

# **The darknet as the new Internet**

**A thesis about how a darknet like Freenet is much like the beginning of the public Internet  
and how it is involved in the future of the net.**

**01-06-2011  
Megan Hoogenboom**

## Introduction

This thesis serves to point out the differences and similarities between the darknet Freenet and the public Internet, and to demonstrate that the development of the Internet we are now so familiar with was not inevitable. It also shows how these darknets, like Freenet, are involved in the future of the public Internet. Darknets often scare people off, because of weird or inappropriate content. This is because the people that are now on these darknets, have their reasons to be there and not on the public Internet, they want to be anonymous. If more people join these darknets, the content will also get more common and approachable. Freenet is a peer-to-peer network, which allows its users to share publications, files, and to publish their own content. Peer-to-peer was first used in the software of Napster, which was the first, illegal, music sharing computer program. It had no central server, it allowed its users, the peers, to connect to each-other without a central point (Harkin 2009).

In Freenet the sharing and looking at content is fully anonymous, all content is encrypted and stored location-independent. When connecting to friends only, an even deeper and more secure darknet can be created. These networks have several similarities with the beginning of the public Internet, which is in essence a network that uses TCP/IP, this protocol was developed already in the 1970s. The public Internet can be easily accessed by a connection through telephone line and a browser on a computer, and these days also on smartphones. The public Internet is moving slowly outside of the browser. This public Internet is often thought of as the only Internet-network available, but darknets like Freenet have been around for a while. The Internet started as an open network, open for other people to develop it further. After the dot-com bubble bust, around 2001, companies were taking the control of the public Internet, and the basic protocol stayed the same. This direction the public Internet took was never the only option, it could have gone differently. Freenet is an example of what the public Internet could have been; an anonymous environment, focussing more on the protection of its users instead of making a profit.

A second dot-com bubble is developing itself, again there are millions of dollars invested into Internet companies. This second bubble can also burst at one point, like the first dot-com boom around 2001, and the question raises what happens to the public Internet and the involvement of darknets like Freenet.

The motivation behind this thesis is a personal project by the author and the fascination of the use of the public Internet by most users. This thesis and the project began with the idea of looking into fears and phobias on the Internet. After reading some texts on this subject a new kind of world opened up for me; the world of the darknets. I installed Freenet on my computer, and started researching this environment. The interesting facts about Freenet were, for me, the anonymity and what this means for the content people place online. The Freesites that are online, have a certain look to them, which reminded me of a previous project I did. This previous project was about abandoned online spaces, and what happens to these website once abandoned. They were mostly personal HTML pages people abandoned after moving to a blog – this is an example of the commercialisation of the public Internet. The abandoned pages I found, were quite similar in look and feel as the Freesites I found on Freenet.

My project enables users to write encrypted messages, to comment on anything in the room it is in. The darknet can be placed anywhere, just like a darknet can exist anywhere on or next to an existing network. On the one hand it invites users because it is an interesting way to post anonymous, encrypted messages. Thus, one can write more honest or sincere messages and feelings. Or be more offensive or hurtful. The network has no censorship of messages or limitations to the placing of the messages. Categories can be followed by the instructions or be created by the users themselves. On the other hand the darknet discourages visitors to engage because the encrypting or decrypting of messages takes time and effort. This is also the case in many darknets online, they are safe and anonymous, but because of this slow and difficult to use. What is more important: to be anonymous and have private conversations or to be able to communicate fast but not have the option to be completely honest.

The messages can be placed or filed into categories, these categories can sometimes be offensive or inappropriate to communicate about in the normal network, on this darknet they are open for discussion. The design is based on the structure of a networking protocol. All elements align with each other, have the same length, distance and proportional size. This is important in a network, because, just like in an online network, if one element doesn't fit it will look like a bug and cannot be executed by the software. What I provide with this project is the translation of an anonymous darknet into the physical world. With this translation I hope to make people more aware of the fact that the public Internet is not the only network. Darknets can be weird, unsafe, uncomfortable places, but the users themselves fill it with content.

## The early days of the public Internet

As a result of the adoption of Part 68 of Title 47 of the Code of Federal Regulations by the FCC – the Federal Communications Commission – in 1977, all costumers of a telephone and telephone line could finally attach any device they wished to the network. Before this it was held back by AT&T, which had the monopoly of telephones at that time, because of commercial benefits. The network could then be opened for earlier developed networking systems, under which ARPANET created by ARPA – the Advanced Research Projects Agency, which was part of the Department of Defence of the US (Griffiths 2002). ARPA also created the PRNET, a packet radio network, and SATNET, a network through satellites. They experimented with all three systems, also connected them to each-other. In the end ARPANET would seem the best candidate to develop further (Ryan 2010). In 1978 Ward Christensen and Randy Suess developed a new piece of software; the Computer Bulletin Board System, BBS (Gilbertson 2010). This small program would start if one person placed a phone call, and would shut down if the caller hung up. While they were connected, the one who made the call could send commands to the computer on the other end of the line. Users could also upload and store files, this was the forerunner of contemporary web forums. BBS was later joined by FidoNet, created by Tom Jennings. This program allowed users to communicate on a bigger scale: global. The PC was getting more common because of these networking abilities, which was the beginning of the World Wide Web or public Internet (Ryan 2010). These first systems were developed by hobbyists/enthusiasts or people of the Home-brew community. Not late after this several companies joined in, and made the technology more available to home users. At the end of the 80s and the beginning of the 90s the competition and commercialisation of the web began slowly. Also, on universities and within companies people were getting more PC's and connecting them via a LAN connection with TCP/IP protocol, which was freely distributed. At the same time, ARPANET funded by the Defence Communications Agency, DCA, adopted the TCP/IP protocol, in which they moved the network of DCA from a networking protocol to an internetworking protocol. This was the foundation of the Internet we know today. The ARPANET was officially decommissioned in 1990, after it had formed the temporary backbone for a new system called NSFNET (NSF, 2011). This was meant to be a high-speed national networking system, build by MERIT and became operational in 1988 (MERIT, 2011). After all this, Tim Berners-Lee developed in 1990 the hypertext language HTML – Hypertext Mark-up Language. He wanted it to be a part of a world wide web of information, where the document format wouldn't make a different, they would all be able to be called up by a URI. URI is short for Uniform Resource Identifier, which is also known as URL. These URI's and URL's consist of a short string that identifies resources on the net, they are often referred to as Internet addresses (W3, 2006). The HTML came along with the first browser and editor to view and create HTML files. This was the beginning of the world wide web, and the browser. The personal web pages got a slow start after the introduction of the browser. Different browsers were developed and people started to buy and use PCs and office computers.

Before 1995 it was forbidden to perform commercial activity on the public Internet, under the National Science Foundation's Acceptable Usage Policy. Because the public Internet was still in hands of the US-government this law applied to the global public Internet. More and more networks were arising on the net, and more people were going “online”. The private sector was the most valuable contributor in the software and protocols of the public Internet, and this is the reason why the US-government's ownership of the public Internet was ended in 1995. Thus, the law that prohibited commercial activity online, didn't apply any more.

After this happening, a lot of new dot-com's were established. The public Internet stood at this point at a crossroads: there were the personal HTML pages, the small and personal networks, and on the other side the new Internet companies, who wanted to make profit. The companies were capable to raise funding, for business ideas, some strong and some weak. According to J. Ryan, in his book “A history of the Internet and the Digital Future”, the first misleading maxim that caused the dot-com boom was: “the net changes everything” (Ryan 2010). The Net, as in the public Internet, didn't change everything, only the digital communications. In this book J. Ryan portrays the history of the public Internet. From the very beginning, the development of the telephone and the telephone-line, to the point we are now, and what the future might bring. The book has a clear chronological order in the history and how the public Internet became what it is today. However a few elements , I would like to have seen implemented in the book, are missing. One is the big importance of users creating personal HTML pages, and later moving to blogs and twitter, which

illustrates the commercialisation of the public Internet. The second element I missed in the book, is the splitting of the net into the public Internet and several darknets.

The web was missing one essential element in the 1990s to 2002s; a capable search engine. The public Internet of the 1990s to 2000s was referred to with the metaphor “I go get Web” (Vander Wal, 2006). As this metaphor implies, in these times one should know where he wanted to go, and in this way find the content. The public Internet slowly moved to the “Come to me Web”, the web where the content and information comes to the user and one can modify what information he wants to receive.

The first web search engines were all created by students on different Universities. The first: Archie, created by Alan Emtage at McGill University in Montreal, indexed computer files. Another one: Gopher, created by Mark McCahill at the University of Minnesota in 1991, indexed plain text documents. These two and more of the first generation search engines were part of the “I go get Web”, the search terms had to be very explicit. In 1993, what is considered to be the first, web robot was created by MIT student Matthew Gray, the World Wide Web Wanderer. It was originally created to measure the size of the public Internet, and was operational from 1993 to 1995. The many web robots, later used, are also referred to as web-crawlers, spiders or wanderers. From here on the search engines developed into engines who gave better search results, crawled more websites and became faster. Different engines provided new search techniques, like Lycos who was the biggest at 1996 and Alta Vista, created in 1995, who allowed natural language inquiries and advanced searching techniques (Underwood, 2004). But, the real search engine revolution began when Google was launched in 1997 by Sergey Brin and Larry Page. It was the first time a search engine used inbound links to rank sites. Google continually crawls the web, with its Google-bots. These bots visit a website, copy the content and follow the links on the page and execute the same procedure. After this process Google creates an index for the page, which is a list of all the words and where they're located on the page. What happens when one is searching via Google, he is not searching the entire public Internet but rather the index of the public Internet by Google. Another element that made Google into the search engine that: “gives you back exactly what you want” (Google, 2011) is the notion of PageRank. PageRank is a program that ranks a page by how many other pages link to it. Thus, it determines the importance of a website, the website with the highest PageRank is probably the one you need. Google tries to keep everything as fresh and updated as possible to give one the best search results (Google, 2011). This resulted into Google becoming market leader in search engine technology. Van Deursen argued in his thesis “Using the Internet: Skill Related Problems in Users’ Online Behaviour” (van Deursen 2010) how the Dutch users of the public Internet find what they are looking for and navigate on the web. He researched activities of 100 people, in four different categories: searching, selecting, evaluating information and using information to complete a task. 98% Of the contributors started the search with Google, 56% used a very common search term and wasn't specific. For example typing in Google “salary” when searching for the minimum wage of a specific year (Klaver 2009). Also, at the same task, 36% of the contributors didn't look beyond the first three search results (van Deursen 2010). This last fact is a very disturbing one, if people aren't able to find what they are looking for themselves, what will the future of the public Internet be?

Shawn Fanning, who's nickname was Napster, launched in 1999 a new type of peer-to-peer file sharing software, also called Napster. It was a decentralised system, in which users could find and copy music easily from each others music collections. This was the beginning of what is called “music piracy”, and is still causing lawsuits and issues of ownership and illegal distribution. Napster was forced to shut down in 2001, but the sharing and downloading of music, films and so on was unstoppable. Many of the Napster users migrated to a new technology: BitTorrent (Ryan 2010). This technology uses no central server or one channel to download a file, but instead multiple channels. These channels are called peers, when one downloads a file using BitTorrent one becomes a leecher. This technology of breaking the file up into smaller parts and then downloading them from different channels, was proven to be very effective and faster than other techniques (BitTorrent, 2011). The concept also includes the notion of keeping files open after downloading, thus seed them, so others can download faster (Ryan 2010). This is a different side of the public Internet than the side that was becoming more and more dominated by commercial companies and money making.

## **The commercialisation of the public Internet**

Ian Clarke wrote in his first paper on Freenet, about tracking and privacy on the public Internet. The possibility of tracking, being traced, endangers the privacy of many users. Clarke states that any information on the public Internet can be lead back to a server, and thus, a person (Clarke 1999). The danger of this issue is that this immediately decreases the freedom and free-speech of the users. The public Internet is often thought of as an anarchic medium, were one can be free and say and publish whatever one wishes. As examples of early illegal mp3 distribution public websites have shown, it is not (Biddle, England, Peinado, Willman 2002).

After the dot-com boom, around 2001, a new approach became known around the public Internet entrepreneurs: the user-driven websites. This step was the first towards a more interactive public Internet, and can be seen as a big step forward in networking (Ryan 2010). Because of these user-driven websites, users became more attached to the websites and communities on these websites were created. These communities were also based on trust, when a user would be doing inappropriate actions, other users could -together- block or delete this user. Another element of user-driven content is peer-to-peer. The user became more a creator and critic on the public Internet, thus, word-of-mouth recommendations became more important than advertisements like banners and pop-ups (Ryan 2010). Peer-to-peer communication also reached the companies. Ebay was one of the first using this principle, to rate sellers. Other commercial companies reach out to bloggers, so they can promote or talk about their product. Another example of this kind of advertisement is virals. Virals can be online videos, emails or interactive games. They can contain an advertisement, or can just be a popular video, email or game. These must have some kind of prominent element in them, this can be something funny, absurd, disturbing etc. (Marketingminefield, 2007). Virals are passed on by bloggers, users of social media and websites. The message can be hidden, sometimes they don't look like an advertisement.

Google-ads is another example of how the public Internet is being dominated by advertisements and commercial companies. Google is one of the most used search engines, and also one of the biggest Internet companies, figure 1. Google offers different services next to the search engine, like Google street view and Google Ad-Words. Google Ad-Words is a service that allows any public Internet user to sell advertisement space on their website through Google (Ryan 2010). This sounds like a fairly good deal, and an opportunity to make money from your website. But it is also a sign of the commercialisation of the public Internet. Only a few bloggers and website owners are making money from their online space, so now everyone wants to.



Figure 1: On this illustration it is shown how the relation between servers on the public Internet is in comparison to Google's servers. The amount of Google's servers is only an estimation, thus it can be even more than the amount shown here (Barrett, 2010).

Facebook works in a different way to make a profit, this is one of the best examples of what web 2.0 can be assigned to. Facebook makes most of its profit out of the companies self-service advertising platform. On this platform one can easily create an advertisement on Facebook, which will be displayed in the side bar on most of the pages of the site (O'Neill, 2010). The special service of this self-service advertisement is the targeting features. All advertisements have different target-groups, on Facebook every user has already published in what category he/she belongs – like gender, age, networks, keywords, relationship-status etc. This way of advertisement uses its users of the website to advertise directly to them with items they might find appealing. Facebook main catch-phrase is “Facebook helps you connect and share with the people in your life” this connecting and sharing is all about the target-marketing (Facebook, 2011). According to Facebook's own website, Facebook had 500 million active users, who interact with 900 million objects – like pages, groups, events and community pages. Also more than 30 billion pieces of content – like web links, news stories, blog posts, notes, photo albums, etc. – are shared each month. These statistics show the influence Facebook has on the public Internet and on the people who use it. All these 500 million users share 30 billion pieces of content within one month, and all of them are used for commercial ends. This also makes a statement about the issue of privacy. Critics have had a lot to say about the privacy policy of Facebook (BBC, 2009). But but the fact is, when a new users signs up, he agrees to the policy of Facebook.

Also Twitter, a company for micro-blogging (Twitter, 2011), does not take the protection of content of its users very serious. As an example there is the case of the Dutch hacker and one of the founders of XS4ALL, one of the first Dutch Internet providers, Rop Gonggrijp (Tegenlicht, 2011). He worked as a hacker for Wikileaks, as he quotes it on his website: “ I have done work for Wikileaks, last when I helped produce the Iraqi helicopter video in late March, early April.” Because of this, apparently, he received a message from Twitter that they had “received legal process requesting information regarding your Twitter account, @rop\_g” (Gonggrijp, 2011). The DOJ, the US Department of Justice, wanted the IP address of Gonggrijp and requested this from Twitter, who in their case only warned their user that this information will be given to the DOJ. This example clearly states that a commercial company will work together with a government to reveal information of their users, they don't protect their costumers with any privacy of anonymity.

## The structure of Freenet

Ian Clarke developed the idea and starting point of the Freenet project at the University of Edinburgh. According to Clarke his tutors weren't that enthusiastic about the project, and didn't see much potential (Beckett 2009). The project was later further enhanced and improved on Sourceforge, with Clake and multiple other people. A paper was also written: "Freenet: A Distributed Anonymous Information Storage and Retrieval System". In this paper the writers, Ian Clarke, Oskar Sandberg, Brandon Wiley and Theodore W. Hong, explain the project, its architecture, the software, the security and so on. Since the graduation project, the software was improved and ready to be distributed and to become a darknet, existing next to the public Internet. In the describing text they explain the motivations behind Freenet: The first point of failure of this public network, is the fact that files are stored on one or a few fixed places. The second point of failure on the public Internet, is the fact that there is no protection of it's users privacy, or no privacy at all.

"The [Freenet] system functions as a location-independent distribute file system across many individual computers that allows files to be inserted, stored, and requested anonymously" (Clarke, Sandberg, Wiley and Hong 2000). They used five design criteria to develop the system. These goals include: "Anonymity for both producers and consumers of information, deniability for stores of information, resistance to attempts by third parties to deny access to information, efficient dynamic storage and routing information and decentralization of all network functions". Thus the users also provide the storage space, and there is no central point or server where files are being stored, also referred to as a peer-to-peer network of nodes. Each of these nodes, which are expected to be run by the users, maintains its own datastore. This datastore is located in the directory of Freenet, and made available to the darknet for reading and writing. It is also a dynamic routing table which contains two elements: addresses of other nodes and the keys that they are thought to hold. Freenet is a system that uses unused disk space of its users and makes this space directly available to other users (Clarke, Sandberg, Wiley, Hong 2000). Unlike other anonymity programs and software, Freenet enables its users to store files anonymous. This also means that one can publish websites and build databases, all in an online-anonymous environment.

As Clarke puts it, Freenet is "a Distributed, Decentralised Information Storage and Retrieval System" (Clarke 1999).

Freenet is a software program that needs to be installed on one's computer. This software runs in a browser, and after answering a few questions, i.e. to verify the level of security, risk or anonymity, it is installed and ready to use. The world of Freenet is a hidden online world, only accessible through the installing of the software (Beckett 2009). Thus, via Google, or any other public Internet search engine, no content of Freenet can be found or retrieved. Freenet runs on the same browser but uses a different part of the web than the public Internet, figure 2.



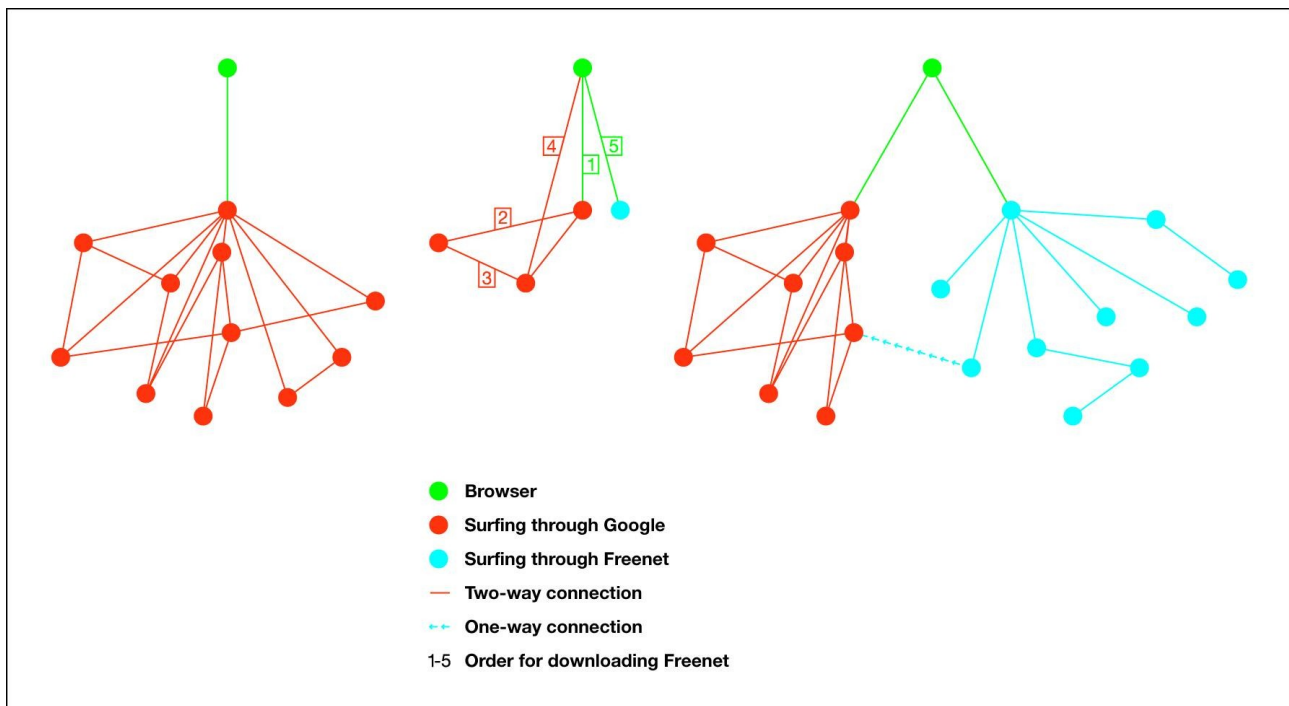


Figure 2: These figures illustrate how the darknet Freenet operates in the web. When starting with a browser to surf the public Internet, different websites can be accessed, also when first going to Google, most websites are connected through Google. On the second illustration the downloading of Freenet is illustrated, for this one needs to be connected to the public Internet, or needs to know someone who is, and then get the software via usb-stick or CD. On the third illustration the way Freenet works, next to the public Internet is shown. It operates next to the web, with the possibility of a one-way connection: in Freenet there is the possibility to retrieve data from the public Internet.

To make sure the user who is requesting content, and the specifications of this content, are extremely difficult to determine, the nodes are encrypted and routed through other nodes (Freenet, 2011a). Freenet works with four different keys, these keys represent the kind of URI Freenet works with:

- “CHK - Content Hash Keys are for files with static content, like an .mp3 or a PDF-document. It contains three elements: the hash of the file, the description key that unlocks the file and the used cryptographic settings.
- SSK - Signed Subspace Keys are usually for sites that are going to change over time. For example, a website that may need news to be updated or information to be corrected, added or deleted. They contain out of five parts: public key hash, document decryption key, cryptographic settings, a user selected name and the current version of the site.
- USK - Updateable Subspace Keys are useful for linking to the latest version of a SSK site. Note that USKs are really just a user-friendly wrapper around SSKs, which hide the process of searching for more recent versions of a site.
- KSK - Keyword Signed Keys allow you to save named pages in Freenet. They are not secure against spamming or name hijacking. But can be easily remembered, because of the simple and readable URI.” (Freenet, 2011b).

All of these keys are the URIs to Freesites and/or files on Freenet. These Freesites are the websites on Freenet. With the Freenet software of jSite, it is fairly easy to publish your own Freesite on Freenet. Once one has build a HTML website, within a local directory, with jSite it takes only a few clicks to publish it. Also, the software will give you the keys needed, and the URI. Updating via jSite is also possible. Freenet doesn't, yet, support Flash, only Java, in which it is build, and HTML and coding. These Freesites are free, as the name predicts, free to publish and store on Freenet.

Because of this whole system the Freesites have a certain look to them. It is easy to create and publish a HTML Freesite, people have done this with much attention to the content and hardly any attention to design. The design has become less important and the content is the basic assumption. Although there are Freesites that look and feel like websites on the public Internet, some are distinctly different. The websites have a very

simple design, a few examples are showed below, figure 3 to 6.

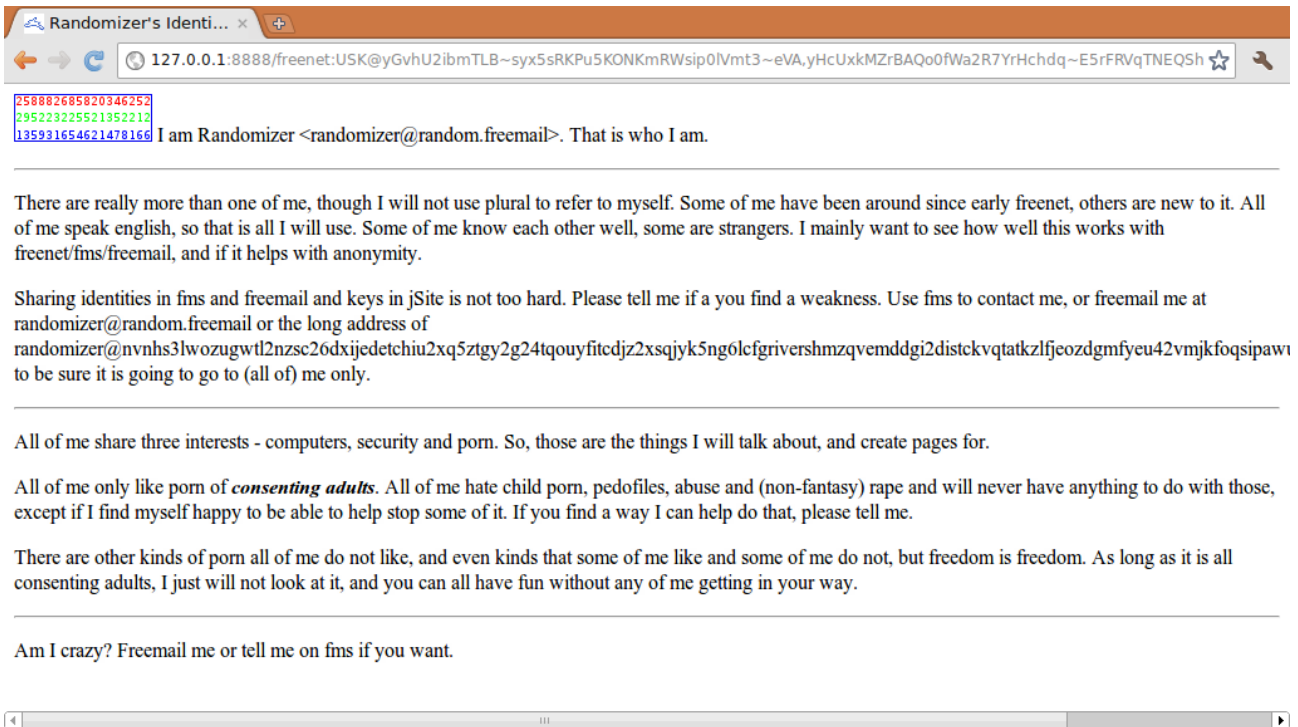


Figure 3: This is an example of a Freesite found on the darknet Freenet. Freenet runs in normal browsers, and the Freesite is a normal HTML page. But there are some significant differences between Freesites and websites on the public Internet. At the left top of the Freesite page there is a rectangle visible with a row of red, green and blue numbers. This image is on Freenet called a . Most of the Freesites have one of these images, and they function as a bookmark-image for each site. The authors of the Freesites design or create them themselves. On several index pages of Freesites, these images function as links, and a small summery or impression of what the Freesite is about. This particular Freesite is named a Flog, which on Freenet is kind of a blog. Except the authors have to create the flogs themselves. There is no ready-made template with easy update scheme and automatically added dates and times on Freenet. The Flogs are more personal Freesites, with ideas and interests of the authors. The design of the page refers to web pages of the early days of the public Internet. This reference is based on the personal editing of the HTML, the simpleness of the design and the non professional lay-out.

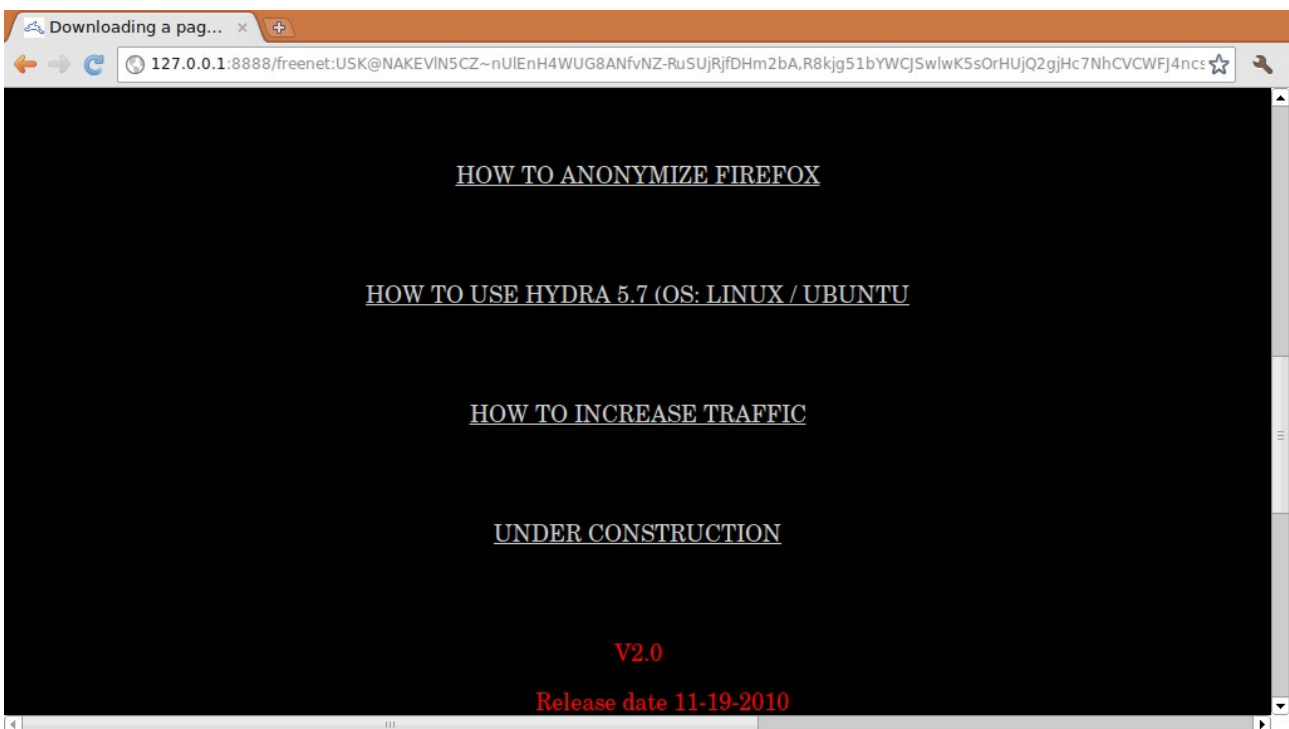


Figure 4 and 5: These two images are screen shots of one Freesite: HackzAndCrackz. This Freesite holds information on how to stay, or be more, anonymous on the public Internet. The page has a simple design, uses simple colours and almost no real design decisions. The page starts with the image of a bum that exposes himself to a family, who than runs away. This image has nothing to do with the subject of the page, but the owner probably thought it was funny. This also illustrates how the users approach the building of a Freesite on Freenet. This page also illustrates the connection between the public Internet and Freenet. Through this page it is visible that users of Freenet are also on public Internet.

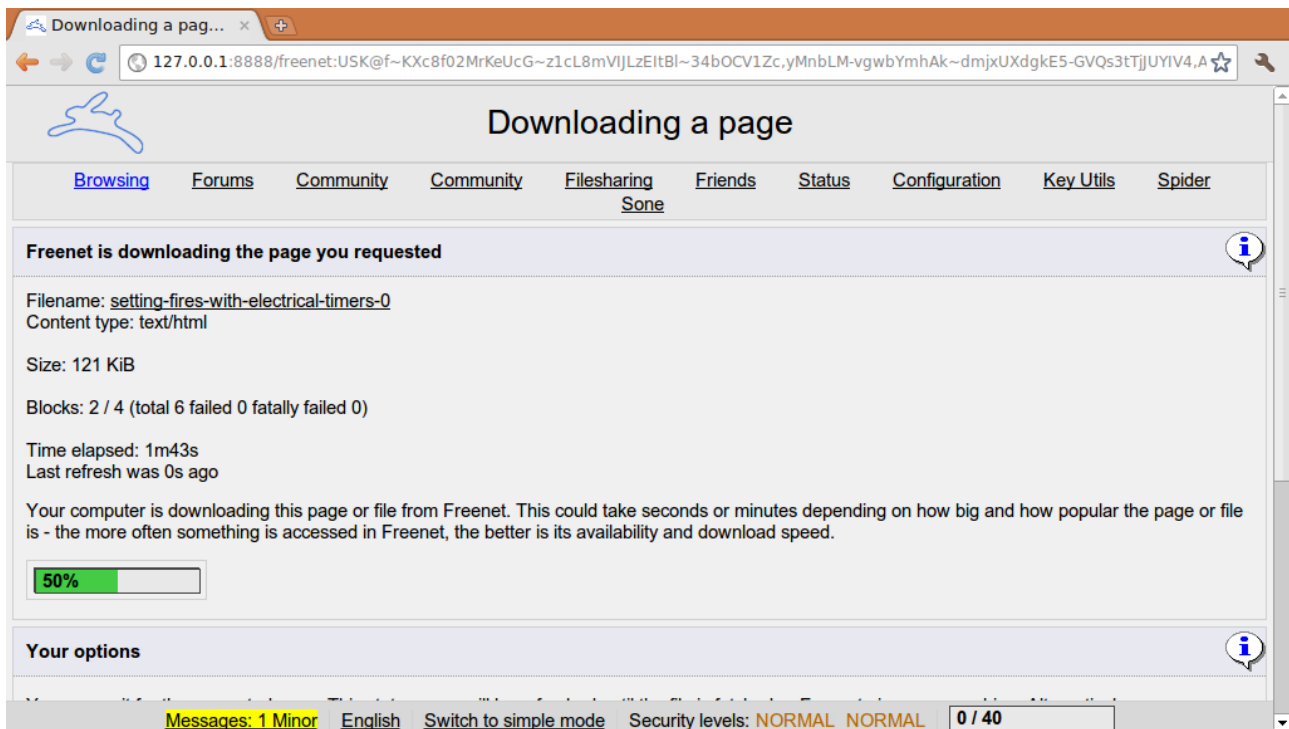
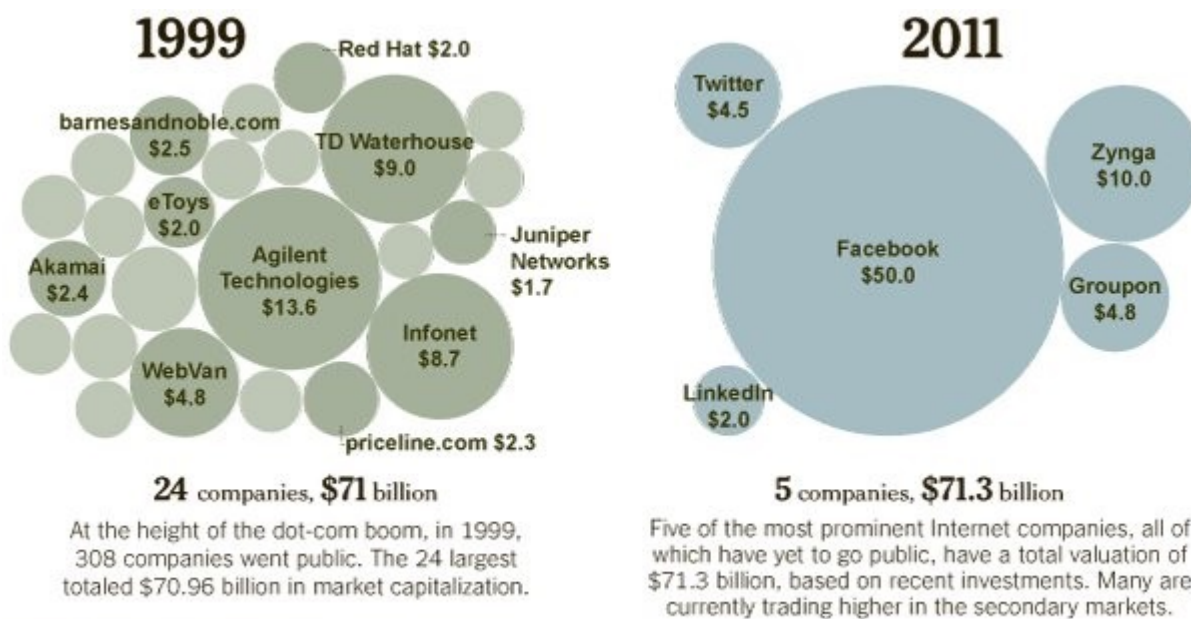


Figure 6: When selecting a Freesite from one of the index-pages, typing in the URL or via the search option of Freenet, this screen comes up. Freenet is loading the page “setting fires with electrical timers” version 0. this loading of a Freesite can take up to 15 minutes, but when keeping Freenet open and downloading a more popular Freesite it takes less time, up to a few minutes. It takes a while for a page to load because Freenet needs to retrieve all the pieces of the page from different locations. On the top of the Freesite the option menu of Freenet within the browser is visible. Freenet has extensions available for download and installation, like Sone. Sone is a twitter-like application on top of Freenet. People can share short messages, like other messages and comment on other peoples “status updates”. At the Forum section, two different forums can be downloaded and installed: FMS and Frost. FMS is in Freenet referred to as the sophisticated forum. Most messages are not too weird for a forum, and most conversations are about Freenet itself. On Frost there is so much spam distributed it is hard to filter the real messages, wrote by humans. On the forum itself it was written that users distribute the spam themselves, with their own build bots, to keep unwanted users out, thus: any newcomers. On this forum the topics are more what one could expect from a darknet forum, weird, discriminating, pornographic and obscene messages can be found here.

## The change/influence of Freenet to the public Internet

On March 27 2010 an article was posted on <http://dealbook.nytimes.com>, part of the website of the New York Times. The title of the article “Investing Like It's 1999” immediately calls up some associations. In 1999 companies were massively investing in Internet companies, and around 2001 the speculative dot-com bubble busted. This article, written by Evelyn M. Rusli and Verne G. Kopytoff, talks about a repetition of history, but slightly different, figure 7. Since the success of Facebook, more companies and investors are pumping money into public Internet (social) network sites. Rusli and Kopytoff quote Roger McNamee: “I worry that investors think every social company will be as good as Facebook”. The big difference, according to the article, between the first turn of the century dot-com boom and the situation the public Internet is in now; is the amount of companies and capital involved. In 1999 there were multiple companies, with no real market-leader. The 24 biggest, that went public, had a shared capital of \$71 billion. The situation now is much less companies. The five biggest companies, who have yet to come public, have a shared capital of \$71.3 billion, figure 7.



Source: Morgan Stanley (1999 companies)

Figure 7: The illustration is made by Morgan Stanley and was used by the article “Investing Like It's 1999”. (Rusli, Kopytoff 2010)

In the magazine The Economist of May 14<sup>th</sup> 2011, an article on the same subject was published. It was titled “The New Tech Bubble”. This article shows a little more light onto the issue of a second dot-com bubble and the burst of this speculative bubble. The author writes about the differences of situation in the first dot-com boom and the situation now. For instance, the public Internet is now truly world wide, and the burst of the bubble would have a world wide effect. China is one of the fastest growing economies of the world, and also on the Internet China is growing bigger than ever. Chinese companies like Baidu, a search engine, and Tencent, who makes online games, are listed on the American Stock Exchange and investors are eager to buy their shares. The ten biggest companies in China have a combined worth of \$150 billion, not much less than Google's. This shows that the public Internet is no longer a American option for profit-making and would mean if a new dot-com bubble is coming, it would have a much bigger impact. But, opinions on the second dot-com boom are divided, some say there is no bubble and there will be no burst because companies, like LinkedIn and Renren, “have proven business models and have healthy revenues” (The Economist 2010). The companies that are now big on the public Internet, already make respectable profits, compared to companies like pets.com, in which money was invested before the formulae was proven to be profitable. Still, the tech bubble could also be different than the last one. Companies like Facebook, Google and LinkedIn may be spared, because of solid profits and business models. The lookalikes and wannabees are not. Investors can pump millions of dollars into companies, that they think could be the next Facebook, but it can also flop because there is already a Facebook. Thus, if there is a new tech bubble on the way, it would involve these

smaller companies, that are not doing a new thing online. The article also states that, when looking at the public Internet now and the previous burst of the bubble, we are more likely to be at the point of 1995, the beginning of the inflation of the bubble (The Economist 2010).

The question these articles bring up has much to do with thinking about the future of the public Internet and the alternatives, like Freenet. Like in the first dot-com boom, a lot of money is being put into public Internet companies, and the question raises if they would survive next to the big market leaders. If not, the second dot-com bubble may become a fact. What this would mean for the public Internet cannot be proved yet, only speculations about this subject are around (Rusli, Kopytoff 2010). For Freenet this could mean more users, and thus more nodes and hence a faster Freenet. The public Internet is almost only focussed on profit and capital, and Freenet not at all, that this could provide a nice get-away if there will be a second dot-com burst of the bubble. One problem that can become real, if users migrate from public Internet after a second dot-com boom, is that companies can join the migration. Freenet is free, and offers free online space. Thus, if users can go there, companies can too. When something like this happens, a continuous circle can evolve from it: migration to a free-speech network – commercialisation of the network – migration to another network.

The first online network, the public Internet, started as a sharing and communicating network for users. More and more content was spread and shared with this new system. More and more people were going online regularly and that was also the point when parents, schools and governments began to question the freedom of this medium. The content on the public Internet wasn't always, according to some groups, appropriate or even harmful for young children to see. Berners-Lee talks about this issue already in his text "The World Wide Web: Past, Present and Future" in 1996. He mentioned PICS, W3C's Platform for Internet Content Selection, created by the first public Internet community. PICS allowed parents and schools, for instance, to create filters on what could be seen on the public Internet. This was a decentralised solution to protect young children from harmful content, because people could set up their own level of filtering. But still can this be seen as the first step in censorship on the public Internet. Tim Berners-Lee illustrates in this text, first hand, the development that the Internet has gone through. He stood at the beginning of the Internet, and gives a personal view in the text. In the beginning of the text he writes that the goal of the web was to be a shared information space through which people, and machines, could communicate. It was supposed to be a flexible medium. I found in this text a lot of similarities between the beginning of the Internet and Freenet, for instance that the Internet, in the beginning, had only content about itself, just like Freenet, mostly, has now.

In 1996 Berners-Lee looked forward to the near future of the public Internet. In the text described above, he talks about how the concept of copyright on the public Internet makes little sense. There is the need from the system to copy content, for instance to save or distribute it. Thus the notion of copyright on a network like the public Internet is in question. The notion of authorship is this in place, because the author remains the author and owner, only the notion of the right to copy content will have to change.

The French historian George Duby talks in his book about the history of personal life, about the word privacy. He clarified the notion of this term in a metaphor as the difference between what happens inside of the house as private and everything that happens outside of the house as public. The windows and doors are the connections from private to public and vice versa. Others say that the concept of privacy is too vague to determine the real meaning of the word (Solove 2008). In the public debate on privacy in the informational age, the definition of the term equals attempts to actively keep information about yourself hidden (Hoboken 2010).

"Privacy is dead, and social media hold the smoking gun" (Cashmore 2009). Cashmore's title of his article on CNN in 2009, states that social media was the end of privacy. Social media like Facebook, Twitter, Flickr are the killers of privacy because, according to the author, when not sharing anything one would, in the online realm, not exist. But this statement can be repudiated. First of all, the concept of sharing is not clear in this context. If one would not share any personal information, but does share personal stories and thoughts completely anonymous, wouldn't this person exist in the online world? When googling this person, nothing will come up, but when knowing ones nickname or place of postings, this person does exist. Social media can be the end of privacy of personal information, like; IP-addresses, current location, pictures of one-self, the use of what computer/browser/internet connection, previous surf-behaviour.

Social media are fairly new on the public Internet, and the successes of Facebook are undeniable. Still this is not the predestined direction the public Internet was always meant to head in. If the public Internet protocol

started with more respect for the privacy, in the broadest sense, of its users, the public Internet could have been something like Freenet is now. Freenet is a different direction of Internet, it can be seen as a kind of parallel universe of the public Internet.

As described in the first chapter, AT&T had a monopoly in the USA on phones and phone-lines. They didn't see much potential in a new networking system, nor invested in the development of the system, and denied the use of this software for a long time. The monopoly of AT&T didn't come out of the blue, the company and the telephone-line have a long history. When Alexander Graham Bell introduced the first telephone, he and his company were granted a patent on all telephone and telephone-lines, in 1877 the second and last patent was given. In 1893 this patent expired, and all companies would be able to sell, make and install telephones and -lines. This evolved into over 6000 independent companies, laying telephone-lines in the USA. The side-effect of this happening were incomprehensible telephone networks. They were separated from each-other and users could not communicate with others who were on another system. The company of Bell, later called AT&T, proposed to the government the solution: a monopoly. Thus, AT&T became a government-sanctioned monopoly under regulation of the FCC (Ryan 2010).

The problem of multiple networks is the communication between the networks. The public Internet almost went in the same direction as the telephone-lines, but J.C.R. Licklider foresaw the problem in the late 1970s. He argued that different networks needed a common standardized protocol, if not they would be unable to communicate with each other. This given, a standard protocol was created and is still in use as the public Internet. Between 1975 and the late 1980's ARPA and its allies were trying to convince the telecommunication industry to standardize decentralised networking. It slowly dawned to the industry that data networks were an emerging market, but they still didn't make the full step to the concept of distributed networking and ARPA's approach of diversity. The telephone company was convinced that, just like telephone communication, digital networks needed one operating company to offer a stable and reliable network. They created their own protocol for this digital networking, X.25. While ARPA created TCP/IP, which enabled diversity, this later became the standardized protocol. Vint Cerf, who was one of the architects of TCP, admits he offered the protocol to the CCITT, the Consultative Committee on International Telegraphy and Telephony, but they rejected the offer because the protocol was developed at the Department of Defence (Ryan 2010). This example shows that a monopoly like AT&T had a lot of power within the telecommunication industry. Luckily people were still developing protocols and searching other ways to introduce them. These companies are focussed on money, and don't want to lose any profit when introducing a new system. Much the same is now happening in the mobile-phone industry, after the introduction of Internet access on the smartphones. Dutch telecommunication company KPN was in 2011 involved in a small scandal about the privacy of data usage of its customers. KPN offers telephones, and calling-service and also public Internet access for smartphones. Because of the development of apps like Whatsapp, ping and other chat programs KPN, and other telephone companies, miss a lot of profit. People are calling less to each-other and more and more are chatting, emailing and Facebooking. To figure out how much use users are making of these services, they announced they had used Shallow Package Inspection, SPI. SPI is a software where the operator, KPN in this case, can see the routing, which means it is possible to see through which port the data is sent and to which server it is headed. After the results of this test, KPN announced it is launching new telephone subscription, in which people are paying extra for the use of Internet services like Whatsapp and VOIP (Eenbergen, 2011). The reaction of KPN to this new development, the movement from text-messaging and calling to free services like Whatsapp, is comparable to the first reaction of AT&T to the public Internet. As the past has shown the development was unstoppable and it would have been for the best if AT&T had embraced the ideas of ARPA. Just like KNP and other companies should do now.

## **Conclusion: The future of the public Internet and the involvement of darknets**

The public Internet started with experiments on different media, the ARPANET was the most promising solution, and this concept was further developed into the public Internet. At this point no-one could have known the direction the public Internet could have gone in. The first motivations of the public Internet were to create “an interactive world of shared information through which people could communicate with each other and with machines” (Berners-Lee 1996). In the beginning of 1996 the network stood at a crossroads: on one side there were the personal HTML pages, build by users who represented information they thought was valuable or the sharing of their hobby’s. On the other side there were the upcoming dot-coms, the first Internet companies wanting and waiting to earn money through the public Internet. After the development of the first search engine, Archie, the development of different search engine techniques started. But, the real change in search engines was brought to the public Internet by Google, founded by Sergey Brin and Larry Page. It was the first search engine that gave users exactly what they wanted, in the first page(s). Van Deursen researched if this - giving every user exactly what he wants - resulted into a laziness of searchers. The people that contributed to his research used in 56% of the times search-terms that were too common to find the specific result and in 36% of the times people didn't look further than the first 3 results. After the dot-com boom, around 2001, the user-driven website was introduced to the public Internet. The first example of a user-driven website was Ebay. On this website people could, and still can, buy items from sellers, and afterwards rate or comment on the seller. The website is based on a trust system. Another example of user-driven content is peer-to-peer. Peer-to-peer was first seen in the software of Napster, and later in the BitTorrent software. BitTorrent is a file sharing program mostly used for the illegal distribution of music and films. BitTorrent uses no central server or only one channel to download a file. Freenet is an anonymous network, also referred to as a darknet. Its founder, Ian Clarke describes it as “a distributed, decentralised information storage and retrieval system”. The software of Freenet needs to be installed on one's computer, and while installing a piece of the hard drive is made available for Freenet. Freenet has, like BitTorrent, no central server, the content on Freenet is distributed, in pieces, onto the users disk space. All information on Freenet can be requested anonymously, because requests, for instance the request for a Freesite, are encrypted. Freenet divides itself from other anonymous programs, because users can store files. Thus, users can build websites on Freenet, called Freesites and build databases. These Freesites are personally made by the users of Freenet. These Freesites have a certain design, which communicates with the design of the first personal websites on the public Internet. The first pages made in HTML were simple, showed only essential information and could be very personal. When the user-driven websites became more popular, owners of several HTML pages moved to standard blogs, often leaving a goodbye message and link to their blog on their page. On Freenet people can also create their own darker, deeper darknet. When only connecting to friends, or other users whose key you know, a private darknet can be set up. These are more safe, anonymous and private than Freenet itself. These dark-darknets are probably used for the distribution of child-porn and terrorist purposes, but these remain speculations. In the future these dark-darknets can also be the substitute to the social networks we use now. Because the public Internet is being more and more ruled by commercial companies, like Google, Facebook and Twitter, who make millions of dollars, a second dot-com boom can be on its way. This boom will be fairly different than the first dot-com boom, around 2001, due to different circumstances. There are now less big companies online, but they make more money than ever before. The public Internet was never intended to be as it is now, its future was not inevitable. The first intentions were it to be an information, sharing system. The user would be able to connect to other users, though the network. Nowadays this description applies more to Freenet than to the public Internet. On the public Internet people use Facebook, Google and other company's services to connect to each other, and these companies are earning money because of this. If for the second time a speculative dot-com bubble bursts, this could have a major effect on how we use the net (The Economist 2011). This development can mean a migration from the public Internet to a darknet like Freenet. If the bubble bursts, most companies will lose money or go bankrupt and this will effect the users, because these websites are user-driven (Rusli, Kopytoff 2010). A safer and more private and non-commercial system will be a good substitute to the previous commercial Internet. If more and more users are going to Freenet, the system will improve and load faster, just like a Torrent file with the most peers is the fastest download. Still, when users are migrating to different darknets, companies can follow too. The service of



Freenet is, like the name implies, free and this could mean even more profit for companies. Companies can even start to invest in hard disk space and nodes. This development will evolve into a continuous circle: A new place for freedom is created; people start to build software to filter content, like search engines; some pages are being excluded; index pages don't index everything anymore and some areas are becoming more and more in the background; (or government/police shuts the website down, because of vulnerable content or because of copyright issues.); users move to new places for freedom.

Freenet users are already thinking of ways to change Freenet, to completely separate it from the public Internet. If more users are going to Freenet, and most of these people have a wireless router at home, a PRNET-like network can be created of Freenet. If every user turns on its router, don't connect it to the public Internet, but uses it to connect to other routers via Freenet; no public Internet access is needed any more. This is still an idea that goes around on the Freenet forums, like Frost and FMS, and can only be realised with more active Freenet users. Here history will repeat itself, the development of the public Internet evolved into three approaches: PRNET, ARPANET and SATNET. PRNET was ARPA's experiment to sent packages via radio waves.

Another scenario is that people are moving to several darknets, and create their own dark and deeper, private darknets. This is comparable to the situation in 1893 in the USA of the telecommunication companies. There were over 6000 different companies, and the connection between these companies was fairly bad or not even possible. If this happens, like in 1893, a solution will be found to connect these different networks.

The other way around, the influence of public Internet on Freenet is also notable. Some Freenet sites index RSS feed from public Internet sites, to also have public information on an anonymous system. There are news sites, technical sites, anarchy-, terrorist- and porno sites on Freenet, that can also be found on the public Internet. Users provide this content on Freenet for people who live in countries where this all is filtered, for instance by the government, from the public Internet. Another element of this influence is that users and developers are building their own Twitter and Facebook-like applications (Github, 2011). The two networks, Freenet and public Internet, will keep on influencing one another as long as they both exist next to each-other.

Either way are darknets going to play a bigger role in the lives of the users of the public and non public Internet. It is important is to give the power back to people; the users of the net.

## **Annotated Bibliography**

### **A History of the Internet and the Digital Future. By Ryan, J., 2010.**

In this book Johnny Ryan portrays the history of the public Internet. From the far most beginning, the development of the telephone and the telephone-line, to the point we are now and what the future might bring. The book has a clear chronological order in the history and how the public Internet became what it is today. However there are a few elements missing I would like to have seen implemented in the book. One is the big importance of users creating personal HTML pages, and later moving to blogs and twitter, which illustrates the commercialisation of the public Internet. The second thing I missed in the book, are the splitting of the Internet, into the public Internet and several darknets.

### **Control and Freedom, Power and Paranoia in the Age of Fiber Optics. By Chun, W. H. K., January 2006.**

Wendy Chun talks about how the public Internet became a commercial medium based on control while it was founded by people who wanted it to be a medium for freedom. This control also connects to the paranoia of this day and age. The users of Freenet often express feelings of paranoia, and they are on Freenet because the public Internet is controlled by several companies.

In the chapter about pornography she talks about how the pornography changed the public Internet. Pornography opened doors to several elements that are now broadly used on the public Internet, but also frustrated a lot of people. People who are afraid of their children looking at indecent pictures caused the shift from open to closed and from private to public. This is an interesting book to read next to texts and books about the public Internet and darknets. Because Chun uses a different approach to the development of the public Internet, and on how the public Internet became what is is now.

### **The World Wide Web: Past, Present and Future. By Berners-Lee, T., 1996.**

Tim Berners-Lee illustrates in this text, first hand, the development the Internet has gone through. He stood at the beginning of the Internet, and gives a personal view in the text. In he beginning of the text he writes that the goal of the web was to be a shared information space through which people, and machines, could communicate. It was supposed to be a flexible medium. I found in this text a lot of similarities between the beginning of the Internet and Freenet, for instance that the Internet, in the beginning, had only content about itself, just like Freenet, mostly, has now. He also addressed the first censorship that happened in the Internet, PICS, which was a decentralised solution to the freedom of the Internet.

### **Analysis: The dark side of the web. By Andrews, S., 2010., 9 March & Uncovering the Dark Side of the world wide web. By Gibson, M., 2000.**

These two small articles, written respectively by Andrews and Gibson, explain the basis of the dark side of the web. These articles hasn't got the content needed for research, but they were the first I read on this subject, and opened my eyes to Freenet and other the existence of darknets. These texts offered references to the other texts described in this bibliography.

### **White Paper: The Deep Web: Surfacing Hidden Value. By Bergman, M. K., 2001.**

Michael K. Bergman emplanes in this white paper the basic elements of the dark web, and darknets. The text is more a technical text on how big the dark web is, and on what content can be found there. Brightplanet's software is explained and used to retrieve content from the darkweb. They also qualify the retrieved content on several elements, to see what the real value of the dark web is. In the end, a proposal is made for two search engines: one that retrieves content from the surface web and another that searched the darknets and dark sides of the web.

**The Darknet and the Future of Content Distribution. By Biddle, P. England, P. Peinado, M. and Willman B., 2002.**

Peter Biddle, Paul England, Marcus Peinado and Bryan Willman investigated the darknet for this text. They explain, in the broadest sense, what a darknet is and where they can be found. They also make predictions about how the “darknet-genie will not be put back into the bottle”. This genie, how they call it, cannot be put back because they reference darknets as a reaction to the public Internet. As long as the public Internet continue to exist in the same way, thus thriving on companies and control, no privacy and no anonymity, darknets will exist.

**Freenet: A Distributed Anonymous Information Storage and Retrieval System. By Clarke, I. Sandberg, O. Wiley, B. Hong, T. W., 2000.**

Ian Clarke, the original founder of Freenet, Oskar Sandberg, Brandon Wiley and Theodore W. Hong describe in this text Freenet, the peer-to-peer network that keeps its users anonymous. They explain what the Freenet has become, and how the network works. They are very honest about that Freenet can not always guarantee ones anonymity and safety, but they do explain to keep this risk at a minimum. The text is very technological, but while reading it, the darknet Freenet gets more clear how it works and how it came to look like it does.

## References

- Ryan, J., 2010. A History of the Internet and the Digital Future. London, England: Reaktion Books LTD.
- Chun, W. H. K., January 2006. Control and Freedom, Power and Paranoia in the Age of Fiber Optics. London, England: The MIT Press.
- Harkin, J., 2009. Cyburbia, The Dangerous Idea That's Changing How We Live And Who We Are. Little, Brown Book Group, Ch. 1-2.
- Solove, D. J., 2008. Understanding Privacy. Cambridge, MA: Harvard University Press.
- The Economist, 2010. The new tech bubble and Another digital gold rush. The Economist Newspaper Limited, May 14<sup>th</sup>, P. 13 and 73-75.
- Berners-Lee, T., 1996 The World Wide Web: Past, Present and Future, w3, [online] August. Available at: <<http://www.w3.org/History.html>>
- Deursen van, A. J. A. M., 2010. Internet Skills: Vital Assets in an Information Society. Enschede, the Netherlands: University of Twente, [online] Available at: <[http://www.alexandervandeursen.nl/serendipity5/uploads/pubs/Dissertation\\_VanDeursen.pdf](http://www.alexandervandeursen.nl/serendipity5/uploads/pubs/Dissertation_VanDeursen.pdf)>
- Andrews, S., 2010. Analysis: The dark side of the web, PcPro, [online] 9 March. Available at: <<http://www.pcpro.co.uk/features/356254/the-dark-side-of-the-web>>
- Gibson, M., 2000. Uncovering the Dark Side of the world wide web. Financial Times, [online] 20 October. Available at: <<http://cryptome.org/dark-spy.htm>>
- Bergman, M. K., 2001. White Paper: The Deep Web: Surfacing Hidden Value, JEP the journal of electronic publishing, [online] August, volume 7, issue 1. Available at: <<http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep:view=text;rgn=main;idno=3336451.0007.104>>
- Biddle, P. England, P. Peinado, M. and Willman B., 2002. The Darknet and the Future of Content Distribution, [online] 18 November. Originally published [online]. Available at: <<http://www.crypto.stanford.edu/DRM2002/prog.html>>
- Microsoft Corporation, 2002 ACM Workshop on Digital Rights Management [online]. Available at: <[http://www.bearcave.com/misl/misl\\_tech/msdrm/darknet.htm](http://www.bearcave.com/misl/misl_tech/msdrm/darknet.htm)>
- Clarke, I. Sandberg, O. Wiley, B. Hong, T. W., 2000. Freenet: A Distributed Anonymous Information Storage and Retrieval System, [online] July 1. Available at: <<http://www.eecs.umich.edu/~zmao/eecs589/papers/freenet.pdf>>
- Seijdel J., 2010. Beyond Privacy, New Perspectives on the Private and Public Domains, Open, [online]. Available at: <<http://www.skor.nl/artefact-4808-nl.html?lang=en>>
- Hoboken, J., van, 2010. Beyond Privacy, The Importance of Privacy. Confusion about the Civil Right of the Twenty-First Century, Open, [online]. Available at: <<http://www.skor.nl/article-4814-en.html>>
- Mansfield-Devine, S., 2010. Going over to the dark side, Webvivant Computer Fraud & Security, [online]. Available at: <<http://www.webvivant.com/feature-darknets.html>>
- Howe, J., 2005. The Shadow Internet, Wired [online] 01, January 13. Available at: <[http://www.wired.com/wired/archive/13.01/topsite.html?pg=1&topic=topsite&topic\\_set](http://www.wired.com/wired/archive/13.01/topsite.html?pg=1&topic=topsite&topic_set)>

Rusli, E. M., Kopytoff, V. G., 2010. Investing Like It's 1999, Dealbook, New York Times [online] Category: Investment Banking, March 27. Available at: <<http://dealbook.nytimes.com/2011/03/27/is-it-a-new-tech-bubble-lets-see-if-it-pops/?scp=2&sq=internet%20bubble&st=cse>>

Klaver, M. J., 2009. Jong en oud verdwaalt op internet, NRC.nl, [online] August 6 Available at: <<http://weblogs.nrc.nl/klaver/2009/08/06/jong-en-oud-verdwaalt-op-internet/>>

Cashmore, P., 2009. Privacy is dead, and social media hold the smoking gun, CNN.com, [online] October 28. Available at: <[http://articles.cnn.com/2009-10-28/opinion/cashmore.online.privacy\\_1\\_twitter-followers-sharing-smoking-gun?\\_s=PM:OPINION](http://articles.cnn.com/2009-10-28/opinion/cashmore.online.privacy_1_twitter-followers-sharing-smoking-gun?_s=PM:OPINION)>

Griffiths, R. T., 2002. History of the Internet, Internet for Historians (and just about everyone else), [online]. Leiden: University of Leiden. Ch. 2 Available at: <<http://www.let.leidenuniv.nl/history/ivh/chap2.htm>>

Gilbertson, S., 2010. Feb. 16, 1978: Bulletin Board Goes Electronic, Wired, [online] 02, February 16. Available at: <<http://www.wired.com/thisdayintech/2010/02/0216cbbs-first-bbs-bulletin-board/>>

Wal, vander, T., 2006. The come to me web, [online]. Available at: <[http://personalinfocloud.com/2006/01/the\\_come\\_to\\_me\\_.html](http://personalinfocloud.com/2006/01/the_come_to_me_.html)>

Underwood, L., 2004. A Brief History of Search Engines, [online]. Available at: <[http://www.webreference.com/authoring/search\\_history/](http://www.webreference.com/authoring/search_history/)>

Marketingminefield, 2007. What is Viral Marketing? [online]. Available at: <<http://www.marketingminefield.co.uk/internet-marketing/viral-marketing/1-overview.html>>

Barrett, 2010. Google's Insane Number of Servers Visualized. Gizmodo, April 14, [image]. Available at: <<http://gizmodo.com/#!5517041/googles-insane-number-of-servers-visualized>>

O'Neill, N., 2010. The Secret To How Facebook Makes Money. Allfacebook, [online]. January 19. Available at: <<http://www.allfacebook.com/facebook-makes-money-2010-01>>

Gonggrijp, R., 2011. US DOJ wants my twitter account info, [online]. January 8. Available at: <<http://rop.gonggri.jp/?p=442>>

Clarke, I., 1999. A Distributed Decentralized Information Storage and Retrieval System, [online]. Edinburgh: University of Edinburgh. Available at: <<http://freenetproject.org/papers/ddisr.pdf>>

Eenbergen, van, C., 2011. Operators gebruiken shallow packet inspection. Techzine, [online], May 16. Available at: <<http://www.techzine.nl/nieuws/26028/operators-gebruiken-shallow-packet-inspection.html>>

BitTorrent, 2011. BitTorrent, [online]. Available at: <<http://www.bittorrent.com/intl/en/>>

Facebook, 2011. Facebook, [online]. Available at: <<http://www.facebook.com/>>

Twitter, 2011. Twitter, [online]. Available at: <<http://www.twitter.com/>>

Github, 2011. Tahrir, [online]. Available at: <<https://github.com/sanity/tahrir>>

W3, 2006. Naming and Addressing: URIs, URLs, ..., [online]. Available at: <<http://www.w3.org/Addressing/#background>>

Freenet, 2011a. Freenet, what is, [online]. Available at: <<http://freenetproject.org/whatis.html>>

Freenet, 2011b. Freenet, understand, [online]. Available at: <<http://freenetproject.org/understand.html>>

NSF, 2011. The Launch of NSFNET, [online]. Available at:  
<<http://www.nsf.gov/about/history/nsf0050/internet/launch.htm>>

MERIT, 2011. MERIT History Time line: 1980-1989, [online]. Available at:  
<[http://www.merit.edu/about/history/timeline\\_1980.php](http://www.merit.edu/about/history/timeline_1980.php)>

BBC, 2009. Facebook faces criticism on privacy change, [online]. December 10. Available at:  
<<http://news.bbc.co.uk/2/hi/technology/8405334.stm>>

Tegenlicht, 2011. Rop Gonggrijp, De Wikileaks code, [documentary]. Available at:  
<<http://tegenlicht.vpro.nl/nieuws/2011/januari/Biografie-Rop-Gonggrijp.html>>

Google, 2011. Technology overview, [online], Ch. 1. Available at:  
<<http://www.google.com/corporate/tech.html>>