on revenue, net present values and a comparison valuation where earlier acquisitions in the application market can establish some sort of indication.

Research Question
The main research goal of this thesis is threefold:

- To get an overview of the situation today in the mobile application market from an economical point of view.
- To be able to give indications and pointers regarding the future of the global economy in the mobile application market, which parts of the markets are uprising and how the mobile application market will influence other markets in the future.
- To conclude whether the high valuation of mobile applications circling the news are realistic.

Methods
This thesis is mostly based on literature studies with the foundation in already existing knowledge about the subject. When it comes to mapping the current state of the mobile application market it is expected that a lot of statistics and general info are collected both from media sites and dedicated sites for statistics. In the prediction of the future it is also expected to gather information from media sites, but mostly with the use of fundamental theory applicable to the mobile application market in combination with future predictions from earlier reports and from dedicated statistic sites. A simulation model with basis in fundamental theory is also to be developed in order to obtain knowledge about the future state of some of the most popular mobile applications today.

Chapter 2
Background

2.1 Brief History

In mid 2008 both Apple Appstore and the Android Market (Later to become Google Play) launched, and already as of October 2013 there were about 2 000 000 applications residing in the two stores, divided approx. evenly [3] [4]. Other appstores exist as well, as for example the Windows Phone store, but main focus resides on the two former because of their great market sizes. Since of launch, the application market has been in exponential growth with for the Apple Appstore, one billion apps were downloaded as of April 2009, ten billion apps as of January 2011 and the number of annual downloads for both Apple Appstore and Google Play reached 102 billion in 2013 [5]. And with both the number of smartphones and adaptors increasing vastly, the mobile application market is predicted to continue its quantitative growth in the future.

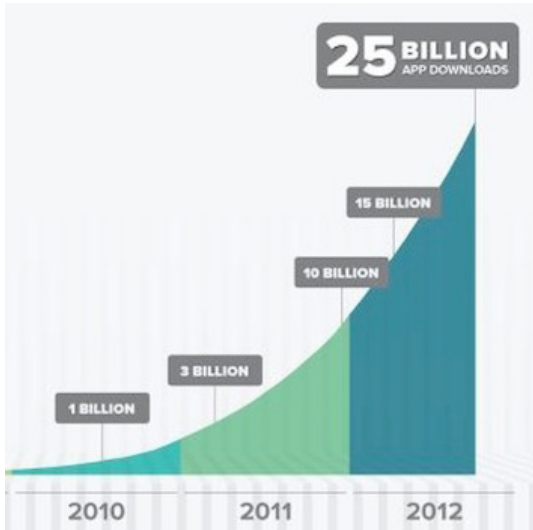

Figure 2.1: *Development of app downloads on Google Play.*

102 billion app annual downloads (approximately with Apple Appstore and Google Play combined) is a lot, and it might sound like a potential gold mine for developers wanting to make money of their applications. But, one of the main issues related to these flashy download numbers is that they are not evenly distributed over all the two million applications out there as seen in figure 2.2 only a minimal amount of free aplications on Google Play are downloaded between 500 000 times

and 1 000 000 times. Even smaller is the amount of paid-for downloaded applications with the same amount of downloads, and the number of apps downloaded less than 100 times almost reaches 500 000 for Google Play. And even if they were evenly distributed, the actual value of one download may not be what developers are hoping, and one can flip the nice calculation including number of billions to a more realistic scenario, which is that in average, an Apple app download is worth $0.175 for the developer including all in app purchases and revenues, and not just the original sale[6]. And with the unevenly distributed number of downloaded applications, it might point towards a market with some actors being able to make good revenues of their applications, but for most other actors, this is not the case. If comparing with figure 2.2 one can then claim the following for mobile applications in Google Play.

- Almost half of the applications have potential to generate zero revenue.
- About one out of three have potential to generate $17 - $170.
- About one out of three have potential to generate $170 - $1700.
- About one out of four have potential to generate $1700 - $17 000.
- About one out of 15 have potential to generate $17 000 - $85 000.
- Not more than one percent have potential to generate $85 000 - $170 000.

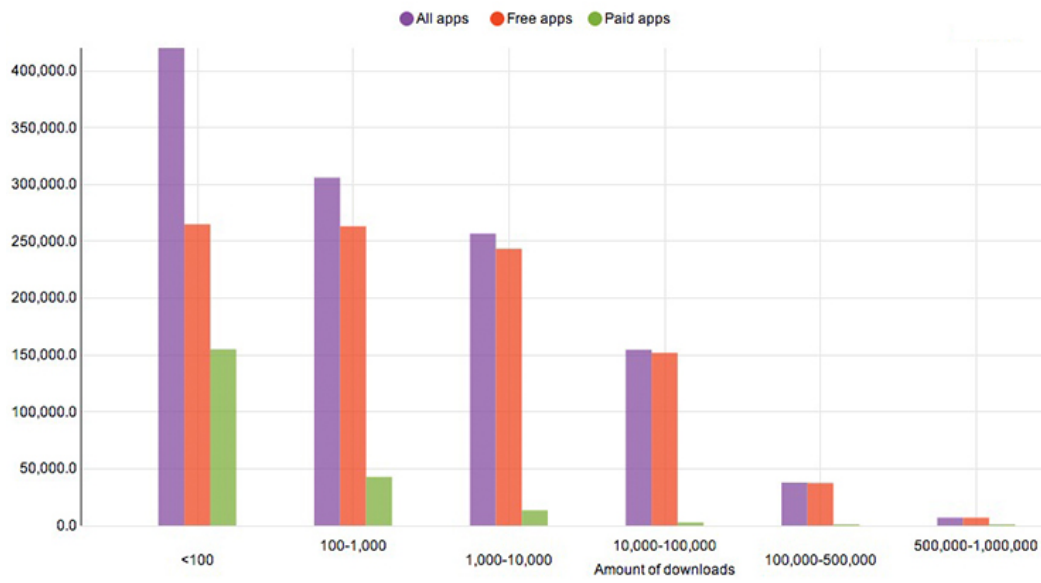

Figure 2.2: *Number of downloaded apps on Google Play. Free vs paid apps.*

Of course, these numbers are only based on the number of downloads and the average value of an application download, and does also not cover the whole life span of the applications. Which categories these apps belong to is also not included, but as seen in section 4.2, mostly games accounts for most of the high revenue streams which is also makes their average download value much higher, and again leaves the other applications with a much lower average download value. Now, the figure also exludes applications with over 1 000 000 downloads, and of course this is where the big money is, but one can also see the minimal percentage of applications residing in this area. The problem with making games is that the production cost is usually higher than for more simple applications, so the total income needs to exceed a greater value to be able to make a profit and this is just one of the many risks to be found in the mobile application market.

2.2 Useful terms

There are some useful terms related to the market and market dynamics in the mobile application market and which also can be useful when studying the thesis.

Mobile apps
A mobile application, often simply referred to as "app" is an application software which runs on smartphones, tablets and other mobile devices. Like in the same way poeople use programs on their computers, these programs have also been shifted towards the mobile device market. Applications can be any type of program, games, text editors or maybe navigation systems typically utilising GPS. Applications are mostly distributed through two main marketing channels: The Apple Appstore for iOS users and Google Play for Android users[1]

Retention Rates
Retention rates describe user activity and can in subject of mobile applications be defined as the number of returning user over time. For instance, if ten users download an application one day and three users are also using it the next day, the retention rate is hence 30 percent this day.

Social Networks
Social networks are often found in mobile applications and is in the mobile case the set of application users with connections between them. These connections enable users to communicate with each other in different ways depending on the nature of the application. Popular communication methods include messaging, photo sharing

[1] iOS is the operating system in the Apple‘s iPhones and iPads. Android is also an operating system runing on most other smartphones in the world.

and "news feeds" where all the users contribute to a common feed of photos, status updates and so on.

Anti-Social Networks
Despite the name, anti-social networks are actually in parts very similar to social networks in the way that users are connected, but the main difference is that in the anti-social networks the number of connections is much lower than in the social network case. An example from daily life could be that in the anti-social network one is only connected to ones closest friends, while in the social network you are also connected to all the people you might have met once but never really talk to, thus the number of connections is much higher in the social networks.

Network Effects
Network effects can be described as the market behaviour where the action from users effects the action of other users in the market, both in a positive and a negative way. In the positive feedback case, when for instance a user downloads an application, more users might also download it as well. In the application market, there are three main ways to gain from network effects.

- Word of mouth. Users are recommending the application to other users.
- Social networking effects. Users gain more when there are other users connected to the application. Hence, when some users connect, even more will then connect as well.
- Top lists. Both Apple and Google provide lists of popular applications. This can be a major boost for an application. Applications‘ positions on the list is decided by their daily download rates.
- Ratings. Applications with better user ratings will be more likely to see an increase in downloads than one with a lower rating. Users can usually rate applications between one and five stars.

In negative network effects, there are both word of mouth effects and social networking effects - but in a negative way. Users are now discouraging other users to download the application, and some social networks are ditrementing from the fact that more and more users are joining. This is called a "Snob effect" and has already started to show on the popular social network Facebook.

Google Search Query Data
In this thesis, there has been actively used Google search query data for many of the analysis. These search queries are obtained from Google‘s "Google Trends" service which shows relative numbers (Google Trend Indexes) with regards to Google search queries over time which tells something about how much users are looking for certain data on Google. An example could be Snapchat. If Snapchat is analysed for a period of three days, and the number of "Snapchat" searches were on Monday: 1 million, on Tuesday: 2 million and on Wednesday: 1.5 million, the relative numbers used by Google Trends would hence be: Monday: 50, Tuesday: 100 and Wednesday: 75. Google does not provide actual query numbers and one can only get access to the relative search query data.

So how will the market develope? The many risks, opportunities and application statistics may help to provide some answers.

Chapter 3
Fundamental Risks

The mobile application market is highly unstable for numerous reasons and the possible risks related to it very much contribute to the value of different mobile applications in the market. Some of the risks are general for social networks and therefore relates to the mobile application market where many of the most popular services are based on social networks. Other risks are directly related to the mobile application market.

3.1 What History tells us

When studying the future of the mobile application market one can benefit from looking into historical events related to similar markets typically regarding the IT industry. By drawing parallells between these markets one can obtain knowledge about how the market might develope.

3.1.1 Dot Com Bubble

In 2001 the Dot-com bubble burst and marks a period where many Internet companies faced massive failures and drastically loss of value on the stock market. [7] The companies‘ main policy was to focus on growth over profit where they assumed that when the customer base was big enough, profits would rise. People would invest lots of money into Internet companies, and companies could increase their stock price by simply adding a “e-” prefix in front of their name, or “.dom” in the end.[8] The stock market in America rose drastically during this period, and hundreds of new companies were founded weekly.

Figure 3.1: *Nasdaq Composite in the period 1983-2002*

The problem was that the growth of the tech sector did not increase the way people predicted and the companies could not generate enough revenue to be profitable. The companies were very much overvalued, but the profits never came and in the end they were left worthless. Many of the companies lacked business plans, had no earnings and still were able to raise big sums of capital, hoping they would keep growing and growing. Pets.com, a former dot-com enterprise was losing money before it went public and still raised billions of dollars. Even the worlds largest online retailer Amazon [9] went from $107 to $7 dollar per share at its worst [10]. Amazon was one of the few companies managing to surpass the burst in the end, and as of 5. of February 2014 has a stock price of $346.45 [11]

The IPOs[1] of internet companies emerged fast, and investors were blindly investing in companies without even looking at a business plan to find out, for example, how long the company would operate before making a profit, if ever. The first signs of the bubble came from the companies themselves and many of them reported great losses and some were out of business only months after their IPO. In 1999, there were 457 IPOs, mostly IT related. 117 of these companies doubled in stock price on the first day after IPO [12]. In 2001 the number of IPOs went down to 76, and

[1]Initial public offering. The first sale of stock by a private company to the public.

where none of them doubled on the first day.

Parallels to the mobile application market

There are similarities between the Dot-com bubble period and the mobile application market today. First, similar to to the valuation of companies in the Dot-Com period, Snapchat has been highly valuated not because of their current profits (which there is none of), but because of their potential profits in the future because of the high number of users and the potential high further growth in the user base. The smartphone market is in heavy increase (see figure 3.2) and mobile advertising is projected to increase 64 percent in 2014 [13], so there is clearly some potential, but because of potential missing business models, Snapchat could also of course have difficulties in monetising and therefore not live up to the high valuation. One example of lack of business model for Snapchat is the possible low level of attractiveness for advertisers. [14]

Worldwide mobile device shipments in 2012 and 2016 (millions of units), according to Canalys

Type of device	2012 shipments	2016 shipments	2012-16 Growth
Basic phone	122.0	58.0	-17.0%
Feature phone	770.8	660.9	-3.8%
Smartphone	694.8	1,342.5	17.9%
Tablet	114.6	383.5	35.3%
Notebook	215.7	169.1	-5.9%
Netbook	18.3	0.3	-65.4%
Total	1,936.2	2,614.2	7.8%

Source: © Canalys (Feb 2013)

Smart connected device market by product category (shipments in millions), according to IDC

Type of device	2012 shipments	2012 market share
Smartphone	722.4m	60.1%
Tablet	128.3m	10.7%
Portable PC	202m	16.8%
Desktop PC	148.4	12.4%
Total	1201.1m	100.0%

Source: © IDC (Feb 2013)

Via: © mobiThinking

Figure 3.2: *Worldwide mobile device shipments in 2012 and 2016*

One big difference between the Dot-Com bubble and the mobile application market is that many of the ideas like online shopping and targeted marketing were premature. [15] The clothing company Boo.com which went out of business following the Dot-com bubble is a good example of how internet shopping was simply too much to handle for both computers (in terms of processing power) and people and so the shopping experience became too poor. Of course, this was only one of the many faults the company did, and the company burned around $188 million in just six months in an attempt to create a worldwide fashion e-tailer, but the sales did not match the expectations. Boo.com's rapid expansion and its staff's spending on luxury offices, first-class plane travel and five-star hotels came to symbolise the excesses of the Internet boom. [16] The companies now do not have the same issue

regarding premature markets and targeted marketing. Snapchat is a very intuitive and simple application and should not have issues regarding this.

So there might now be a more receiving market in terms of adaption of the new emerging services than it was in the Dot Com-era and the risk of prematurity does not seem to apply now in the same way as before. People nowadays actually adapt new technologies and services rather quickly, and the risk is more moved to the issue of rejection which comes in a later phase after adaption (see section 3.2).

3.1.2 Online Social Networks that have failed

Snapchat can be regarded as a social network (Altough also as an antisocial network. See section 4.3), and one of the reasons for the scepticism around the valuation of this company is because a vast number of social networks have failed before. MySpace is a social networking service founded in 2003 and was the most visited social networking site in the world between 2005 and until early 2008. It was also in 2006 a more visited website than Google in the United States. [17] In April 2008 however, Facebook surpassed Myspace as the number social networking site on the web [18], and since then the activity on MySpace has been decreasing. Figure 3.3 shows the development over time from the perspective of Google Trends and shows that since the peak at July 2007, fewer and fewer Google searches for MySpace has been recorded. Many other social networking services have also suffered the same fate as MySpace. Social networks like Friendster, Last.FM and the two Norwegian social networking services Nettby and Blink have all had very similar development in Google Trends as MySpace. So why did these networks start deteriorating so quickly after peaking? Of course many reasons contribute to the final result, but some central ones are pointed out like general adaption and rejection (see section 3.2) which is discussed together with an irSIR model of online social network dynamics. Social resilience (see section 3.2.2) defines how resilient social networks are to changes in the environment and has also been a big reason for the failures of previous big online social networks.

Figure 3.3 shows the development of four former online social networks in terms of Google Trends and they all show a rapid declinement after reaching the top and MySpace, Friendster and Blink had an average lifetime at around 24 months after reaching the top. When comparing these social networks to popular social mobile applications, section 5.4 might indicate the same declinement for Snapchat. Last.FM also quickly started declining, but still managed to have a lifetime at around 59 months after reaching the top.

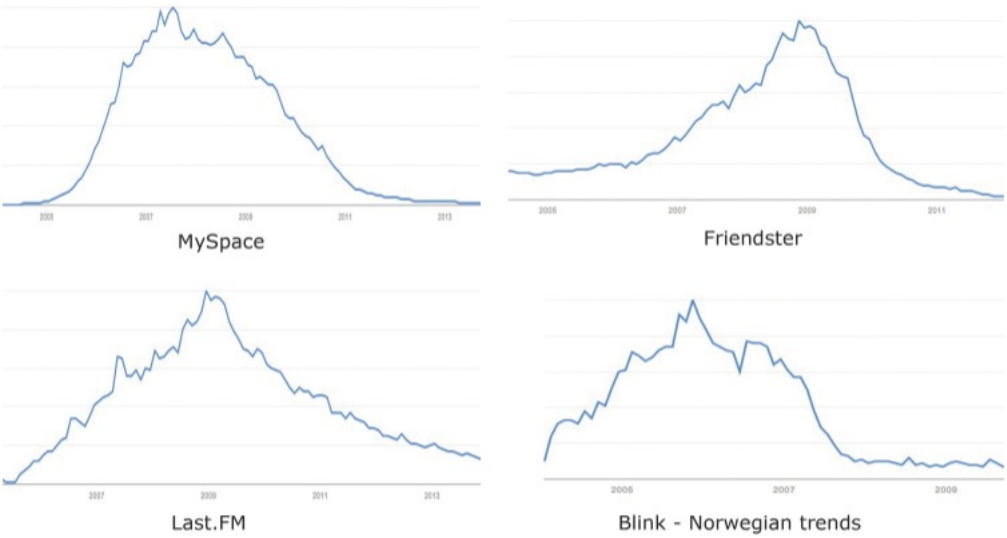

Figure 3.3: *Four former social networks with similar trends*

Similarities to the mobile application market

According to Pinch Media data shows the average shelf life of an iPhone app is less than 30 days, which means that in average only around 20 percent of users return to use the app the first day after they download it, and then it quickly drops off from there. By 30 days out, less than 5 percent are using the app. Users returning to the application is what makes the retention rate of an app and is very important in valuation of the applications, with the explanation that an application can have an infinite number of downloads and still be worth nothing due to extremely low retention rates. Figure 3.4 [19] illustrates the average retention rate of free applications. It is very important though to mention that these are numbers for apps in general, and social apps have tendencies to have a much higher retention rate. Figure 3.4 [20] shows the different retention rates per month from the different industries. Messaging apps see a retention rate over 50 percent and social apps just below 30 percent.

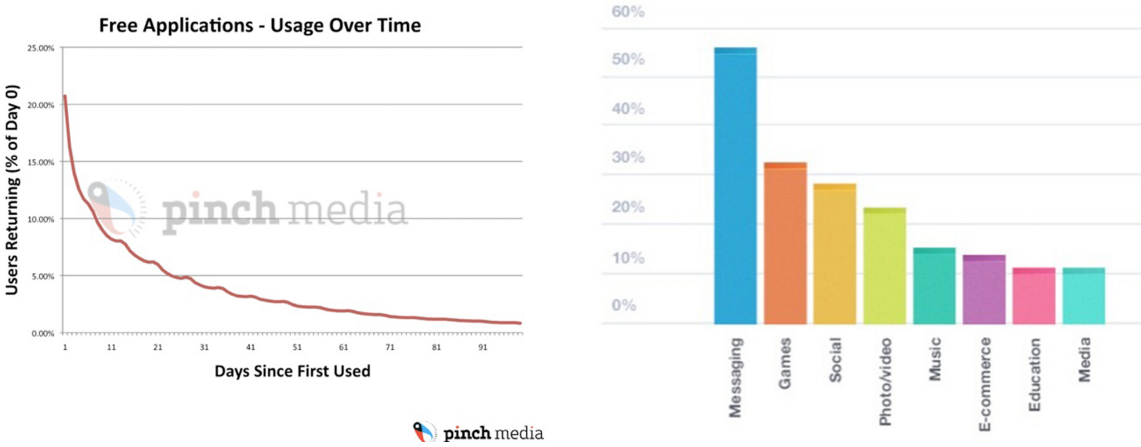

Figure 3.4: *Usage over time for free apps and retention rates by industries*

Like in the old social networks that failed (and in social networks in general) Messaging apps and social apps seem to have high retention rates, but are very dependent on other users using it as well. Like the previous networks in figure 3.3, these apps are more vulnerable to abandonment of the service due to that the core of the product is connectivity between users. Simulation of the development of the userbase of Snapchat in section 5.4 indicates that a smaller number and also stronger connectivities among users can lead to fast deteriorating effects when abondment occurs.

3.2 Adaption and Rejection

People nowadays adapt new technology and services rather quickly and contributes to the rapid development of for instance popular online social networks. The social networks increase in userbase because of the positive network effects from early adapters, but they also will experience a rapid decrease in userbase as people start rejecting the service, leading to negative positive feedbacks. How networks protect themselves from these deteriorating is dependent on the social resilience of the network.

3.2.1 Life Cycle

Most products, also in the mobile application market will experience going through the Product Life Cycle shown in figure 3.5 which includes the phases research and development, introduction, maturity, decline and then discontinuation.[21] The mobile application market is shaping in a way that the Monopoly stage is phasing out with more and more applications entering the market making the process of coming up

with new ideas much harder. More and more new applications are imitations of already existing applications and the competition stage is often the new introduction stage. Section 4.3.1 discusses on how many mobile messaging apps do mostly the same, but with small differentions many suffices to exists and very equal market shares occurs.

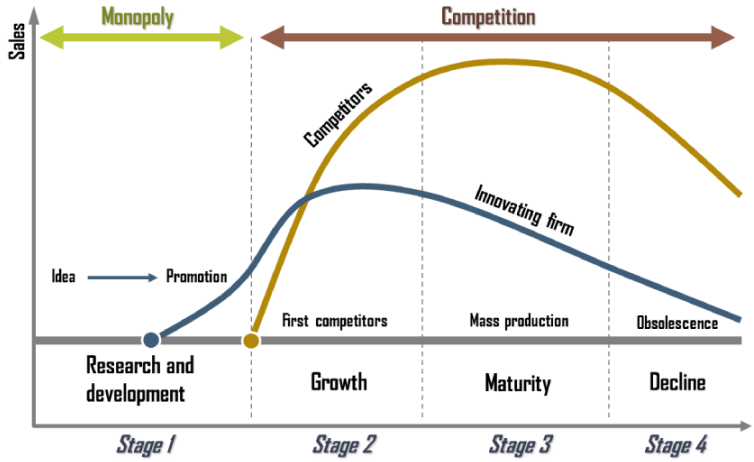

Figure 3.5: *The Product Life Cycle*

The life cycle of products shown in figure 3.5 typically counts for products (like many mobile applications) not dependent on direct positive feedback from the market and for more social networks/applications the OSN Life-Cycle may appeal more and which also fits quite well the graphs in figure 3.3. The OSN life cycle follows a cycle of four stages. In the *Introduction* stage people are introduced to the service and invite new friends which makes the service grow fast. This phase starts when there are some initial adopters of the service and an exponential growth can be seen and then eases of some as the service enters the *Growth* stage. The growth stage is the stage where the network does not grow as fast as in the beginning, but the network has grown to a big enough size for marketers and business to take notice. The service is upgrading with new features to be able to keep up the growth. In the third stage, the *Maturity* stage much fewer new registrations are observed and many are also quiting the service. Very often, in this stage the service needs to innovate to turn the negative trend, although many are not able to. An example is MySpace which many claim to fail very much due to the fact that the service did not change over time. The last stage is the *Decline* stage where the number of new registrations is lower than the number of users quitting and it needs a total overhaul to keep up the service. This is very often the last stage for the social networks and in the end fails and drops out of the market.

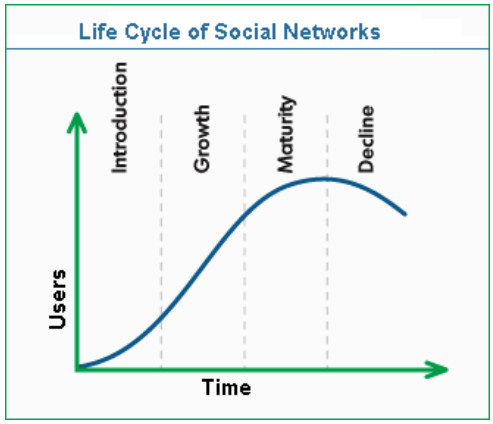

Figure 3.6: *The OSN Life Cycle*

Figure 3.7 shows the development of nine social networks in terms of Google Trends after reaching the top, then deteriorating and in the end failed. These are networks in the Decline stage and the average (the red line) shows that after 20 months the index dropped to 45.8, but for four of the networks below the average line the index had dropped to 22.5. These nine graphs may indicate a typical life cycle for these networks, and therefore also for the social (or anti-social (see section 4.3)) mobile applications and the graphs actually fit with the Snapchat simulation model in section 5.4 that is supposed to simulate the future of the userbase for Snapchat.

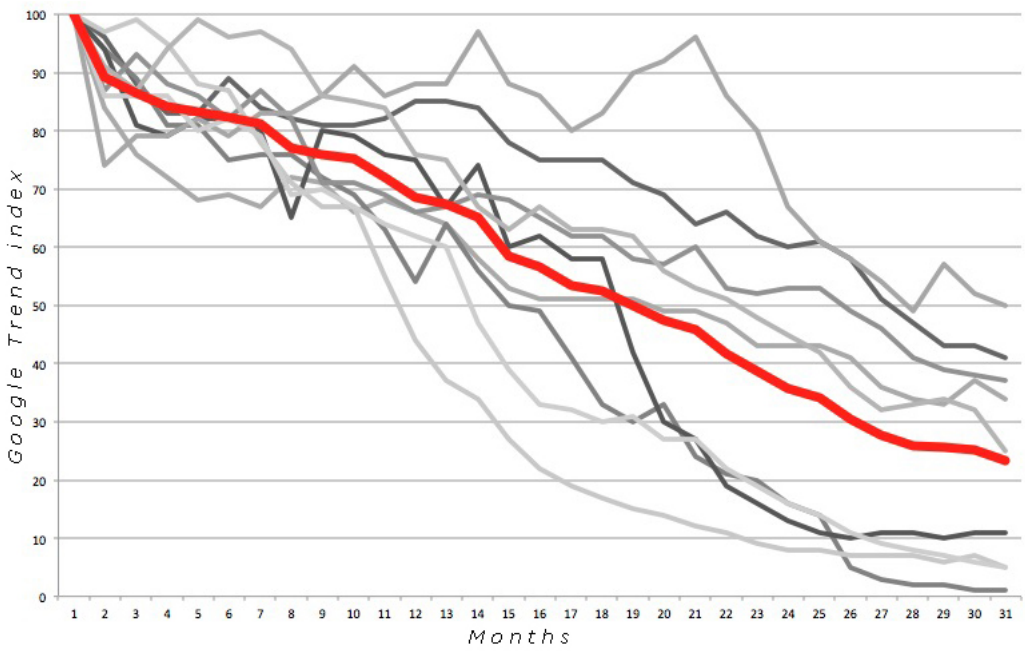

Figure 3.7: *Google Trends for nine social networks. Below the red average line: Nettby, Blink (both Norwegian networks), Friendster and Bebo. Above the red average line: Ning, Digg, Last.FM, Tuenti and MySpace*

The different reasons for the life cycles shown in figure 3.7 are partly covered in sections 3.2.2-3.3.

For each of the OSN's analysed in section 3.1.2, there can be defined two variables, TT (Time to top) and TB (Time to bottom) where TT is defined as the time period it took for the OSN to rise from the Google Trend Index between 10 and 15, to Index 100. Vice versa, the TB is defined as the time period it took before the OSN again went from 100 on the Google Trend Index to the index between 10 and 15. The variable α is then defined as the fraction $\frac{TT}{TB}$ From the nine ONS's that were analysed, $TT_{avg} = 28,5 months$, and $TB_{avg} = 33 months$, giving the $\alpha_{avg} = 1.16$. So if a maximum point has been reached and the service has started declining one might use α as an indication on how fast the decline rate will be.

3.2.2 Social Resilience

Threshold Global Works defines social resilience as the timely capacity of individuals and groups–family, community, country, and enterprise–to be more generative during times of stability and to adapt, reorganise, and grow in response to disruption [22]. Put in other words, it is the ability to adapt and fight off changes from the outside. One can say that MySpace lacked the ability to fight off the changes that Facebook brought and was taken over by Facebook when looking at unique daily users in December 2008.

One can quantify social resilience by using k-core analysis which identifies subsets of the network where all users have at least k friends or connections. By studying how the network connectivity develops after removing connections one can for instance identify nodes that are important for keeping the network connected.[23]

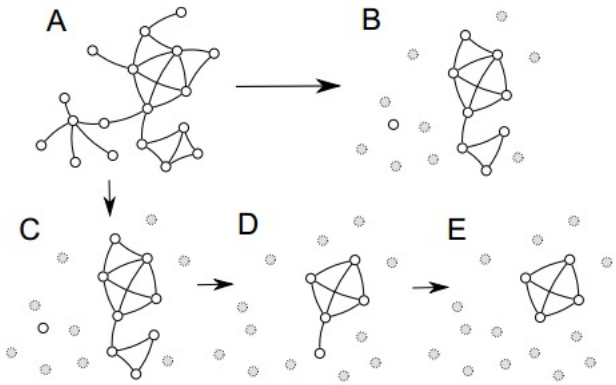

Figure 3.8: *The development of the network connectivity by removing connections where nodes have < 3 connections. The 3-core of the network is thus obtained.*

Figure 3.8 is meant to show that users will leave the network if they are left with less than three friends and these dynamics of the network are very similar to the dynamics used in the simulation of Snapchat in section 5.4. These dynamics show the main principle of when a user leaves a network, other users would leave, but it does not describe why the first user left. This is more unclear due to the fact that it could be anything from the user getting bored from using the service to the user not being able to restore a lost password, leading to discontinuation of the service. Other reasons causing the first user to leave also includes changes in the user interface, technical problems, threats to privacy or competing sites. The Snapchat simulation model covers this by using certain probabilities that a user will leave the service without being influenced by any other users.

Similarities to the mobile application market

Mobile applications that are of the non-social network nature but are only utilised without interaction with other users, can be said to have a social resilience only dependent on the general retention rate of mobile applications, that is, they have a $k\text{-}core = 1$, where 1 refers to the user itself. The retention rates are shown in figure 3.4. A tighter comparison can be done on mobile applications that are social (or anti-social) and the term k-core explained in figure 3.8 can be used in analysing of these mobile applications. Many of the popular mobile applications are actually anti-social (see 4.3) and because these networks are pretty closed off (which means a user has much fewer network connectivities than in the social networks) the k-cores are usually smaller and could more easily lead to mass abandonment of the network as a negative effect from other users leave.

3.2.3 irSIR Model

Epidemiological modeling of online social network dynamics [24] compares Online Social Networks to epidemiological models to explain user adaption and abandonment of the social networks. While Adaption is analogous to infection and means that a user joins the network, abandonment is analogous to recovery and thus means that the user leaves the network. The proposed infection recovery SIR model (irSIR Model) was used to validate the network by the use of publicly available Google search queries for "MySpace" as a case study and then applied the same principles for "Facebook". The results show that Facebook will meet a future of rapid declinement of user activity in the next few years.

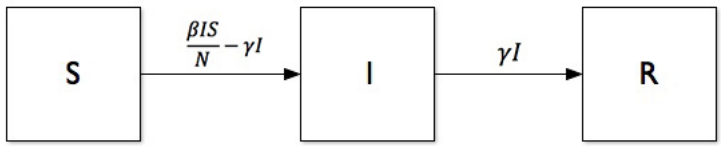

Figure 3.9: *irSIR model*

The model in figure 3.9 shows the dynamics of the total population $N = S + I + R$ and shows how users go from being susceptible S to infected I and then ending in the recovered stage R with different rates depending on the infection rate β, the fraction of the infected population $\frac{1}{N}$ and the recovery rate γ. These rates are similar to the ones used in the Snapchat simulation model in section 5.4.

$$\dot{S} = \frac{-\beta IS}{N} \tag{3.1}$$

$$\dot{I} = \frac{\beta IS}{N} - \gamma I \tag{3.2}$$

$$\dot{R} = \gamma I \tag{3.3}$$

Equations 3.1-3.3 shows that the rate at which the S, I and R changes. Equation 3.3 shows that the rate the population are going from the infected stage to the recovery stage is only dependent on the infection rate γ and the infected population I, and not the total population N which the infection rate $\dot{I}$ depends on.

As can be seen from figure 3.9 and the equations 3.1-3.3, the main dynamics of the model is that when a user joins the network, other users have higher probabilities of joining the network. Also, when a user leaves the network other users have higher probabilites of leaving the network. Figure 3.10 shows the irSIR model applied to MySpace and Facebook and the curve for Google search queries for the two in the given time period is very similar to the irSIR model curve. While in the MySpace case the irSIR curves matches very well with the real curves, and in the Facebook case the irSIR curve is only used for future prediction of Facebook. Section 3.1.2 shows the development of MySpace and four other social networks in terms of Google Search Queries and where the end results have all been the same; A rapid declinement of users shortly after peaking.

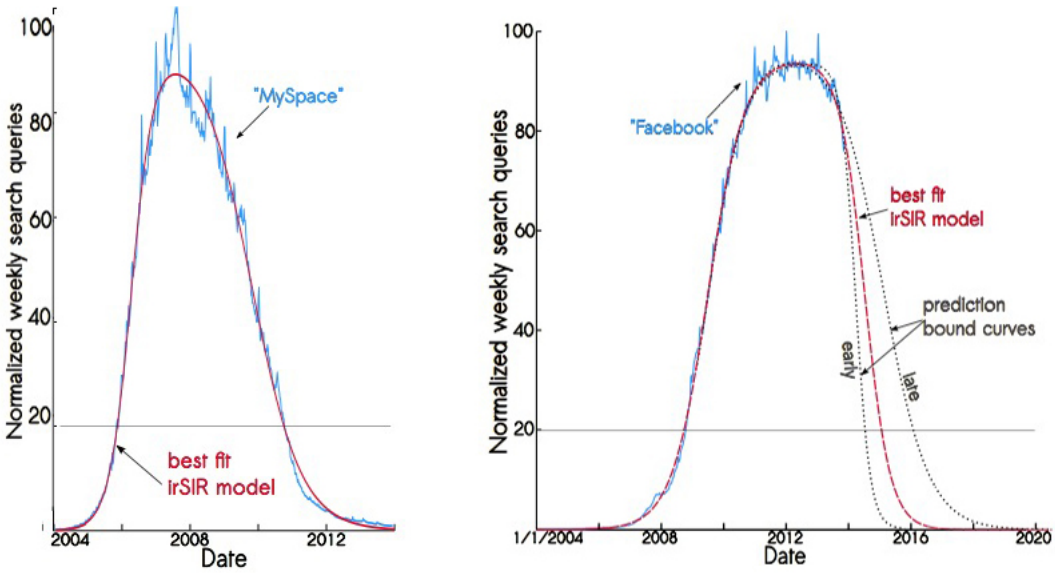

Figure 3.10: *irSIR applied to MySpace and Facebook*

The irSIR model can be linked to mobile applications as well which are dependent on a certain network of connections to survive. Section 5.4 uses a model similar to the irSIR model to simulate how the Snapchat userbase can develope in the future.

3.3 Number of new apps being uploaded every day

Around the start of 2014 there were around two million apps residing in Appstore and Google Play. While in the Appstore, around 25 000 - 30 000 new apps are uploaded every month[25], Google Play registered a little over 80 000 new apps in January 2014[26]. The issue here of course being when someone is uploading a new app, the number of already existing applications in the different stores can basically drown this new app leaving it unnoticed by users. In addition, companies like Conduit Mobile are making it easier for people to create apps by offering already existing solutions which users can use to make their app with no knowledge of coding. And according to Bianor[2], studies confirm once again that it is relatively hard to make money from Android applications if you rely on a one-off installation fee. Very few apps from the Android Market are ever downloaded, with 20 percent of free and 80 percent of paid apps never getting the chance to grace anyone's device. As many as 52 percent of all free Android apps are downloaded less than 1,000 times. The report shows only 5,6 percent of all free Android applications being downloaded between 50,000 and 500,000 times, with a meager 1 percent of those reaching over 500,000 downloads. The situation does not look much brighter for paid Android apps. Only 0.1 percent of paid applications in the store have seen more than 50,000 downloads, and only about 5 percent were downloaded between 1,000 and 50,000 times. In 2010 over 225 000 mobile applications were in the Apple Appstore and at the same time Apple had paid out right over $1b to application owners which means that on average, each owner made $4.44 on their applications. For the median paid application the number was around $682 per year, which again shows that the vast majority of mobile applications do not earn any money. Some investments in the mobile application market has actually paid of rather well, and Kleiner Perkins iFund cashed out $98 million from a $5.6 million investment in the mobile application company ngmoco. But still, breaking even on a paid application would for an application owner take around 51 year as the average cost to produce the application is around $35 000.

Already, it leans against a conclusion that there might be only few big mobile applications dominating the app market, (as also supported in section 4.3 about anti social networks) and most other applications will see download numbers of maximum 500 000 times which might not be a big number in an international context. As a comparison, Snapchat had over 8 million adult users only in the U.S by june 2013. [27]

3.4 Dangerous Business Models

Some people develope mobile applications just for the fun ot it, but it is fair to say that probably in most cases, a central strategy behind the project of a mobile

[2]http://www.bianor.com/blog/which-are-the-most-downloaded-mobile-apps/

application is to to figure out how to make it a financially viable endeavor. There exist different business models for generating revenue on a mobile application from monetising on people directly paying for it to letting the user have the application totally for free and monetise on other areas, typically from advertising.

3.4.1 Application Key Performance Indicator

The most intuitive way to measure the success of an application is the use the numbers of daily downloads and many might think that a ton of downloads directly indicates success. Although this gives some indication, the number of downloads only enables an application to succeed, but it does not make it a success on its own, and there are many other factors that play their roles in the total measurement. An Application Key Perfomance Indicator (AKPI) is a type of variable that basically gives pointers on how successfull the application is. There are many different AKPI‘s related to each application, but some stand out be more important than others, and these variables help point of the costly and risky business models one embarks on.

1. Customer Acquisition Cost
CAC is one of the AKPI‘s that brings the most risk. CAC is the direct cost of acquiring another customer, that is a new download from one of the app stores. In some cases where the application highly benefits from positive feedback from the market the average CAC can reach almost the zero point, but in most cases capital is needed to acquire users. A more formal definition can be CAC = Total costs related to expansion of userbase / Acquired Customers where total costs related to expansion of userbase can be everything from payrolls to costs directly related to marketing. All costs related to internal costs like payrolls are hard to analyse from a neutral point of view because it varies very much from business to business (but should be analysed internally), but costs directly related to marketing is easier to get a grip on to illustrate the risks related to CAC. Facebook Mobile offers developers to advertise their applications in a way that users seing the ad can directly install the application by clicking "Install" on the ad. On average, developers can expect a cost per download to be around $1.70 [28] which is fine if the acquired user leaves behind a sum $\geq$ $1.70 or the acquired user provides other users as well, but like seen in this section, most applications are totally free for the users and the suggested $CAC_{marketing}$ might be a costly method to expand your userbase. So mainly the problem with CAC is that it is hard to come below the average revenue left behind my each user.

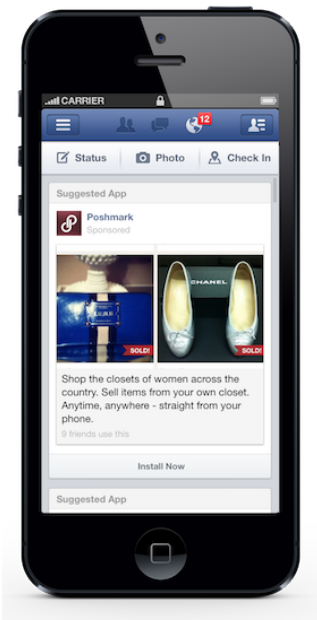

Figure 3.11: *Users can install applications directly from Facebook Mobile*

2. Average Revenue Per Download
The term ARPD defines the average revenue that an application makes from each user who downloads the application. There are different factors that influence the ARPD for an application typically how well developed it is, but also very importantly the type of business model utilised and ARPD differs greatly depending on the business model, and three types are discussed in this section. Comparing again with the CAC, figure 3.13 shows that the $CAC_{marketing}$ exceeds one out of five of the highest All-time ARPD applications as of February 2013. Obviously, these applications have a CAC much lower than the ARPD.

3. Retention rate
The retention rate of an application is one of the most important KPI for an application and it basically indicates how often the existing users are using the application, which again is related to the ARPD and also points out whether the CAC is worth the investment. The retention rate is one of the biggest challenges related to mobile applications, and as seen in figure 3.4 the average user will use the application again the next day with an approx. 25 percent possibility and the usage drops drastically thereafter. Therefore, in the worst case the combined result of all users might actually lower the ARPD with more than 75 percent. A common "rule" is the "30/10/10 retention rule" which states that 30 percent of all users will use the application each month, 10 percent will use the application each day and 10 percent of the users will use the application concurrently[29].

3.4.2 Main Revenue Models

The term ARPD defines the average revenue which an application makes from each user who downloads the application. There are different factors that influence the ARPD for an application typically how well developed it is, but also very importantly the type of business model utilised and ARPD differs greatly depending on the business model, and three types are discussed in this section.

Up-front payment model

In an up-front payment model the owner of the application is directly monetising from the users buying the application and the applications are sold through the mobile application market places, like Appstore and Google Play.

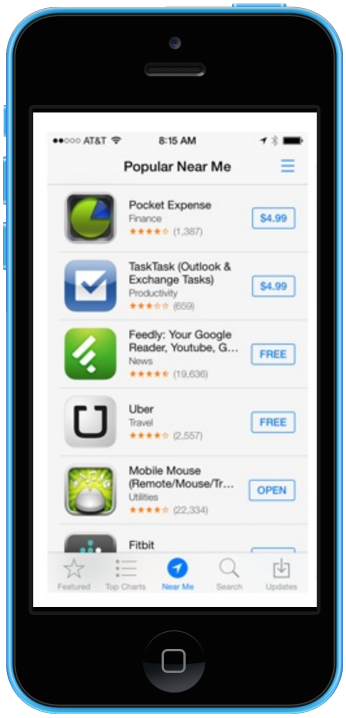

Figure 3.12: *Up-front payment at Appstore*

The model is safe for the owner, providing instant monetisation from each user, but also has a major limitation. The number of people paying for a mobile application is much fewer than people downloading applications for free. Figure 2.2 [3], where the y-axis shows the number of apps, the x-axis shows the number of downloaded apps. So this model might give the owner a steady income, but this model does not seem to scale in terms of userbases, and therefore different models are used.

In-App Purchase Model

This model targets the issue on lack of downloads due to the fact that the user has to pay up-front to be able to download the mobile application. Instead of paying to be able to download the application, users are given the application for free, and the costs are for instance related to unlocking certain features in the application. Some applications generate revenue from advertising from non-paying users, and from in-app purchases from paying users (Who pays to remove the adverts from the application). This scheme is called "Freemium-scheme" where the application itself is free, but for a certain payment users get access to the premium version. Around 70 percent of applications in the Appstore were of March 2013 Freemium applications and In-App purchase revenue amounted to 76 percent of the U.S iPhone application revenue. [30] Figure 3.13 [31] shows the top grossing applications as of February 2013 where the all-time ARPD comes from in-app purchases and advertising combined which means that the income from in-app purchases must be lower than the total all-time ARPD. In comparison, Facebook, with 78 percent of the daily active users being mobile users, had an ARPU in USA and Canada in Q1 2013 (a period of three months) at $3.50 [32]. This gives an ARPD $2.73 which is more than half of the all-time ARPD for the highest grossing application in figure 3.13. This

[3] Stats from http://www.appbrain.com/stats/android-app-downloads

also indicates that advertising model might has more potential when utilised in the correct way.

Top Grossing Applications February 2013

iPhone, United States, apps released since January 2012

Grossing Rank	Application	All-time ARPD	Release date
1	Clash of Clans	$4.66	2012-06
2	Candy Crush Saga ®	$1.14	2012-10
3	Hay Day	$3.29	2012-05
4	MARVEL War of Heroes	$2.93	2012-09
5	The Simpsons™: Tapped Out	$2.14	2012-02

Figure 3.13: *Top Grossing Applications February 2013. ARPD from In-app purchases and advertising combined.*

Advertising Model

In the advertising model, an application is generally given to the user for free in exchange for presenting advertises to the user. Typically, the applications using a pure advertising model are social applications. This is because these are often the only applications with potential to grow a big enough userbase to be able to monitise on it, and also to be able to grow this large of a userbase one often has to give the application to the user for free. It also can be hard to offer in-app purchases to the user because often there is not much worth paying for in social applications unless you are a business owner wanting to promote your content. But it is not only the potential for advertisers that contribute to the high valuation, but also the massive userbase itself (that is mostly possible on the advertising model), and that is maybe why Candy Crush (In-app purchase business model) with an estimated income at $633,000 every day (see conclusion in section 3.4.3) is valuated to $5.5 billion [33] and Snapchat with no revenue following close with a $4 billion valuation.

3.4.3 Conclusion

For mobile applications where the user has to pay up-front it can be difficult for the application to grow. People in general might not like to pay for digital content

because maybe they do not feel that the content is worth it or because they might not know what they are paying for. Therefore many owner offers parts of their applications for free and the user has the choice whethere he/she wants to buy the whole version. Applications are often also offered totally for free, but extra features cost. In the free version, there is often shown advertises to the user which dissapear if the user chooses to buy the whole version. Candy Crush [4] is an example of an mobile application with huge success in an in-app purchase model mixed with advertising and it is played more than 600 million times a day and is bringing in an estimated $633,000 every day. [34] Although in-app purchases work great for some applications, it does is not suitable for all applications and therefore the only model might be the advertising model where the application is given to the user for free exchange for some commercial. These are the applications that are highly dependent on large and stable userbases over long periods, and it is here that the biggest risks are.

So it might seem that there are certain correlations in terms of which model is used and the risk/prize ratio. Typically Up-Front payment brings the smallest risk, but also the potential smallest prize. In-App purchases is in the middle with potential medium risks and medium prizes and applications which uses the advertising model have high risks (see section 3.1.2 and section 3.2) but also great potential prizes. But since the potential prize for the ads. model is potentially very high, many are trying to compete in this market. Of course most fail, ending up with no revenue and therefore the average revenue per application is so low and the investment risk is huge.

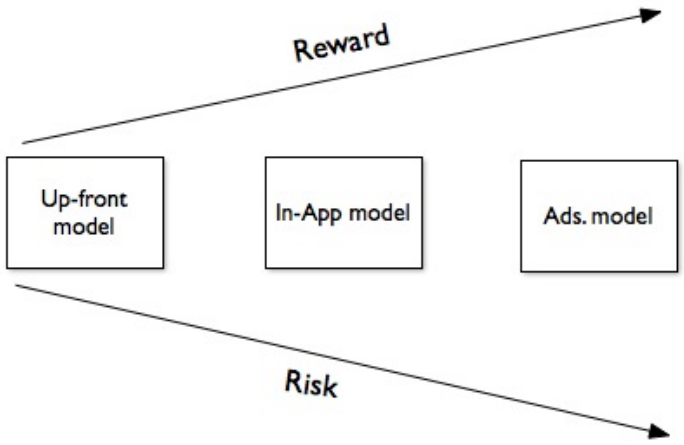

Figure 3.14: *Risk vs Reward for the different models*

[4] Game found at http://www.candycrushsaga.com/

Chapter 4
Opportunities

4.1 Increased Market Size

The number of new smartphones and tablets entering the market is in constant rise, and as seen in figure 3.2 the worldwide number of shipments of smartphones is estimated to double in 2016 from 695m to 1343m units. From this forecast it is expected that there will be 1.75b smartphone users in the world in 2014 and by 2016 the number is expected to be 2.28b which amounts to approx. 31 percent of the entire population.[1] The smartphone adoption is slowing some in western countries due to already high population of smartphone users, but developing regions like Asia-Pacific, the Middle East and Africa will drive the increase further. This is further explained in section 4.4.3 regarding mobile advertising.

	2012	2013	2014	2015	2016	2017
Smartphone users (billions)	**1.13**	**1.43**	**1.75**	**2.03**	**2.28**	**2.50**
—% change	68.4%	27.1%	22.5%	15.9%	12.3%	9.7%
—% of mobile phone users	27.6%	33.0%	38.5%	42.6%	46.1%	48.8%
—% of population	16.0%	20.2%	24.4%	28.0%	31.2%	33.8%

Figure 4.1: *Smartphone users and penetration worldwide between 2012 and 2017 [1]*

"Business and Productivity apps - An Untapped Developer Opportunity" [35] analyses the app market situation today and compares it to the market in the future. The report estimates the value of the total app development to be $70b in 2013, and it estimates that this value will more than double by 2016. In 2014 North America leads the app economy both in terms of total revenue from sales within the region and in terms of how many applications being published. North America accounted for 42 percent of global appsales, but Asia, Latin America and Africa increase in sales which leads to North America only accounting for 33 percent by 2016. So the market is definitely increasing worldwide. The constant growth up to 2016 has till now mostly been fuelled by rapid adoption of smartphones and tablets all over the

world, and with this continuation the app store sales are projected to rise to $40b by 2016 as compared to $18b in 2014.

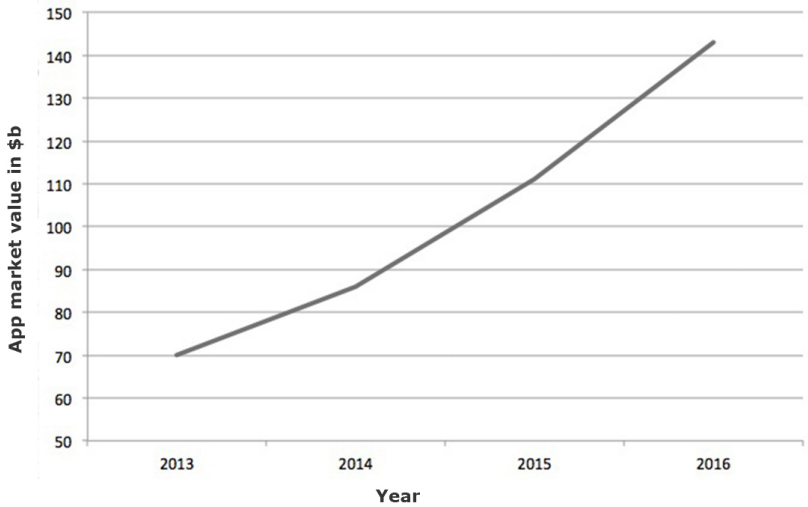

Figure 4.2: *App market size between 2013 and 2016.*

So with growth in the market, opportunities open for the many developers out there, and when the market also increases in geographical size there will be opportunities for new applications in the new emering markets.

Smartphones have taken over the mobile market in Southeast Asia with two out of three mobile users using a smartphone in 2013 as compared to one in two in 2012. Also, in Singapore and Malaysia, 88 percent of mobile phone users are smartphones users. [36] Figure 4.3 shows a forecast for the volume of shipments of smartphones in 2017 in different continents. Asia/Pacific sees the highest growth in percentages with Latin America and Middle East and Africa following. Worldwide it is estimated to be a shipment volume of around 1.7 billion to 1 billion in 2013.

Worldwide smartphone forecast by region, shipments, market share and growth 2013-2016: IDC					
Region	**2013 Shipment Volumes***	**2013 Market Share**	**2017 Shipment Volumes***	**2017 Market Share**	**5 Year CAGR**
Asia/Pacific	528.2m	52.3%	986.0m	58.5%	23.2%
Europe	182.1m	18.0%	261.0m	15.5%	11.1%
North America	151.0m	15.0%	189.0m	11.2%	7.8%
Latin America	91.1m	9.0%	154.7m	9.2%	23.7%
Middle East and Africa	57.6m	5.7%	95.0m	5.6%	18.5%
Total	**1,010.1**	**100.0%**	**1,685.8**	**100.0%**	**18.4%**
Source: © IDC (November 2013) * Forecasts				**Via: © mobiThinking**	

Figure 4.3: *Worldwide smartphone forecast*

Figure 4.4 shows the number of 3G/4G subscriptions for different countries. While the number of subscriptions in United States amounts to 91.6 percent of the total population, China's percentage amounts to 28.9 and India's percentage amounts to 7.2 percent. This shows a big potential in this market and both countries see a high increase in usage of smartphones, mostly low-cost smartphones, which are much lower-margin than premium smartphones like the iPhone, Samsung Galaxy Note, and HTC One. Yet, China and India are also getting more affluent over time, China especially. Phone makers that can dig in now on the lower end will have an advantage if they can provide a range of phones for customers who get more spending cash and start looking for the next step up. [37]

The 100 million club: the top 14 mobile markets by number of subscriptions

	Country	Mobile subscriptions in millions	Population in millions source: World bank	% of population	3G/4G subscriptions in millions	% of population	Sources: subs; 3G subs	Last update
	World	6,587.4m	7,046m	93.5%	1,876.6m	26.6%	Informa	06/13
1	**China**	1,218.5m	1,351m	90.2%	391m	28.9%	China Mobile China Unicom China Telecom	10/13
2	**India**	Active: 738.9m; total: 870.6m	1,237m	59.7%	88.5m	7.2%	TRAI Informa	09/13 06/13
3	**United States**	345.2m	313.9m	110.0%	287.4m	91.6%	Informa	06/13
4	**Indonesia**	285.0m	246.9m	115.4%	45.5m	18.4%	Informa	06/13
5	**Brazil**	268.4m	198.7m	135.1%	77.9m	39.2%	Anatel/Teleco	08/13
6	**Russia**	237.1m	143.5m	165.2%	41.2m	28.7%	Informa	06/13
7	**Japan**	135.3m	127.6m	106.0%	107.7m	84.4%	TCA	10/13
8	**Vietnam**	127.7m	88.8m	143.8%	18.0m	20.3%	Informa	06/13
9	**Pakistan**	126.1m	179.2m	70.4%	N/A	N/A	Informa	06/13
10	**Nigeria**	Active: 120.9m; total: 169.5m	168.8m	76.4%	12.7m	7.5%	NCC Informa	09/13 06/13
11	**Germany**	113.6m	81.9m	138.7%	46.0m	56.2%	BNA Informa	06/13 06/13
12	**Bangladesh**	110.7m	154.7m	71.6%	0.4m	0.2%	BTRC Informa	09/13 06/13
13	**Philippines**	109.5m	96.7m	113.2%	16.6m	17.1%	Informa	06/13
14	**Mexico**	102.7m	120.8m	117.6%	19.8m	16.4%	Informa	06/13
Source: Paul Lambert, Informa (Q2 2013); national telecoms regulators							**via: mobiThinking**	

Figure 4.4: *Top 14 mobile markets by number of subscriptions*

As for China there were around 391 million 3G/4G subscribers in Q2 2013 which amounts to 28.9 percent of the total population and in 2012 there was an increase of 108 percent of smartphone sales much because of general low production costs and also subsidies from local operators. [38]

In Inda there were around around 88.5 million 3G/4G subscribers in Q2 2013 which amounts to 7.2 percent of the population. The opportunity for cheap smartphones to replace feature phones in these markets is huge: 95 percent of phones that consumers buy in India are below $168.

4.2 App Categories

Out of the over two million apps residing on the appstores, there exist numerous different categories and sub-categories which can tell us something about the market regarding possibilities and risks. Two categories stand out when it comes to their max potentials. Figure 4.5[39] shows the categories with the most uploaded applications on the Apple Appstore as of March 2014. 18.29 percent of the apps were in the category gaming which means that there are approx. 200 000 gaming applications on the Apple Appstore today.

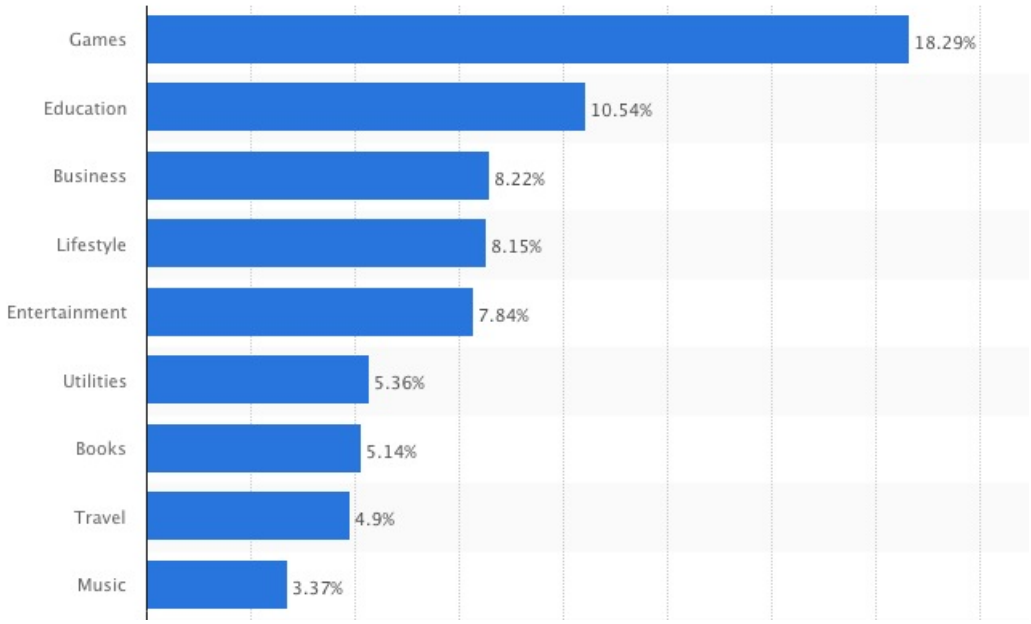

Figure 4.5: *Most popular Apple App Store categories in March 2014, by share of available apps.*

The games are the applications with the highest ARPDU (see section 3.4.2) when looking at the five top grossing apps, and in 2013 the top 400 games generated 92 percent of Google Play‘s revenue and 79 percent of Apple Appstore‘s revenue[40]. This relates to the fact that at the same time games accounted for 33 percent of all

downloads on iPhones, 48 percent of all downloads on iPads and 37 percent of all downloads on Google Play. What also contributes to the high revenue is that games are also the applications with the highest retention rates besides messaging apps (see figure 3.4), leading to more possible revenue from mobile advertising.

Social networking applications only account for 1.92 percent on the same list as in figure 4.5 and section 4.3 indicates the huge potential in this area. After the recent acquisition of WhatsApp and the high valuation claim of Snapchat (see chapter 5), these types of apps have taken the center stage and there are actually seven messaging apps around the world with over 100 million users each. This is rare when it comes to social networking with that similar properties of the different services. The different reasons for this "phenomenon" are discussed in section 4.3.1, but to illustrate the great potential of social networking apps, there exists a messaging app in India called Nimbuzz which was founded in 2006 and now has 150 million registered users which is a very large userbase, and around 30 percent of them are residing in Asia[41]. In 2012 another messaging application was registered in India and has today over 15 million registered users with 60 percent of the users residing in India[42].

Business and Productivity apps
The report "Business and Productivity apps - an untapped developer opportunity" also highlights an app category currently a bit unknown in the mobile application market today. The report points out the growing audience among normal users and business users who use mobile apps to make them more productive at work and in daily life and shows to different use cases in the enterprise such as

- Mobilising workforce and business processes.
- Higher availability of cloud services to anytime and anyplace.
- Extending new marketing and sales channels.

There seems to be a lot of openings in this area of the market and brings numerous opportuninites for developers. Forbes highlighted in 2013 ten mobile apps to make ones business more productive[43] which shows the potential when it comes to pricing of applications and willingness to pay among enterprise users. Most of the applications on the list cost money, some in the area $5-7, some in the area $10 per month and one cost around $300 if bought for an enterprise. So even though the consumer app market still is, and will most likely remain bigger than the business app market up to 2016, business and productivity applications present better opportunities for a more sustainable business with higher user engagement and more value in the long term. Figure 4.5 shows that Business apps account for 8.22 percent of all the apps

on the Apple Appstore, and although Productivity is not on the list, the rest of the market, the consumer market, accounts approx. 90 percent of all the applications. But still the Business and Productivity market had an estimated value of $28b in 2013 (vs. $39b for the consumer market) and is estimated to grow up to $58b in 2016, growing at a slightly slower than the consumer market.

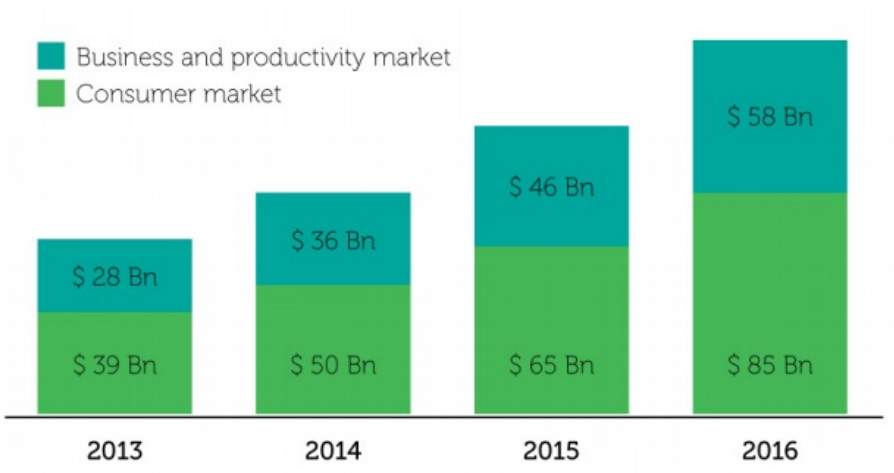

Figure 4.6: *Estimated value of the Business and Productivity market vs the Consumer market between 2013 and 2016*

While figure 4.6 tells us something about the total value in the app market, figure 4.7 provides a more easy overview directly relating to the developers in terms of monthly incomes. These numbers have many similiarities to the numbers mentioned in chapter 2 and it also shows the much higher revenues for Business apps.

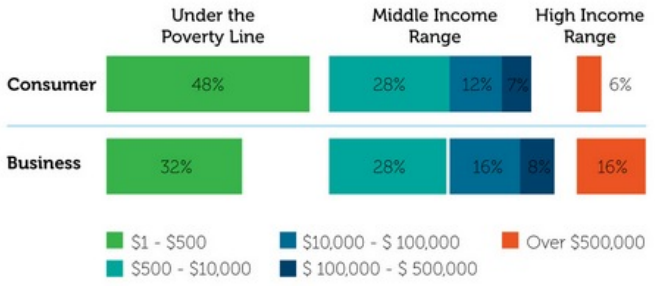

Figure 4.7: *Comparison of revenues between Consumer apps and Business apps*

4.3 Anti-Social Networks - often found in mobile applications

These types of networks differs from Online Social Networks in the way that users have a much lower number of connections. For Facebook, the average number of friends among adult Facebook users is 338 while in anti social networks, this number is much lower and therefore the connections typically are much stronger than in the Facebook case. The market for anti social networks is a great example on how there are room for more players in the market, especially in the mobile application case. The three mobile messaging apps[1] Viber (200 million users as of may 2013 [44]), WhatsApp (300 million monthly active users as for august 2013 [45]) and WeChat (100 million registered users outside China[46]) have all achieved very high market shares, and from these numbers it might seem that there will not be a winner who takes it all. These three mobile messaging applications do not differ much from each other, and table 4.1 shows the main differences between the three. Because of the big similarities between these anti social networks the main reason for a Winner takes it all-market should be that one of the networks have so many users that it will in the end acquire all users due to network effects. Though this goes against the principle about anti social networks: Users do not want to be where everyone else is, and with the current relatively even market shares between these three anti social networks, there might not be a change in the future and the market shares would stay approximately the same in the time to come. In other words there will not be a winner who takes it all in this market.

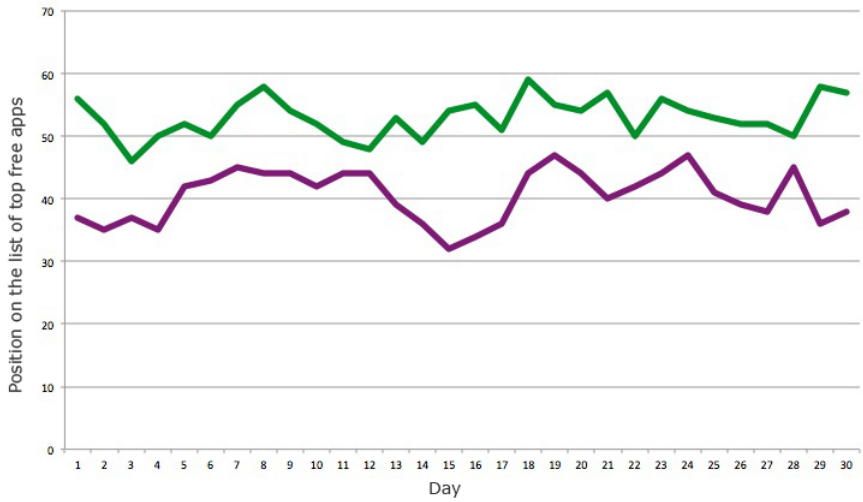

Figure 4.8: *Similar download rates for WhatsApp in green vs Viber in purple - Placements on the Norwegian Apple Appstore Market in March 2014.*

[1]Mobile applications where users can send direct messages to other users

Anti social networks are on the rise and seem to gain popularity because they also focus on areas that for instance Facebook can not focus on due to design. Not only that, many of these anti social networks focus solely on one thing, for instance photos.[47] An example is of course Snapchat which only focuses on sending photos between users, and the mobile messaging apps which only focus on sending messages between users. Also, because of typical snob effects[2], users flee to these anti social network.[48]

Facebook has probably understood this, and in february 2014, they acquired the mobile messaging app WhatsApp for $16 billion in cash and stock and Facebook also stated that " WhatsApp's core messaging product and Facebook's existing Messenger app will continue to operate as standalone applications" which might be an indication that Facebook will keep the anti social properties of WhatsApp [49]

Area	**WhatsApp**	**Viber**	**WeChat**
Supported OS	All	All	All
Price	$0.99	Free	Free
Communication	Text, photo, video, audio clips	Text, photo, video, voice call	Text, photo, video, audio clip, video call
Desktop compability	None	Mac, Windows	Browser

Table 4.1: Comparison of WhatsApp, Viber and WeChat. All with high market shares

4.3.1 Room for more players

A classic approach to analyse the social meda site market and also the social mobile applications is to whether there is a Winner takes it all-market or if there is more potential for an oligopolic market where different actors take different parts of the market. In the mobile application market there are some applications that have most of the users, often because there are no competitors, but others like WhatsApp, Viber and WeChat all have very large userbases and there is clearly an oligopolic market in this case (see more in section 4.3). In terms of social networking in general, Facebook is clearly the biggest [50], but that does not mean that Facebook takes the whole market and that there is no room for other actors. This might be due to some important factors.

[2]The more users in the network, less users will eventually stay. This is a negative network effect

- Multihoming costs. If there are low costs both in terms of physical and psychological factors then users might have tendencies to multihome between different networks. Many people are today multihoming between Facebook, Twitter, Instagram and for instance LinkedIn.
- Product differentiation can lead users to multihome between social sites. An example could be Instagram and Facebook. While Instagram only posts photos, Facebook posts photos plus everything else which itself is a small product differentiation which has made many users multihome between the two networks. A good example is the different mobile messaging apps WhatsApp, Viber and WeChat discussed in 4.3 which all have big similarities.
- Network effects are imporant both in good and bad. The general concept is that when more users joins the network, even more will join.[51] But it can also apply to a more negative sense, snob effects which makes users to actually leave the network if to many people are connected. This often leads to users fleeing to anti-social networks like the messaging apps. See section 4.3 for more on this subject.

Because being part of social networks normally does not come with any physical costs for the users, they can have more tendency to multihome between different social networks if there is some type of reward related to being part of more networks. This is related to product differentiation which means that the user finds some extra benefit of using the new network that the current network is not supporting. When smaller networks (for instance Twitter) differentiates its product from the bigger network (Facebook), then all members of the bigger network will multihome to the smaller networks.[52] The product differentiation might appeal to users for different reasons. For young people it might not be of the most importance where all the people are, but where the correct people are which can lead to negative network effects also called snob effects. An example of this is Facebook‘s decrease in the number of teenagers. [53] “They feel that everything they post on Facebook is scrutinized, and they could jeopardize their future by sharing themselves being silly, partying, or by discussing their opinions. They worry parents, friends, and potential hirers might discriminate against them based on their digital past.” is a good way to say it and it clearly captures the concept of negative network effects in practise. Social Media Competition: Differentiation with Use-Generated Content [54] studies competition and multihoming between social media sites from a game theoretic point of view (ref til hva dette er), and where they model three important features of social media sites.

- The content on these sites is usually generated by users.
- The preference of a consume is governed by local network effects[3]
- Consumers have strong tendencies to multihome.

The paper states that in most equilibria[4], a subset of consumers will multihome between the different social media sites often because the consumers have hetergoneous preferences. A particular example could be online dating in which users have highly heteogenous preferences in terms of what they are looking for in a relationship (Typically long-term or short-term relationships), and is a market where there are many big competitors with different appeals.[55]

The concept of product differentiation seems to highly relate to the mobile application market as well as in social networks in general. Many of the anti social mobile applications focus on some sort of product differentiation to be able to compete in the market. A good example is the competition between WhatsApp, Viber and WeChat described in section 4.3.

4.4 Mobile Advertising

One of the main reasons why Snapchat achieved the high valuation as it did is because of its potentials within advertising. Also, online advertising has many benefits as compared to traditional advertising like TV, radio and newspapers and therefore boosts the value of the companies being able to offer advertisers these possibilities.

4.4.1 How people react to mobile advertising

The purpose of knowing how people react to advertising is to make sure that if the advertisement might be of interest to a person, then the advertisement may have to be shown multiple times to ensure that the person has an optimal response to the ad. On the other hand, if it is unlikely that the person will respond more positively to a advertisement shown frequently, then the advertisers do not want to waste money on unnecessary impressions. Digital advertising, for instance over the web has the great advantage that advertisers can control the number of times the advertisements are shown to the different users and therefore there are possibilities of optimising both in costs and in exposure levels. A Frequency Response Function helps marketers to find a model of effectiveness when advertisements are shown multiple times to the audience. There are typically thee ways people react to advertisements:

[3]Network effects restricted to location. For instance a user is only influenced by users close to him/her

[4]A condition in which all acting influences are canceled by others, resulting in a stable, balanced, or unchanging system.

linear response, learning curve response and threshold response.[56] While the linear response means that people are assumed to react equally every time they see the advertisement, the learning cuve response (S-curve) assumes a slow response to the first exposure of the advertisement, but in which the response is better for each exposure until the response to the message tails off. In the treshold response function people shows little response until a critical frequency level is reached. At this level, the the response rises to the maximum capacity. Figure 4.9 shows an example of the different response functions. In the linear response function, every exposure contributes to 12,5 percent of the overall effect. In the learning curve (or the S-curve), each exposure up to a certain number (the fourth exposure in this example) of exposures contribute more and more to the overall effect, and after that declines. The threshold response function shows no response until the fourth exposure and after that the exposures are wasted on the user.

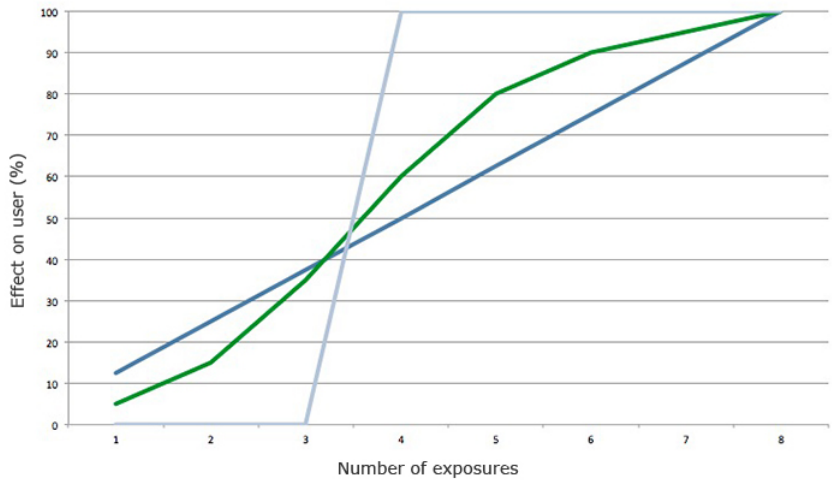

Figure 4.9: *Cumulative Response function - linear response function, S-curve response function and treshold respond function.*

Which response function to work with has to be chosen by the marketers and is typically assumed typically from analysis of the effects from earlier advertising campaigns. The learning curve has an intuitive appeal because it seems to capture the complexity of life better than the linear model which has the slightly unrealistic assumption that a person will react the same way for every exposure of the advertisement. The challenges with the learning curve however, is to know the point in which the curve starts exponentially increasing and how fast it is increasing, but there can be made qualified assumptions by doing good research. The faster this curve grows the better, and therefore by using native advertising and RTB, the curve should start

grow exponentially faster than traditional advertising. (See Native advertising and Real Time Bidding under section 4.4.2)

In digital advertising, marketers typically have different compensation methods which can be used in conjection with the different response functions. Digital advertising gives accurate results on how many times the advertisement has been exposed and how many has clicked on it, which also can be used in analysis of prior ad campaigns and how to plan future campaigns.

4.4.2 Benefits of Mobile Advertising

One of the main reasons why Snapchat achieved the high valuation as it did is because of its potentials within advertising. Also, online advertising has many benefits as compared to traditional advertising like TV, radio and newspapers and therefore boosts the value of the companies being able to offer advertisers these possibilities.

Cost

According to TV Cost and CPM Trends- Network TV Primetime [57], the average cost per 1000 home for 2013 was 25,06 dollars. The table in figure 4.10 [58] shows the average CPM on Facebook for 2013 by industry and ranges between as low as \$0.10 and \$9.08 with the average being around \$1.25.

Performance Metrics for Facebook Ads Worldwide, by Industry, March 2013

	Average CTR	Average CPC	Average CPM
Telecommunications	0.92%	\$0.34	\$1.39
Publishing	0.79%	\$0.22	\$1.75
General retail	0.50%	\$0.31	\$1.39
Entertainment	0.44%	\$0.26	\$0.78
Health and beauty	0.43%	\$0.36	\$1.00
Sports	0.30%	\$0.36	\$9.08
Consumer packaged goods	0.26%	\$0.30	\$0.82
Travel and leisure	0.26%	\$0.35	\$0.72
Clothing and fashion	0.25%	\$0.08	\$0.36
Finance	0.24%	\$0.21	\$0.43
Food and beverage	0.22%	\$0.21	\$0.65
Nonprofit	0.21%	\$0.19	\$0.52
Technology	0.21%	\$0.20	\$0.38
Deals	0.17%	\$0.39	\$0.23
Gaming	0.11%	\$0.30	\$0.38
Advertising and consulting	0.07%	\$0.22	\$0.16
Automotive	0.03%	\$0.34	\$0.66
Dating	0.03%	\$0.38	\$0.10
Other	0.39%	\$0.23	\$1.89

Source: Salesforce Social.com, "The Facebook Ads Benchmark Report," June 11, 2013

158661 www.eMarketer.com

Figure 4.10: *Average CPM for ads on Facebook for 2013 by industry.*

Targeting
One can argue that a 30 second TV commercial makes more impression on a person than an online ad, but a 30 second TV commercial about clothing for men might not be make any impression for a female person anyway (regarding number of sales). So even though it might make more impression on the people interested in the product being advertised for, there are still being wasted many impression on people not interested in the product. This is where the subject of targeting comes to play which is very customisable in online advertising. Targeted ads let marketers narrow the advertising to the users they think would actually be interested in the product or service they are advertising for. Facebook gives advertisers possibilities to narrow in on different areas like age, sex, location, interests and networks the users are connected to (Might be Universities or Facebook profiles that people like, for instance artists, athletes or organisations). This type of targeting can be very effective in terms of costs and reach which TV commercials can not provide.

Measurability
By measuring number of exposures, number of clicks or number of actions as a direct cause of an exposure, one can get a good overview over how effective the advertising is. This can further be used in analysis on how to create a better ad campaign next time and to get a general knowledge on how people responds to the product or service being advertised for.

Speed
Online advertising can provide more flexibility in terms of speed. Online ads can be deployed immediately after being designed and do not have fit the publishers schedule. (On television for instance there are for instance only one spot for advertisers between two television shows) [59] This can for instance be suited for food stores that want to quickly get rid of foods that are closed to the expiration date and can be sold for low sums instead of being thrown away.

Formating
In contrast to TV commercials and radio commercials, online advertisers has a much wider variety of possibilities in presenting their ads, for instance images, audio and video. Interactive ads are also possible[60] with input queries or other forms of entertainment.

Native Ads
Sharethrough defines native advertising as a form of paid media where the ad experience follows the natural form and function of the user experience in which it is placed. Native ads have forms that matches the visual design of the experience they live within, and therefore look and feel like natural content. [61]

Figure 4.11 shows a native ad included in the news feed of a Facebook Mobile user. The ad is included in the same feed as posts from for instance friends, and therefore seem more natural to the user.

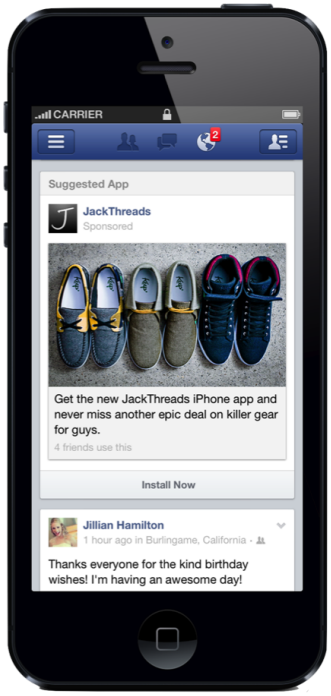

Figure 4.11: *A Native ad on Facebook Mobile.*

A study on native ad effectivenes was performed by Sharethrough[5] and IPG Media Lab[6] in measuring the "visual attention and brand lift" in native ads compared to traditional display ads. In the report, native ads was said to engage audiences in deeper, lengthier ways The most interesting results from the study were the following

- Consumers looked at native ads 53 percent more frequently than display ads.
- 25 percent more consumers were measured to look at in-feed native ad placements (the most common editorial native ad format) than display ad units.
- Native ads registered 18 percent higher lift in purchase intent and 9 percent lift for brand affinity responses than banner ads.
- 32 percent of respondents said the native ad "is an ad I would share with a friend of family member" versus just 19 percent for display ads.

Of course, the value of this type of advertising is higher than for traditional advertising because of the response it provides. Companies being able to provide this form of advertising therefore have possibilities to monetise big. [62]

LBS

Location based services (LBS) is a term for a collection of services provided to a user based on the location of the user and these services are hot topics when it comes to mobile advertising. An example use case of LBS could be if you are standing 100ft from your local Starbucks cafe and at this moment they have a really good offer on one of their coffees. Location based advertising would in this case be utilised in a way that you are notified on your smartphone that there is a really good offer on

[5] www.sharethrough.com
[6] www.ipglab.com/

coffee on Starbucks. Of course this has the potential to increase customer activity at Starbucks, and there is actually an application purely dedicated to this sort of use - it is called Shopkick and was of January 2014 rated as the 35. most promising company in America.[69] A short note on Shopkick and its use cases can be found in Appendix B. Like the general mobile advertising market, the LBS market is also growing fast and the global revenue is expected to read $10.3b in 2015, up from $2.8b in 2010. [70] There are a number of different factors contributing to the LBS market growth, for instance

- Increase in GPS and smartphone adoption.
- New and better business models.
- Better coverage and higher mobile network speeds (3G/4G).

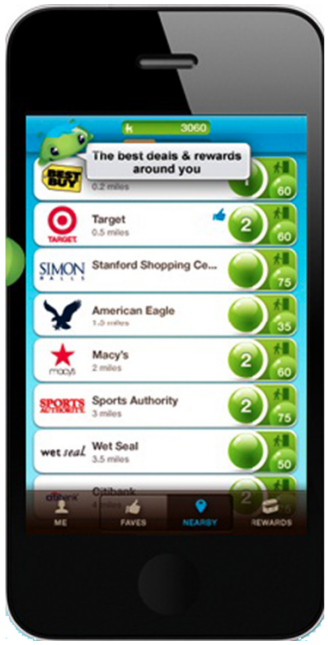

Figure 4.12: *Example of LBS advertising. The mobile application Shopkick tells the users about nearby offers.*

All these factors lead to growth of mobile advertising, and leads to increase in the mobile app economy. Network operators[7] did in 2008 gain 80 percent of all LBS revenue, but due to the factors mentioned above (especially GPS adoption), mobile apps not depending on the network operators are starting to get increased revenue streams from the LBS services. In 2011 the revenue for the network operators had fallen to 50 percent and is still decreasing. Advertisers are increasing their spendings on local ads, and it is estimated that in 2016, local ads will account for 58 percent of U.S mobile ad spending by 2016[71].

Real Time Bidding

RTB is a style of programmatic buying in which digital advertising opportunities are auctioned off in real-time[63], and the cost efficiency and tageting opportunities can highly be optimised with RTB. [64] It adresses the issue with traditional online advertising where advertisers pay the same amount per impression for every user when the advertising can be much more worth showing to one person than to another. In other

[7] A mobile network operator (MNO) is a telecommunications service provider organization that provides wireless voice and data communication for its subscribed mobile users.

words, it further optimises the principle of targeting and cost efficiency. An example can be that if advertiser A and advertiser B want to show an ad to a user. If advertiser A finds more value in showing the ad to this user than advertiser B, advertiser A will pay more for this impression and therefore win this bidding. RTB is highly on the rise as shown in figure 4.13. [65]

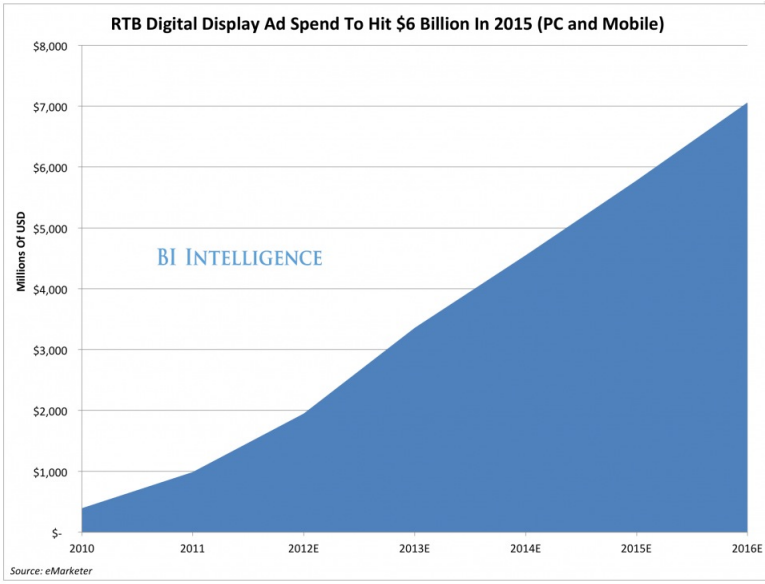

Figure 4.13: *RTB Digital Display ad spending over time*

Summarised, online and mobile advertising come with big oppurtunities both for advertisers and for platforms selling the ads. The advertising is cheap, is much easier to target to the audience and have smart ways of being displayed to the user in terms of native advertising and RTB. The advertisers also have easier to meassure the effect of the advertisements often by meassuring the number of people who have seen the ad, or by meassuring how many people clicked the ad. This can further be used in analysing and planning of future ad campaigns. Many mobile applications hold the potential to provide all of these services and therefore have potential to generate high revenues for both the platform selling the ads, and the advertisers.

4.4.3 Increase in Mobile Advertising

Mobile advertising is only pointing upwards both in terms of number of new smartphones entering the market and in terms of smarter advertising methods, making the advertising more worth. This means that there is more room for actors within mobile applications both because there are more smartphones to target, and because of smarter and more valuable ways of advertising, the mobile applications are less dependent on a massive userbase as earlier. In many big countries where the smartphone markets are emerging and mobile advertising is currently far from its potential, there are huge possibilities for both old and new mobile applications to spread and to generate revenue. Also, mobile data is being more accessible around the world giving people possibilities to stay online on their mobile applications much longer than before. Popular applications like Snapchat which can lose popularity in the current existing market can experience new life cycles in new currently unpenetrated countries.

Both the business models of Facebook and Twitter rely heavily on income from advertising and it is plausible that Snapchat‘s business model will do the same. Since Snapchat is only available for smartphones it is important to gain knowledge of how the market for mobile advertising will develope. Facebook stated that mobile advertising accounted for around 41 percent of the total advertising revenue in Q2 2013. [66] Figure 3.2 shows the worldwide mobile device shipments in 2012 with 694.8 million and 2016 with 1342,5 million. Although the increase in shipments is estimated to increase with around 1,93 times from 2012 to 2013, one can not establish the relationship with this number and the accounted percentage for mobile advertising. It still gives a good pointer that revenue from mobile advertising will increase. Facebook also reported that mobile users increased with 51 percent in Q2 2013 compared to Q2 2012. So in general, mobile advertising increases and in fact apps are starting to dominate the mobile ecosystem. A consumer spends on average 2 hours and 38 minutes each day on smartphones and tablets, and in fact around 80 percent of the time was spent using apps and only 20 percent was spent on the web. [67] Analysts say mobile advertising will increase 64 percent in 2014, and because at least 17 percent of the time people are on their mobile devices is spent on social networks, analysts also predict that advertising in social networks will increase 47 percent. These numbers correspond to $13.1 billion spent by marketers on mobile ads[68]

Chapter 5
Case study - Snapchat

Snapchat is an intuitive to use application where users take photos (or snaps as many calls it) with their smartphones, add some descriptive text, set a timer and then send it to people on their Snapchat contact list. The recievers of the photos will be able to look at them for a given time decided by the timer, and is usually between one and ten secons. After that, the photo dissapears and is not retrievable for the users. So the idea is pretty simple, and maybe this is why people are using it so much and why it is very quickly adapted by new users. So instead of sharing life events on Facebook, through Snapchat one can share small events in ones daily lives with friends without feeling like telling the whole world. Snapchat is therefore often viewed as an anti-social network rather than a social network. Recently Snapchat launched a new feature where users could publish photos on their "Story" where all users on the contact list can see the photo. This is explained more in depth in the retention rate experiment i section 5.3.

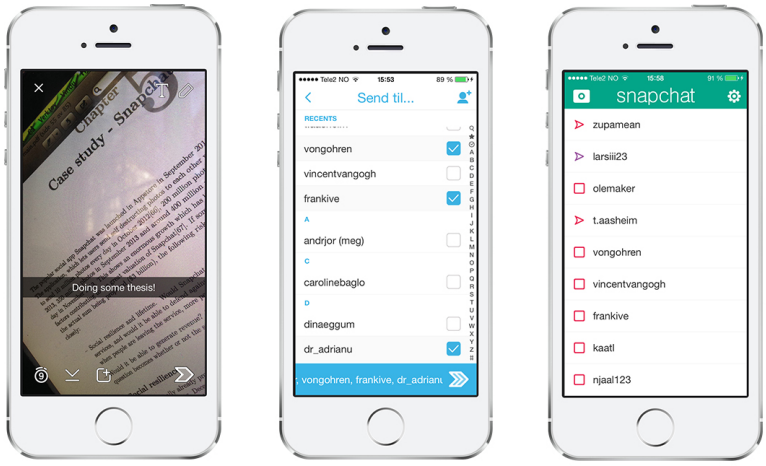

Figure 5.1: *Snapchat main features. 1. Take a photo, add descriptive text and timer. 2. Send the photo to your friends. 3. See incoming photos from friends.*

Snapchat was launched in Appstore in September 2011 [72]. The application, which lets users send self destructing photos to each other was used to send 10 million photos every day in October 2012[73], 200 million photos in June 2013, 350 million photos in September 2013 and around 400 million photos every day in November 2013. This shows an enormous growth which has been one of the factors contributing to the great valuation of Snapchat[74]. If someone were to pay the actual sum being proposed ($3 billion), the following risks are to be studied closely:

- Social resilience and lifetime. Would Snapchat be able to fight off similar services, and would it be able to defend against the deteriorating effects like when people are leaving the service, more people are leaving?
- Would it be able to generate revenue? Today there is no revenue, and the question becomes whether or not the service is suitable for generating revenue.

5.1 Social Resilience

Snapchat has actually already proven that it is able to fight off major competitors that have similar products. December 21, 2012, Facebook relased the iOS application Poke[1] which lets people send photos, videos, pokes, or text Facebook messages to their friends that expire after a few seconds. In other words very similar to Snapchat[75]. Exactly how big Snapchat was at this time is difficult to know, but there were around 50 million daily sent photos on Snapchat in the end of 2012. Interestingly, the active usage for Snapchat actually grew in market share from December to January after Facebook had relased Poke and then leveling off into February.

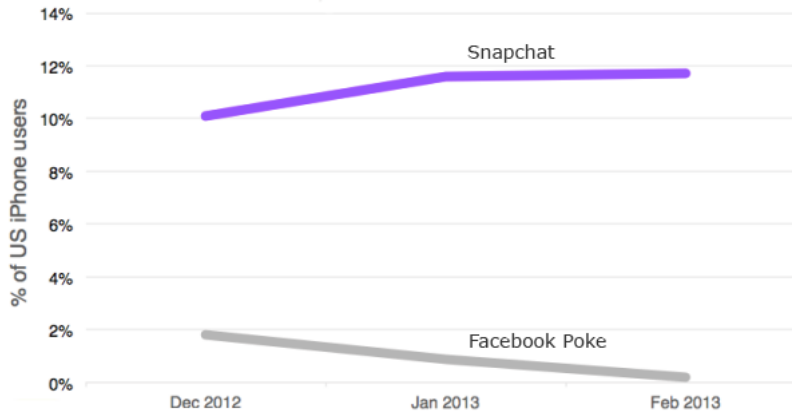

Figure 5.2: *Snapchat vs Facebook Poke.*

[1]Can be installed from https://itunes.apple.com/app/id588594730

So when withstanding loss of users when your opponent is Facebook which has already very large market shares when it comes to social networks, one can say that Snapchat is quite social resilient when it comes to other similar services. It is difficult to say why Facebook Poke was not able to compete against Snapchat, but it might have something to do with the concept of anti social networking. Victor Pineiro, Strategy Director at Big Spaceship, explains that the intimacy Snapchat provides might be one of the main factos behind Snapchat's success. He says, "Its one-to-one (or small groups) messaging makes each received Snap a bit of a gift, or whispered secret. You don't know who else received it, and you don't know if you're the only one to receive it. Because of this, it could facilitate a much more intimate form of communication between brands and their audiences".[76] The users might only want to communicate with certain users and not their whole Facebook contact list. So when it comes to anti social networking, Snapchat has more resemblence with the messaging apps like WhatsApp, WeChat and Viber which also lets users only communicate with the users you have added yourself. These three messaging apps all have some differentiation (See table 4.1) and till now there has not been a winner takes it all market. The same might be seen with Snapchat and similar services with some differentiation. But Snapchat can also be a potential victim of the irSIR model (See section 3.2.3) regarding which both social and anti social networks can be due to users generally abandoning the networks over time. Figure 5.3 shows Google Trend for Snapchat including April 2014 where the frequency of Google searches for "Snapchat" has decreased in February and then increased some in March. While this probably applies more to how the rate of new users developes (because they might look for Snapchat on the internet to either learn more about it or to download it), it might not tell us about the retention rate of the already existing users. (See Retention Rate in section 5.3) Many social networks have had the same development when it comes to Google Trend (See section 3.1.2), and some increase after a heavy decrease is common in many of the failed social networks.

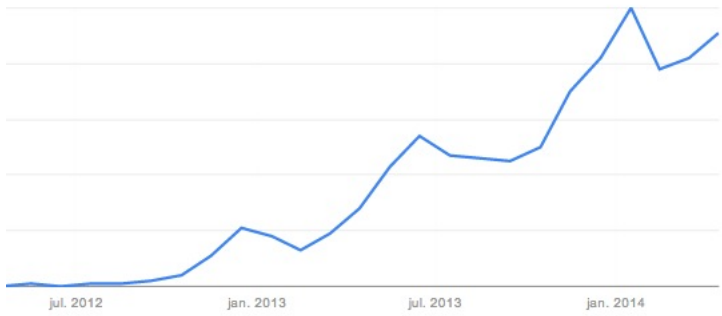

Figure 5.3: *Worldwide Google Trend Snapchat*

5.2 Download Rate

The number of daily downloads an application has is very valuable in knowing the current state of the application.

Download rate - March 2014
Even though figure 5.3 shows a negative development for Snapchat in February, the download rate is still high in March. A sample of 30 days in March for the Norwegian iPhone market shows that Snapchat is on average the 10. most downloaded application each day. This amounts to around 1500-2000 downloads per day in the Norwegian iPhone market.[2] The graph in figure 5.4 shows the sample of 30 days in March and each sample is gathered 11AM for each of the given days. These numbers are used in the simulation model in section 5.4

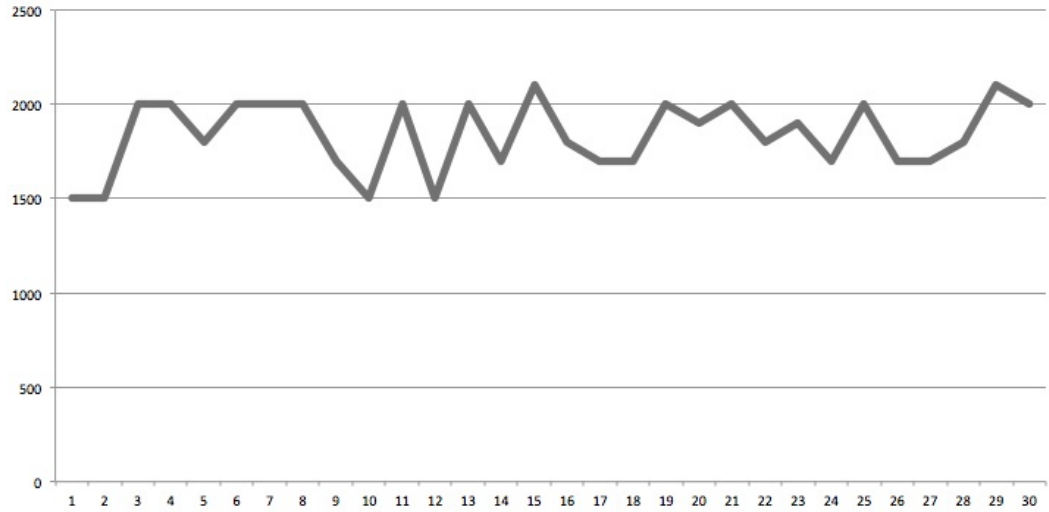

Figure 5.4: *Estimated daily downloads in the Norwegian iPhone market for March 2014.*

5.3 Retention Rate

Snapchat is an application with a typically high retention rate because of some factors. First of all, it is a less barrier using the application to send photos to other users than for instance publishing photos on Facebook. On Facebook, users might only want to present their best sides when publishing photos, while

[2]The number of downloads is estimated based on previous download numbers from self-made application "Mattilbud". www.mattilbud.com

on Snapchat the tolerance is much lower, leading to more frequent photo shares. Second, when users are receiving photos from other users a notification is sent to the user on the phone as shown in figure 5.5. In general a notification on an application has an opening rate between 30 and 60 percent[77], but it is likely that Snapchat has a higher opening rate for notifcations because the notifcations might appeal more personally to the user than app notifications in general.

Figure 5.5: *Snapchat notification telling the user that he/she has received a photo.*

Retention rate experiment - March 2014
While the graph in figure 5.3 might indicate that the rate of daily downloads is lowering (but is still very high as of March 2014. See section 5.2), it is important to know the retention rate of the already existing users in order to make some sort of establishment regarding the future of Snapchat. There are different ways of measuring the retention rate, but with very limited data available, a bit more primitive way is selected.

One of the functions of Snapchat is the "Story"[3] which lets a user upload a photo and where all of the user's contacts are able to view this photo. One can also monitor how many other users have watched the story during a 24-hour period, and by using this one can see the number of daily active users from your contact list. (Note that this it at least the number of active users. Probably it would be more because not all users would be looking at the photo you posted on your "Story".) By posting a new photo on random selected days over a given time frame, a certain indication of the retention rate can be obtained, at least among the contacts of the user.

The graph in figure 5.6 shows a quite stable retention rate during March and shows that at in average at least half of the number of friends were active on Snapchat the given days. Note again that not every friend being active on Snapchat is recorded in this experiment. This is because users are active without looking at the "Story".

[3]A photo that can be seen by every connected friend who wants to see it. The photo deletes it self after 24 hours. http://webtrends.about.com/od/Snapchat/fl/What-is-a-Snapchat-Story.htm

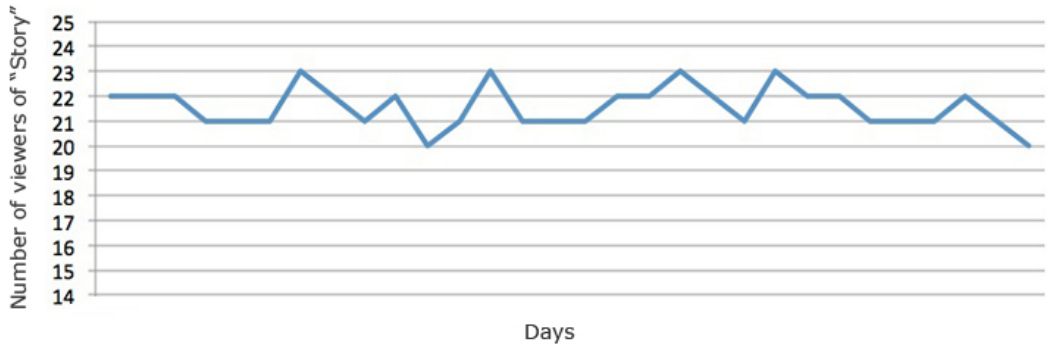

Figure 5.6: *Number of viewers of "Story" ranging from 1st of March to the 30th of March. Number of max possible viewers per story = 41.*

5.4 Simulation model of Snapchat in the Norwegian iPhone market.

One might be able to obtain some indications on how Snapchat will develope by simulating the different core factors that contribute to the development of number of users over time. Like in social networks like Facebook and Twitter, a Snapchat user is dependent on other users also using Snapchat to have an incentive to start using it or keep using it. A simulation model proposed here simulates the development of the number of users and uses dynamics loosely showed in figure 5.7 and the reason why the simulation model only covers the Norwegian iPhone market is due to the fact that in this market a certain knowledge on how the population looks like is obtained, and it is known that around 50 percent of Norway smartphone owners actively used the app[78] . Figure 5.7 shows a subset of the total population and the population is divided into three types of users.

- Users never having installed Snapchat (White nodes). These users can install Snapchat.
- Users already having Snapchat installed (Snapchat logo nodes). These users can delete Snapchat.
- Users already having deleted Snapchat (Black nodes). These users can again install Snapchat, though typically with a much lower probability than the users never having installed Snapchat.

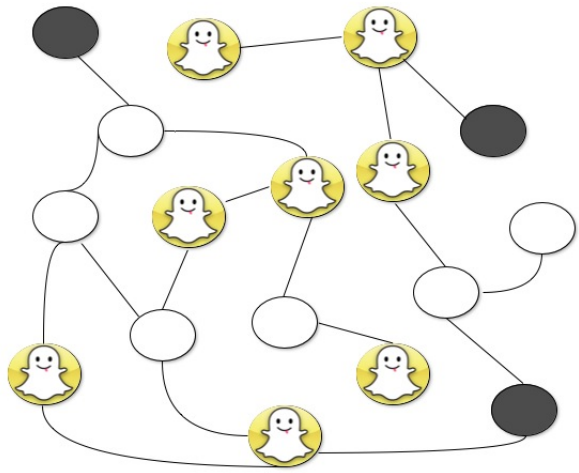

Figure 5.7: *Subset of the Snapchat Population at an arbitrary time. Snapchat nodes indicate existing users. White nodes indicate users who have never downloaded Snapchat. Black nodes indicate users who have deleted Snapchat. The links between the users indicate friendships*

Figure 5.8 shows another way to present the model similar to the irSIR model in figure 3.9. B denotes the number of users never having had Snapchat installed, P denotes the number of users having Snapchat installed at the current time and Q denotes the users who have deleted Snapchat or gone inactive. The functions $f(n)B$ and $f(n)P$ denotes that the number of users will move from B to P and from P to Q in a rate decided by the number of friends n each user have. The function $f(n, \mu)Q$ denotes that an inactive user can reinstall Snapchat, but at a lower possibility than for the users in B. This is where the μ matters.

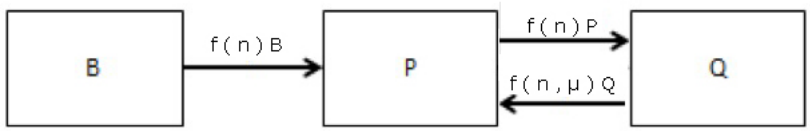

Figure 5.8: *Snapchat Population as a block diagram with user flows.*

The main dynamics of the model are:

1. A user has a certain number of friends in which certain relationships exist. These relationships will influence whether a user installs or deletes Snapchat when other users do the same.
2. A user can stop using the service on a random given day without being influenced by other users, that is a user might stop using Snapchat simply because he/she does not find interest in Snapchat anymore (or other reasons) no matter how many of his/her friends use it. This might also be because the user has discovered a more interesting service and will start using this instead.
3. A certain amount of users already have Snapchat installed before the simulation begins and there are no innovators in the model which means that every user who installs Snapchat does it because other friends already have it installed.
4. The relationships among users and the different probabilities that influence install rates and delete rates are chosen so that the rate of new users will in the beginning of the simulation match with figure 5.4 and figure 5.6.
5. None of the users have initially installed Snapchat and then deleted Snapchat.
6. No new iPhones enter the market during the simulation period.

The main sequence of operations in the simulation model is:

1. Initialise population in which the users are divided into Never installed, Installed according to a given distribution. (In the Norwegian market, 50 percent of the users have Snapchat installed which amounts to 390 000 users[4]. No users have in the model initially deleted Snapchat.
2. Initialise friendships in which users get relationships among each other. These relationships are evenly distributed and in general there are no friends with tighter relationship conections than others.
3. Loop over 750 days and simulate each day. Each day includes all of the three listed main dynamics of the model.

The simulation is performed using Java and the graphic results are exported to Excel.

[4]iPhone users on Facebook in the age 13 to 35 according to Facebook Advertising options

5.4.1 Results

Three different cases are studied and in each, the number of friends that a user has changes. The number of friends used in the cases are $n = 5, n = 10$ and $n = 20$.

$n = 5$
In this case, users who do not have Snapchat will initially install it, but after the period around two months, more users have due to general loss of interest in the product, started to delete Snapchat. Since every user has maximum five friends, the declinement will increase in time because less and less of a user's friend now has Snapchat. Figure 5.9 shows the development over time.

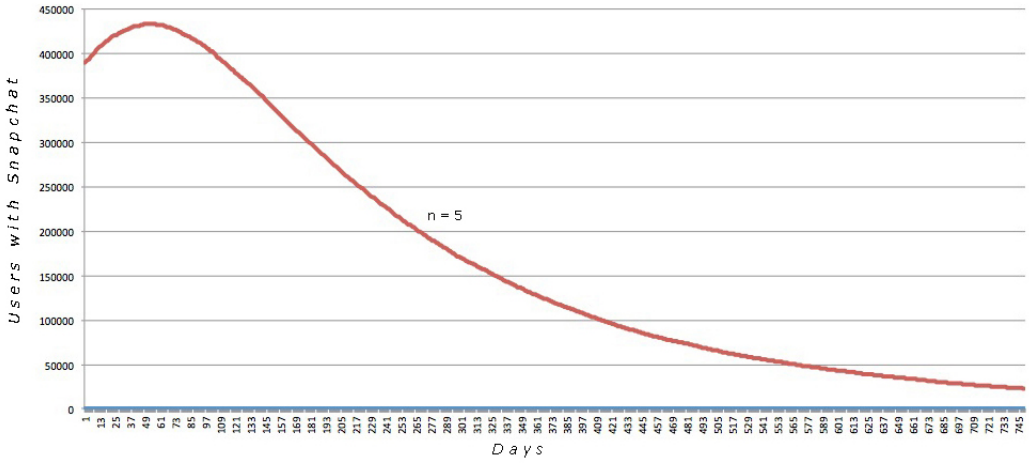

Figure 5.9: *Simulated development of users over 750 days where* $n = 5$. *Maximum number of simultaneous users* $\approx$ *430 000.*

$n = 10$

In this case, users who do not have Snapchat will initially install it, but in this case the maximum number of users in the service is lower than in the case where n=5. This might be because of users in general lose interest in the product and because each user have more friends in this case, this levels out the rapid incline in the beginning. This also might lead to a slower declinement after reaching the maximum, and as showed in figure 5.10, the number of users who have Snapchat installed starts declining after around three months.

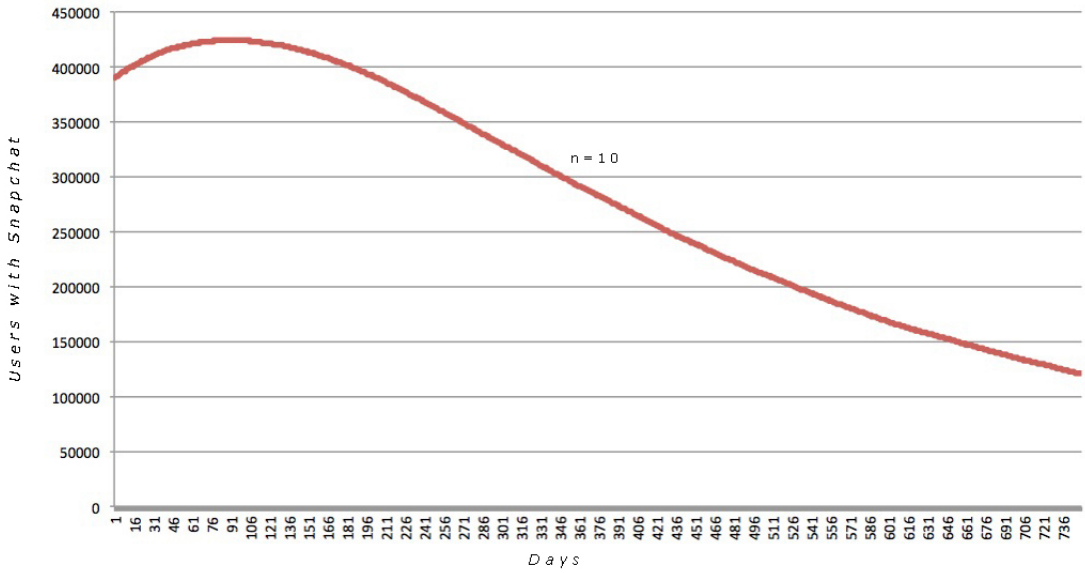

Figure 5.10: *Simulated development of users over 750 days where* $n = 10$. *Maximum number of simultaneous users* $\approx$ *430 000.*

$n = 20$

As in the two previous cases, users who do not have Snapchat will initially install it, but due to the same reason as in the case where n=10, the inclinement towards the top will go slower, and the same goes for the declinement. The declinement of number of users starts at around six months. Figure 5.11 shows the development over time.

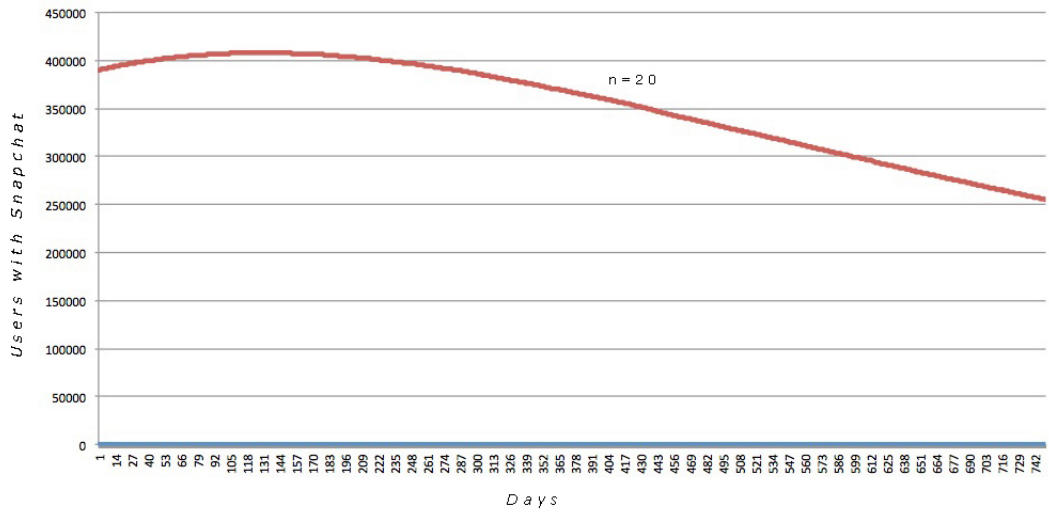

Figure 5.11: *Simulated development of users over 750 days where* $n = 20$. *Maximum number of simultaneous users* $\approx$ *410 000.*

Discussion

One can compare the three cases and find that the more friends a user has, the more stable could Snapchat be over time in terms of number of users. Whereas in the case $n = 5$ the user base is almost gone in the end of the period, in the case $n = 20$ there are still around 250 000 active users. In the case $n = 10$ it approximately lies in the middle of the two other cases. Although the relationships established among the users are uniform and do not follow a certain distribution, the development of users seems plausible, but to take the simulation to the next level, another distribution of friendships should be looked into. It makes sense that Snapchat would survive longer if each user has more friends than in the case where each user has lesser friends so comparing the different graphs for the different cases makes sense. But what can be discussed is the fact that in the performed simulation, the more friends each user has the lower becomes the maximum number of users having Snapchat installed. As explained in the $n = 10$ case, this might be because in the case where each user has 20 friends, then more users will each day delete Snapchat and the negative networks

effects would overweigh the positive network effects coming from users installing Snapchat. This could me delved more into in a next step model.

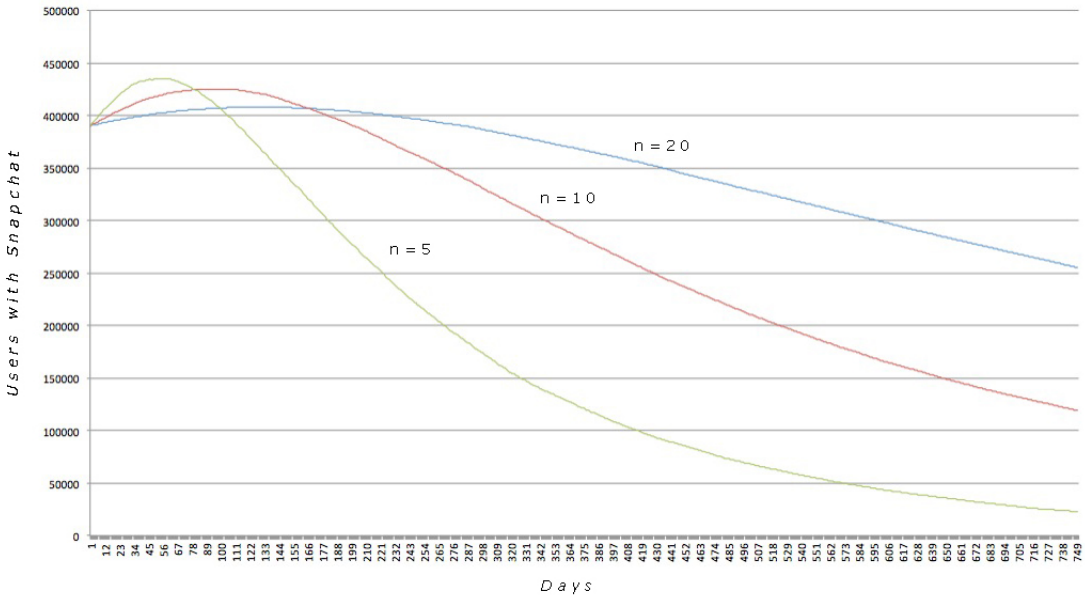

Figure 5.12: *Comparison of the simulated development of users over 750 days for the three cases n=5, n=10 and n=20 .*

5.4.2 Revenue Generation

Because of the intimacy Snapchat brings from its anti social properties gives it a potential to be more content-driven than any other social medium. This is because whenever a user receives a photo on Snapchat it feels much more personal than seeing the same photo on Facebook. the instant sentiment/feeling of receiving that video on your phone is something that can't be replicated through Facebook, Twitter, etc. It feels more personal and private at the same time." [76] This might be used to take native advertising to a more innovative level by including influential people or groups like artists, bands, athletes or actors in the same way typically Red Bull does through Youtube.com by posting videos of athletes wearing Red Bull outfit. There are lots of other possibilites as well, and some posibilities are listed below.

– Stickers. A sticker is simply explained a small photo, typically a cartoon that you can send to another user and has become very popular in messaging apps, for instance Viber[79]. Since launch of the market in November, Viber users have downloaded over 100 million sticker packs, but the company has not

disclosed how much revenue has been generated by the market. Snapchat allows users to add texts to their photos and in the future, why not stickers also. Branded stickers is another approach by letting big companies like Coca Cola or Nike have stickers of their logos present in Snapchat.

– Branded content. This is similar to the native advertising for instance Red Bull is promoting along with many others.[80] The point is to use Snapchat as a platform for companies to advertise through through influential people who are promoting their ads.

– Display advertising. The more traditional way of displaying ads. These ads might be shown just before the user is able to look at a photo he/she just received.

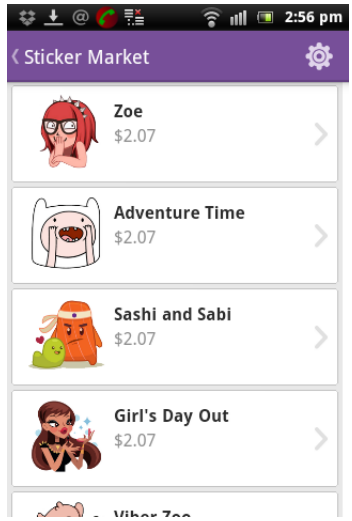

Figure 5.13: *Stickers market for Viber.*

Revenue generation example and simulation model

The revenue generation example from the Norwegian iPhone market in this section is mostly used as a basis for the calculations in section 5.5 on Snapchat value discussion. One can get an indication of the revenue generation for Snapchat by using the simulation model in section 5.4. The simulation model only covers the Norwegian iPhone market, but could still provide some indications used in further discussions in section 5.4. An average active Snapchat user is estimated to recieve between 20 and 50 photos through Snapchat every day[81], and each photo can be seen between one and ten seconds. So an average active Snapchat user can spend between 20 seconds at the absolute lowest and eight mintues and 20 seconds at the highest. Meeting

approximately in the middle with 25 photos recieved and each photo shown for five seconds, and average active Snapchat user is active on Snapchat for two minutes and 30 seconds. Note that is a bit simplified and the the amount of time a user spends on Snapchat without looking at photos is excluded, that is, for instance time taking a photo and sending it to users. Using the revenue generation method in item three in section 5.4.2 one can calculate some potential revenue to been seen for Snapchat in the Norwegian iPhone market. Display advertising is one of the revenue generating methods Snapchat can utilise to be profitable in the future, and one can by the use of the simulation model in section 5.4 calculate a potential profit over the given period simulated while using that the average time per active user per day amounts to 150 seconds. Some example values have to be set in order to make revenue examples.

1. Each active user is on average active for around 150 seconds.
2. Each second of display ad has a value of \$0.00119[5]
3. Users will be displayed an ad all the time they use Snapchat.

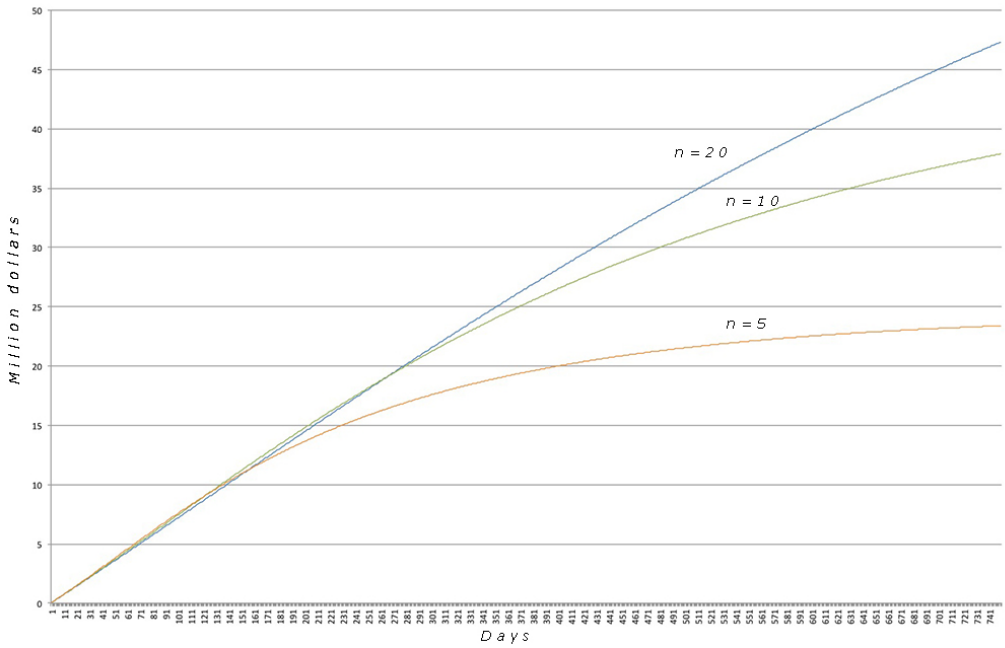

Figure 5.14: *Potential revenues for Snapchat in the Norwegian iPhone market over 750 days.* $n = 20$ *gives \$47m,* $n = 10$ *gives \$37m and* $n = 5$ *gives \$24m.*

[5]Derived from average CPM value from figure 4.10

While in the Norwegian case where $n = 5$ the total revenue lies between \$20 million and \$25 million, it is almost the double in the case where $n = 20$, giving a revenue at almost \$50 million in the first 750 days.

5.5 Snapchat Value

It is rather difficult to find articles on the subject of Snapchat valuation that actually uses any numbers except from current userbases. So even though the calculations in this section contain some uncertanties when it comes to advertising values, development of userbases and time spent on Snapchat daily, the calculations still might give a good indications on whether the \$3b valuation of Snapchat has roots in reality or not.

Revenue based valuation
By including Snapchat userbases for the U.S and the UK (Which are the only registered numbers except from Norway, but which contributes too little in this setting.[82]) - but still counts for large parts of the total userbase worldwide) one can use the same revenue model as in section 5.4.2 to calcuate the total revenue over a period of 750 days, and thus get an indicator on whether the \$3b valutation is an acceptable valuation. The analysis in this section is a worst case analysis where both the userbases in the U.S and the UK follow the same normalised graph where $n = 10$, extracted from the graph in figure 5.10. So even though in the Norwegian market the userbase starts deteriorating after reaching 50 percent market share, the U.S and the UK userbases start deteriorating at the current userbases. Hence:

- There are 26 million initial Snapchat users in the U.S, denoted u_{usa}
- There are 11 million initial Snapchat users in the UK, denoted u_{uk}
- The development of the userbases in U.S and UK follow the same development as the graph in figure 5.10 with $n = 10$ and the userbases start deteriorating almost immediately. Hence the current userbases have almost reached their maximum points. This normalised graph is denoted $f(d)$ and is shown in figure 5.15

The rest of the values are the same as in section 5.4.2, hence

- Each active user is on average active for around $t_{active} = 150s$.
- Each second of display ad has a value $v_{ad} = \$0.00119$[6]
- Users will be displayed an ad all the time they use Snapchat.

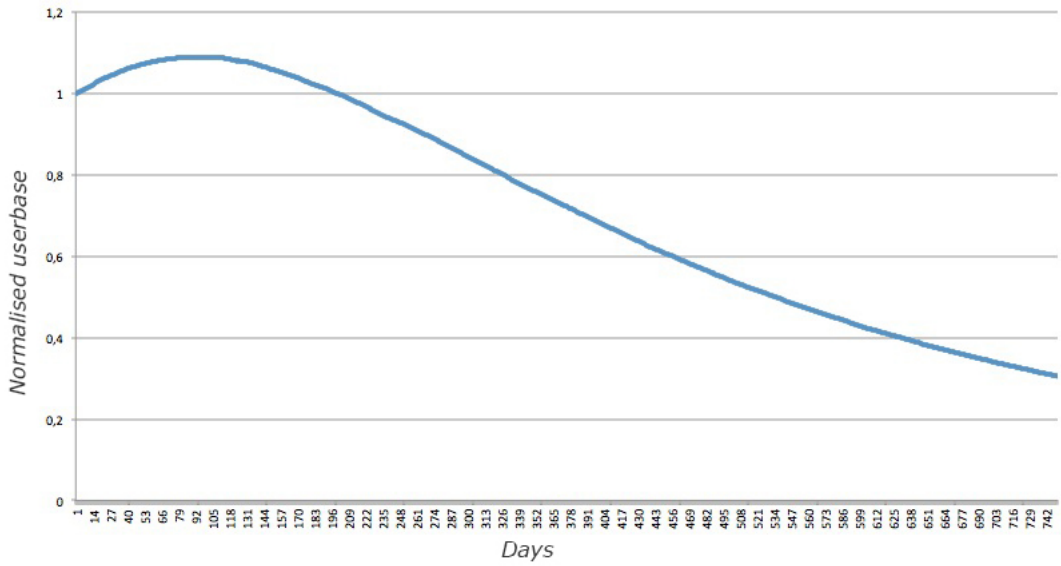

Figure 5.15: *Function $f(d)$ which shows the normalised userbase where $f(d) = 1$ equals the initial userbase.*

By summarising the cumulative revenue streams for U.S and UK over the period of 750 days on can match the results up against the valuation claims.

$$TR_{750days} = \sum_{d=1}^{750} (R_{d,us} + R_{d,uk}) \tag{5.1}$$

$$TR_{750days} = t_{active} v_{ad} * \sum_{d=1}^{750} f(d)(u_{usa} + u_{uk}) \tag{5.2}$$

[6]Derived from average CPM value from figure 4.10

Where R denotes revenue for the given day d and TR denotes the total revenue over the period. The result is carried out in equation 5.3

$$TR_{750days} = \$3592b \tag{5.3}$$

The cumulative revenue stream over 750 days for these two countries exceeds the valuation of \$3b, but is this enough to state that the valuation is fair? There are some ways to examine whether this result answers the question or not. One way is to point out areas of the model that contribute in a more positive way than it might should and areas in the model that contributes in a more negative way then it might should. For instance of most importance on the optimistic side is the point which states that users are all the time displayed an ad, and this might be a too optimistic claim. The total revenue over the period would halve by halving this value, making $TR_{750days} = \$1796b$. Users might be spending less time than 150 seconds per day on Snapchat, but they also might be spending more time, so this claim might not make big differentiations in the final result. The point which states that the UK and the U.S userbase curve follow the $f(d)$ curve is probably a too negative claim and which contributes to a much lower total revenue in the period. So the userbase could grow to a higher maximum point like in the Norwegian case. Also, with the value of digital advertising growing (see section 4.4), the value v_{ad} probably contributes to a more negative TR than it should. So there are some points that drag the probable value down, and som that drag it up again, so the results might not be totally correct, but it still gives an indicator that the \$3b valuation claim might be an OK estimate. One important thing to take into consideration is the fact that $TR_{750days}$ only goes for U.S and UK which means there are many other countries left. For instance countries in Asia have still not been penetrated by Snapchat, thus leaving possibilities for Snapchat to generate a much higher TR than in the case discussed.

NPV Based Valuation

The Net Present Value states how much Snapchat is worth today based only on future cash flows and a discount rate d. The discount rate is a key variable in the process, and can be decided by a firm's weighted average cost of capital (after tax) for instance, or use higher discount rates to adjust for risk or other factors [83]. But one important thing is that $NPV \leq TR$ in all cases giving that the NPV value will be less than the maximum possible revenue for Snapchat in the given period. By setting the 750 days to be approx. two years, equation 5.4 illustrates how the NPV becomes less than TR.

$$NPV = \frac{TR_1}{(d+1)} + \frac{TR_2}{(d+1)^2} \leq TR_1 + TR_2 \tag{5.4}$$

The NPV does not defend the $3b valuation, but it should not probably be used either in this case because most of Snapchat's value is not directly related to instant revenue, be rather what the user can do for the acquisitor as seen in the paragraph on comparison based valuation in section 5.5.

Comparison Based Valuation

One can also compare Snapchat to the recently acquired mobile application WhatsApp which was acquired by Facebook for $18b paid mostly in Facebook stocks. With the 300-450 million active users, a $0.99 yearly fee per user, and no fluctuations in the userbase the total revenue over the same 750 days would be approx. $600m -$900m - certainly a lot lower than the potential $TR_{750days}$ for Snapchat. Part of the deal between Facebook and WhatsApp also states that WhatsApp will stay free of adverts and is still going to be a standalone application, so it does not look like there is much more to gain financially directly from WhatsApp, but was still acquired for the sum of $18b. Probably, the value represents what Facebook can do with WhatsApp to both expand its own service and to halt the expansion of other services like for instance Twitter og Google. WhatsApp may become less inclined to work with companies that compete with Facebook which they did with Instagram after acquisation where they stopped the Instagram-Twitter integration[84]. Facebook also might want to make sure that they are not losing mobile users to new applications entering the market, and in this way they are also acquring a huge number of mobile users. Even though WhatsApp will stay free of advertising, Facebook will not. The acquistion of WhatsApp gives Facebook access to all user data giving them larger possibilities to achieve even better targeted advertising. Facebook also needs to expand its Europe and emerging markets presence which is possible because WhatsApp is large in developing countries. So there are many reasons besides the actual revenue from WhatsApp that contributes to the high valuation, and many of the same reasons would also apply to Snapchat. So if acquiring Snapchat would help Facebook in maintaining their large userbases, gaining more revenue from their own advertising and halt expansion of other similar services, then the value of Snapchat definitely increases. But, the acquisition of WhatsApp values each user to $42, and the potential acquisition of Snapchat would value each user to $50 [85], so the difference is not that large, but it still might be difficult to defend that each user of Snapchat is worth more since WhatsApp is profiting $0.99 per user and the daily retention rate for WhatsApp is around 70 percent. The retention rate of Snapchat is not known (but estimated in section 5.3), but it is very rare that retention rates go higher than 70 percent.

All things combined with possible revenue streams from advertising, strengthening the market position of the acquirer whilst also halting expansion of competetive services the $3-4b valuation is not that far off and there is huge potential in acquring Snapchat if it is administrated correctly in the future. At least the next two years

could bring in $2-3b from advertising alone. The value per user compared to WhatsApp may indicate that the valuation is too high, but it is hard to know because of the unkown retention rate on Snapchat.

Chapter 6
Conclusion

6.1 Key Findings

In the sense of an economical aspect many factors contribute to where the mobile application market is headed. This chapter summarises the different factors extracted from this project and ends with a conclusion on how the market might develope.

We have seen that the applications that have been (or will be) heavily invested in are of the social or anti-social kind but that the risks are high due to the uncertanties in the applications‘ living times. Like most products, mobile applications in general will go through the Product Life Cycle where in the end every application will enter the decline stage. When this happens of course varies but in the mobile application market the decline stage is met faster often because of different reasons related to the market specific for mobile applications, like for instance the number of new applications entering the market every day and the average retention rates of standard applications. Social- and anti social applications tend to have higher retention rates and are more likely to reach the growth stage faster, but are also more likely to enter faster through the decline stage due to the deteriorating effects from the lack of retention from users. This effect is described as negative network effects and illustrated in the irSIR model in section 3.2.3 where users first adapt the service but then rejects the service rapidly due to other users rejecting the service as well. We have seen MySpace follows the irSIR userbase development curve from the beginning to the end and that the development of the userbase of Snapchat follows a similar curve as for MySpace (and many other social networks), having the irSIR model as a basis for the simulation model in section 5.4. Snapchat was analysed in terms of userbase development and valuation claims and we have seen that Snapchat is actually very social resilient when it comes to competitive solutions as in a way proven when fighting off Facebook‘s attempt to imitate the service with their Facebook Poke, but is vulnerable when it comes to the deteriorating effects from where users simply are not using the service anymore, which leads to rapid declinement of the active userbase. So even though we have indicated high retention

rates among users, its social resilience might not be strongest due to its anti-social properties. The Snapchat simulation model shows the different possible outcomes as a function of social resilience and illustrates how much faster the service declines when the number of strong connectivities among users is low. When it comes to the valuation claim of $3b it highly depends on the way you analyse it. In a pure revenue based valuation and in a NPV valuation with cash flows directly from the service, Snapchat probably does not reach up to the claimed amount, but other way of analysing it might indicate otherwise. Snapchat could give already big existing actors like Facebook a competetive advantage and halt the growth of others. This was probably the case in the WhatsApp acquisition and it seems like it may be the case for Snapchat as well. So you will not see an independent investor pay this value because for him/her the service may only have its worth in pure revenue, but for Facebook many other benefits are possible from this acquisition. Also important is that most of the sum payed in the WhatsApp acquisition was in Facebook stocks making it a much lower risk project than it would in a pure cash payment. Maybe this would be the case for Snapchat as well and minimising the risk.

We have seen that the market for mobile advertising is pointer upwards mainly because of the number of new smartphones being shipped out to the market, and because digital advertising in general is becoming smarter and hence more valuable. New smartphone markets are emerging, especially in Asia, but also in Africa which means there are more users to target, and with fewer users needed to be reached the mobile advertising markets open for more actors. And with mobile data being more and more accesible around the world users are able to use online applications more often and thus increasing the value of each user.

6.2 How the Application Market can develope

From the look of how mobile applications, with and without social (or anti-social) properties are experiencing typical life cycles, and also from the amount of new applications being introduced to the market through Appstore, Google Play and Windows Phone Store, it is believed that the market will be in constant motion with different applications residing in the top layer of the market. As each application‘s life cycle developes, new similar applications with some product differentiation slowly win market shares. There will not necessarily be a winner who takes it all (see section 4.3.1) and very often some top applications will compete in the market with quite equal market shares. This is shown to be typical in the mobile messaging app section of the market. The product differentiation between the different messaging apps overcomes the fact that initally one app has initially a much bigger userbase and therefore one can see equal shares of the market shared between the applications. Though these applications might share the market, it seems like eventually all applications will die out and there will in general be a continuously change in the

top layer of the mobile application market. The different applications die out in a pace dependent on both the size of the userbase and on the ability to inovate over time and thereby building a strong social resilience and acting proactive to the issues residing in each stage of the product cycle and the OSN cycle (see section 3.2.1). Also, many mobile applications are launched at different geographical areas which means that an application launched in the U.S often will not reach Asia before after a while, so each life cycle could be restricted to a geographical area so that an application could die out in the U.S and then start a new cycle in for instance Asia.

Anti social networks are becoming more and more popular and many of the existing social networks tend to lose users to the anti social networks. This is already been observed in the case where many teenager users flee from Facebook to messaging apps. While we have seen the anti social networks are becoming more popular, they are also more vulnerable to rapid declinements due to the few number of connections among users.

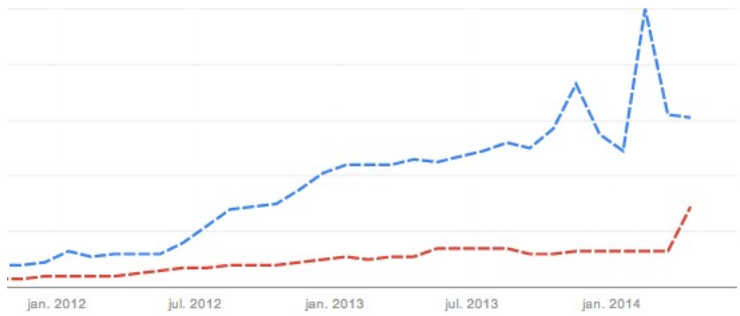

Figure 6.1: *WhatsApp in blue and Viber in red in terms of Google Trends from the U.S. Even though WhatsApp has a much higher search index, there is not a Winner takes it all market and towards the end Viber actually gains an even higher search index and WhatsApp a lower one, tightening the competition between the two.*

The mobile application market gains more and more value mainly because of newer technology that allows for better and more useful applications, more and more people are acquring smart phones which gives them access to mobile applications and because smarter ways of gaining revenue through these applications are developing. Digital advertising becomes more and more worth because it is now displayed in a way that engages the users much more than before and has the potential to reach out to much more people than before. There are questions whether the mobile application market will experience the same burst bubble as in the Dot-Com era mainly because a very high number of applications are submittet to the different app stores evey day, and very few of them actually generate some sort of noticable value. This is a

hard question to answer but one thing that differs from today and in the Dot-Cot era is that the market is now not premature. In the Dot-Com period many of the failed IT companies were for instance e-commerce (i.e boo.com) that focused too much on making high tech internet sites where people could buy clothes. Though people were not ready for these kinds of solutions, and neither were the technology. The e-commerce sites ran slowly on normal computers and the shopping experience stalled. This is not a problem today and people are adapting to new services very quickly.

Also, a new app category has been pointed out as the future for many app developers, Business and Productivity - applications to make life easer for normal- and business users. This categoy is to provide constant growth in market value and in more long term values with higher retenion rates among users and enterprises. Not only that, it is estimated to be a less congested market and thus provides openings in the market for developers.

6.3 Future Work

There are several things identified as possibilities for future work on this subject. In general, one can point out more risks and opportunities related to the mobile application market as for instance

- One can go more into detail on historical events which might relate to the mobile application market and perform a more detailed study on how earlier mobile apps have gone through different life cycles.
- By going more into depth with possible emering app categories, one can identify factors contributing to a shift in the market and help pointing out clogged parts of the market, and hence also point of more open parts of the market.

Most interesting might be to further improve the simulation model of the userbase development for popular mobile applications, which could be both dependent on social properties and not dependent on social properties. Future factors to include in a simulation model could be

- A more complex correlation between users, being that some users are more tightly coupled than others for instance.
- Increase the geographical coverage area, most ideally expand to the whole world.

– Include the fact that smartphone shipments worldwide is increasing which could influence both current markets and help identifying uprising markets.

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Appendix A
Snapchat simulation code

The Snapchat simulation in section 5.4 uses Java for the actual simulation, and then the results are exported in to Excel for a graphical representation.

The first function that runs is the initialisePopulation function that decides whether a user already has downloaded Snapchat or not and then make all the users ready for connection establishments with other users.

```
public static void initialisePopulation(){

            for(int i =0;i<population;i++){ // Iterate the whole
                population
                   double rnd = (Math.random());
                   if(rnd<probOfHavingSnapchat){ // Check if the user
                       already has Snapchat
                          User person = new User(i, true);
                          downloaded.add(person); // Add person to
                              "Downloaded population"
                          totalPopulation.add(person);
                          needsFriends.add(person); // Make ready for
                              connection initalisation

                   }
                   else if( rnd>probOfHavingSnapchat){
                          User person = new User(i,false);
                          freeUsers.add(person); // Add person to
                              "Non-downloaded population"
                          totalPopulation.add(person);
                          needsFriends.add(person); // Make ready for
                              connection initalisation
                   }
            }
```

Following is the initialiseConnection function that establishes connections among users. The boolean function $friendlistFull()$ makes sure that no users have more friends than the number n shown in the results in section 5.4.

```
public static void initialiseConnections(){
for(int i =0;i<=needsFriends.size();i++){ //Iterate the list of people who
    needs connections
       int newFriendIndex =i;
       if(i==needsFriends.size()){
              break;
                                  }
              while(!needsFriends.get(i).friendlistFull()){ // check if
                  user i has room for more friends
                     newFriendIndex++;
                     if(newFriendIndex == needsFriends.size()){
                     break;
                     }
                     needsFriends.get(i).addFriend(needsFriends.get(newFriendIndex));
                         //add connections
                     needsFriends.get(newFriendIndex).addFriend(needsFriends.get(i));
                     needsFriends.get(i).addRelationship(needsFriends.get(newFriendIndex));
                     needsFriends.get(newFriendIndex).addRelationship(needsFriends.get(i));
                     if(needsFriends.get(newFriendIndex).friendlistFull()){
                            needsFriends.remove(newFriendIndex);
                                         }

                                         }


                            }
       }
```

After the population has been initialised and the connections have been established, a certain number of days are to be simulated where each day contains a number of users who delete Snapchat and a number of people who download Snapchat. For every user there is a very small probability that the user will quit the service independent on other users.

```
public boolean willRandomlyDeleteSnapchat(){
              double i = 0.0005;
              if(i<(Math.random())){
                     return false;
              }
              return true;
```

```
        }
```

If the function *willRandomlyDeleteSnapchat*() is true, then the *chainReactionDelete*()-function is called which is a recursive function that checks if other users will delete because other users delete.

```
public void chainReactionDelete(){
                for(int k = 0;k<this.friends.size();k++){
                        if(this.friends.get(k).installed==true){
                                if(this.friends.get(k).willDeleteBecauseOfOtherDelete()){
                                        this.friends.get(k).chainReactionDelete();
                                        this.friends.get(k).deleted=true;
                                        this.friends.get(k).installed=false;



                                }
                        }
                }
```

In the same way as there is a chain reaction for deleting users, there is also a chain reaction for downloaded users. There are as mentioned no early adopters among the users so every user downloading is doing it because some other friend has already downloaded it.

```
public void chainReactionDownload(){
                for(int k = 0;k<this.friends.size();k++){
                        if(this.friends.get(k).installed==true){
                        if(this.friends.get(k).installed==true &&
                            this.get(k).willDownloadBecauseOfFriend(totalPopulation.get(k).fr

                                        this.friends.get(k).chainReactionDownload();
                                        this.friends.get(k).deleted=false;
                                        this.friends.get(k).installed=true;



                                }
                        }
                }
```

Appendix B
Shopkick

Shopkick is a shopping app for smartphones and tablets, which rewards users for walking in to stores and buying items in the store. The virtual currency called "kicks" is added to a users account each time the user enters a store, buys an item or something similar. This currency can then be used for gift cards, movie tickets etc. In 2012, the application added 200 million dollars in profits to around 7500 different stores and is used by over 4 million people. A similar approach is suggested in this project.

Figure B.1: *Shopkick*

Shopkick has introduced a level of “gamification” to the shopping experience, letting consumers earn rewards visiting stores — a big plus for retailers keen to increase foot traffic. It also offers a service whereby users can scan barcodes for selected brands to get additional deals or other benefits. Even though the original principle has remained, the use of digial catalogs has led to a skyrocketing engagement among the users.