Institutionen för datavetenskap
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Final thesis

A study of Bitcoin as a currency for email-based micro-transactions

by

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LIU-IDA/LITH-EX-G--15/076—SE

2015-12-18
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Examiner: Aseel Berglund
Abstract
Bitcoin is a cryptocurrency that has been the focus of a lot of discussions lately and has attracted a large number of users. Its offers many possibilities for cheap transactions and unregulated finances which has been realized in numerous sites and applications on the web and in mobile phones. One medium that seem to have been neglected when it comes to Bitcoins development is email. This is curious since Bitcoin by its nature seem to have many properties that would work well with texted messages. The purpose of this study it to analyze the current papers about Bitcoin to find the current status of email based Bitcoin services, and try to analyze if email as a tool is a suitable medium to be used with Bitcoin. This analyze is done through a systematic literature review of current papers, followed by an examination of past and current Bitcoin companies that has used email as part of their service. In the end the results suggested that the low security in email, and the apparent lack of services that would benefit from an email based Bitcoin service suggest that a service like that would be hard to develop today and not very useful to the public.
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1 Introduction

1.1 Motivation

On the Internet today there are a multitude of applications that offers different services to their users. Some services come for a price and some are free. Many large stores as well as single users plan to make their income from the online services and therefore has to deal with the problem of finding a simple and secure way to transfer money from the user to the seller. Typically nowadays those transactions are made with help from a central agency, most often a bank. The bank will take care of all security measures and handle the transactions for a small fee. A system like this usually works well when the transaction is large enough, while dealing with smaller transactions comes with a problem. The fee for the transfer is usually a flat sum or has a lower boundary, which means that when the sum is small enough the fee would become unreasonably large compared to the sum itself.

A few years ago a new kind of currency did emerge that challenged that way of thinking. The so called crypto currencies are decentralized in their function and get their value solely from the cryptographic proofs they use to maintain peoples trust in them. Cryptocurrencies are built around open financial networks, coupled with automatic methods to maintain security and make transfers that supposedly make them impossible to deceive. Therefore with a crypto-currency the need for someone outside the transaction to verify the transfers disappears, which solves the problems of transaction fees. The most popular cryptocurrency today is called Bitcoin and has quickly built a user base where the amount of transactions average today in 2014 to be about 60000 transactions per day [1].

Another thing to consider is the method of transfer people prefer to use. The most common way today when a person wants to send money to another on the Internet is to contact a bank and ask them to make a transfer from their account to the other person. There are alternative ways, like placing money in a physical envelope and send it by mail, which would be easier but also far less secure. If those two systems could be merged and give the users an option to send money as easily as you would send an email, but with the greater security of a bank then you would have the best of both worlds. With a cryptocurrency this might be possible, the question is if using cryptocurrencies would be a good idea considering how new and experimental they are.

The paper is meant to collect the current scientific and public knowledge about Bitcoin to use as a base for analyzing validity of an email based money-transfer application using Bitcoin as its main currency and from it extract the appropriate facts to decide whether it is a good idea to develop an application like that. A client like that could be of good use for many users that might feel hampered by the inflexible rules of banks today or of the low security of many internet transfer services. Since email is a practical and intuitive way to send messages over the net, and most internet users has an email account, it would hopefully be possible to use email to help people with minor transactions and thereby make money handling on the Internet more practical.
1.2 Purpose
This paper is a collection of two studies with the purpose to analyze the availability and need of an email based Bitcoin service.

The first study will be a systematic literature review focused on recent studies and articles published online regarding Bitcoin in connection to email and its users. The goal is to map how much of an impact Bitcoin has made and in what environments it is used the most nowadays. This study will focus on small sums, microtransactions, the general attitude of Bitcoins today and if Bitcoin and emails are considered compatible.

The second study will be an online search for Bitcoin services that are using email services involving Bitcoin, and a search of sites that has tried this in the past and failed. Of special interest will be how long these sites has operated, if they still are active and if not why they failed, and the nature of their other services.

1.3 Questions:
These are the specific questions each study will focus on, they will also be the base for the query string formulated later.

For study 1 I have chosen:

- What is the most common way for a user to use microtransactions today?
- How could a microtransaction of Bitcoins be handled through email, considering
  - The public opinion
  - The most common usage patterns for micro transactions?

And for study 2 I chose:

- What are the major sites that offer Bitcoin services today
  - What email based services does these sites offer
- What email based Bitcoin sites are currently offline
  - What services did they offer
  - How long did they last
  - Why did they fail

1.4 Limits
This study will not take special care regarding communities that mine Bitcoins as a source of income but does not otherwise use it as a currency for transactions. How the bitcoins are minted is of less interest compared to how people use them later. This study will also only focus on Bitcoin and not on any other cryptocurrencies there are out there.
2 Theory

2.1 Microtransactions
A microtransaction is an online payment of a very small amount of money. On the Internet that kind of transaction happens all the time, especially in the online computer-game business and the mobile market. In the mobile market alone 79% of the revenue in January 2014 were supposed to have come from microtransactions [2].

In the early days of the Internet purchases was usually made for a whole product or a finished game. In 2005 however Microsoft introduced the X-Box Live Marketplace were users, with the help of store bought gift cards, could upgrade their previously bought games. Unlike before players could buy new content and gain additional parts of the story for a small extra fee [3]. The ability to charge the players later for extra material proved popular among the game-developers, so the system soon became popular on the Internet were the practice of using small purchases to upgraded games soon became the standard way to increase revenue. Those purchases, typically of 12$ or less, are today called micro transactions and has continued become increasing popular, not only for internet gaming and the now defunct X-Box Live, but for all kinds of shopping over the Internet and through mobile phones. Google Store, one of the largest players in the mobile phone app area, is said to have paid out 5 Billion dollars to developers last year from their app stores alone [4].

Microtransactions may have found their market but come with their own built in problems. The money involved is small, sometimes no more than a few dollars or less. With sums that small even a minor bank fee could turn a profit or a gift into a major loss for the seller. A 3$ fee for a 5$ transaction would effectively remove more than half the profit in banking costs alone Today it is common practice for users to reward programmers that have made a free service they like by donating a minor sum, typically a dollar, to show their appreciation. These small transactions would have the same bank fee associated with them as any other internet transaction, which means that the low value of the transaction compared to the bank fee makes the fee equal or larger than the sum itself. Some online banks, like PayPal, solve this by offering their users’ reduced static fees for minor sums, but those reductions are not available everywhere[5].

2.2 Cryptocurrencies
Cryptocurrencies as an idea goes back to the early Internet. A currency that could be transferred over the Internet in a quick and secure manner from one user to another without bank fees or delays would be most useful for entrepreneurs. In reality banks soon took control over the Internet transfers, making the system work in approximately the same way as outside of Internet. In 2008 however, this changed when the pseudonym Satoshi Nakamoto published a paper on the site metzdowd.com. In this paper he suggested “What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party”. [6] The next year he introduced the first version of his Bitcoin software together with the first Bitcoin block.
2.2.1 Double spending
The largest problem with using cryptocurrency is how to avoid double spending. If someone can use the same money to buy two or more different things at the same time without anyone noticing the transactions, then the currency will soon lose trust and become worthless. To avoid this cryptocurrencies announce all transactions in a public ledger to every user. These ledgers are stored locally along the network for everyone to see and whenever a cryptocurrency has been spent the transaction will automatically be noted within these global ledgers and be verified if it is valid. Not until this is done will the currency be ready for use by the receiver. To avoid fraud all transactions are also coded with public-private key cryptography, allowing the sender to sign with his private key while the receiver acknowledges it with his public key. Another problem is the risk that someone tries to falsify the cryptocurrency ledgers and create a false history that would make it appear that he had more money than he actually did. To avoid this cryptocurrencies use block chains which makes the information hard to falsify.

2.2.2 The block chain
The Bitcoin wiki describes the block chain as such:

A transaction database shared by all nodes participating in a system based on the Bitcoin protocol. A full copy of a currency’s block chain contains every transaction ever executed in the currency. With this information, one can find out how much value belonged to each address at any point in history [7].

Each block in the blockchain contain a sequence number, a timestamp, a nonce, a hash of earlier blocks and the transactions themselves.

![Figure 1 The hashing chain](image)

With the block chain every transaction ever made all the way back to the first block in the chain lies open for any user to verify. To avoid double spending the hashing of the previous block is on purpose made mathematically difficult to calculate. As a result it takes a long time even for a powerful computer to make a new block, but is easy to verify if one is valid once it is done. For someone to falsify the block, it would require that someone managed to calculate the entire block chain before anyone else notice that a single block is wrong, which would theoretically take more computer power than is available in the world today. This adds to the security of cryptocurrencies and the validity of the blockchain system. The blockchain is also the means that some cryptocurrencies use to distribute new coins to the users. Every time a new block is added to the chain it will collect all the current transactions and store them together with a hash of the previous block. To inspire the users to allow for the cryptocurrency-network to make these calculations on their computer, the user will be rewarded with a number of freshly minted coins every time they manage to make a new block before anyone else does. This process is known as mining and is common with most cryptocurrencies.
2.3 Bitcoins

2.3.1 Origin
Bitcoin is the first cryptocurrency and the one that is described in the article by Satoshi Nakamoto. It follows a structure centered on the sha-256 hashing function for building the block chain. A technical description of this structure would however fall outside the scope of this document and will not be presented. After the paper published it took less than a year before the first software for using the network was made and the first block published. Bitcoin is both the name of the currency itself and for the protocol that controls it. To separate them I will in this study use an uppercase B when I talk about the protocol Bitcoin and lowercase when I talk about the bitcoin money itself.

2.3.2 Markets
Since its introduction Bitcoin had at first a slow start but after having built acceptance by merchants it quickly gained popularity. Over time the value of an individual bitcoin in other currencies has fluctuated wildly and in November 2013 it reached a peak of 1214$/coin but has since then fallen to a value of about 400$/coin where it has remained relatively stable these last months.

![Bitcoin value over time](image)

Figure 2 Bitcoin value over time

Today Bitcoin is accepted among thousands of stores and institutions[8], with a calculated market value today of over four billion dollars.[9]. Unfortunately the anonymous nature of Bitcoin has attracted less honorable salesmen too. In October 2013 a popular Bitcoin trading place called Silkroad was taken down by federal police after evidence of drug sales and money laundry were discovered. Money speculators has also found the currency and invested in it which has made some users worry that the popularity of Bitcoin is nothing but an inflated bubble that might burst at any time.
2.3.3 Advantages
Bitcoin is today the most popular cryptocurrency in use with a traded volume of millions of dollars per day.

It was the first cryptocurrency and is therefore the one with the longest blockchain, giving it an extra security over the other currencies. All cryptocurrencies also share a number of advantages over standard currencies.

- Cryptocurrencies decentralized structure makes transfer fees unnecessary, while it supposedly keeps the security of a more centralized currency.
- Since Cryptocurrencies by definition belongs to the one that knows the private key to the transaction it does not need any accounts or passwords. As long as the user knows his own address he will always be able to use his bitcoins while no one else can.
- Cryptocurrencies are anonymous and cannot be traced.

2.3.4 Disadvantages
The sudden interest in cryptocurrencies by speculators has made value of those currencies fluctuate quickly in a short time. Bitcoin is especially vulnerable to this because of its greater media exposure. For users of Bitcoin there are also some other aspects they has to be aware of.

- The ownership of the money is tied to the private address of the Bitcoin wallet. If someone lose that address by a hard drive failure or suchlike, the money are gone.
- A Bitcoin transfer is final and cannot be revoked. Also it cannot be traced to a specific person after the trade has been made making Bitcoin transaction vulnerable to fraud.
- Several Bitcoin sites have been closed down by federal law because of illegal operations like drug sale or money laundry.
- The impact of other cryptocurrencies is still small but is gaining ground. The possibility of a competitor to take over Bitcoins leading position is still unlikely, but not impossible that it happens in the future, making Bitcoins then lose its value.
3 Method
Since cryptocurrencies begun to gain popularity many articles has been published about this new phenomenon describing their impact on current economics and its possible future. Among these articles there are several that deal with security and the ways a user can transfer bitcoins to each other. A lot of new services has also appeared recently that deal with Bitcoin, some of them are based around email. To analyze this, two studies will be made. One is a review of the available literature to see what is mentioned about Bitcoin in connection to emails. The second study will map the available Bitcoin services if today in order to get a feel for the possible need for another service in the same field. I will also see what Bitcoin companies that can be found that once had email based Bitcoin services but then failed. The chosen method for the first study will be a systematic review of published papers and articles about Bitcoin. Material will mostly be taken from Google Scholar, IEEExplore and ScienceDirect, also only peer revived sourced will be considered. Since Bitcoin is a young and developing currency, no source earlier than 2013 will be considered valid. The second study will be a review of published services on the internet. The search with be done by ordinary Google search and all sites that deals with Bitcoin will be noted.
3.1 Study 1: A systematic literature review of Bitcoin

3.1.1 Search strategy
Our strategy for this systematic review is to take the review questions and break them down into their components. Those will be used as bases for making search words to be used in a database. To make sure all relevant reports are found it is also important to include the most common synonyms in the search strings.

3.1.1.1 Keyword definition
Earlier in the report it was decided that the following questions would be the focus for the review.

- What is the most common way for a user to use microtransactions today?
- How could a microtransaction of bitcoins be handled through email, considering
  - The public opinion
  - The most common usage patterns for micro transactions?

From these I made a few more specific questions

- In what situation do users use Bitcoin for microtransactions today?
- In what situation would users buy with Bitcoin and pay through email?

It is now possible to break down the questions into its components.

3.1.1.1.1 Question 1
For the first question the following search words are derived directly from the question

- Use
- Bitcoin,
- Microtransaction
- Today

To make sure every suitable paper are caught it is useful to add some relevant synonyms to the list.

- Use – purchase, shop, buy
- Bitcoin – cryptocurrency
- Microtransaction – small transactions, minor transactions
- Today – nowadays, now, recent

3.1.1.1.2 Question 2
The same method was applied to the second question which resulted in the following keywords.

- Buy – purchase, shop, barter
- Bitcoin – cryptocurrency
- Pay – fee, payment
- Email – mail
3.1.1.2 Query string definition

To make the search as effective as possible the search words and synonyms are compiled into Boolean strings. Each question will be described by one string each, which will then be used on all three databases. The results will be filtered to make sure the result includes only reports and not patents or books, all results must also be in English.

With the query strings from both questions I made the following tables

| In what situation do users use Bitcoin for microtransactions today? |
|---|---|---|
| **Keywords** | **Synonyms** |
| Use | Purchase, Shop, Buy |
| Bitcoin | Cryptocurrency |
| Microtransaction | Small transaction, Minor transaction |
| Today | Nowadays, Now, Recent |
| **Query string** |
| (use OR purchase OR shop OR buy) AND (bitcoin OR cryptocurrency) AND (microtransaction OR “small transaction” OR “minor transaction”) AND (today OR nowadays OR now OR recent) |

Figure 4, Search words for review 1, question 1

| In what situation would users buy with Bitcoin and pay through email? |
|---|---|---|
| **Keywords** | **Synonyms** |
| Buy | Purchase, Shop, Barter |
| Bitcoin | Cryptocurrency |
| Pay | Fee, Payment |
| Email | Mail |
| **Query string** |
| (purchase OR shop OR buy OR barter) AND (pay OR fee OR payment) AND (bitcoin OR cryptocurrency) AND (email OR mail) |

Figure 5, Search words for review 1, question 2

Those are the search strings that will be used in the database search
3.1.2 Study selection and quality assessment

3.1.2.1 Inclusion criteria
To make sure the studies relevant and of a high enough quality I decided to limit our searches some more. This paper will only consider studies that:

- Mention cryptocurrencies in a meaningful way in regards of
  - Email messaging
  - Security concerns
  - Public usage with transactions

- Are a peer reviewed article from a
  - Conference
  - Journal
  - Thesis published at a university

- Are in English
- Has been published in 2013 or later
- Can be reached and read through the search engine of the LIU library databases

3.1.2.2 Exclusion criteria
In particular papers will be avoided if they appear to be:

- Written by someone that has a personal economic interest in Bitcoin or transactions and therefore could be considered biased.

3.1.2.3 Sources
As sources the following databases were chosen because of their large knowledgebase and general good reputation.

- Google Scholar
- Science Direct
- IEEExplore
3.1.3 Database search
I got about a thousand results from the databases by using the search queries described earlier. Since the focus would be on results from between 2013 and later, and only if they were either journals, university reports or conference publications, they became somewhat fewer when the database were set to filter away those that did not fit the criteria’s. The results from Google Scholar became a bit of a problem since it was not possible there to filter the result so it would only include reports, journals or conference publications like the other databases could. The only possible options was to filter away patents and citations. As a result the number of reports found with that searchengine were far greater than from any of the others. This will be rectified in the manual phase of the selection.

<table>
<thead>
<tr>
<th></th>
<th>In what situation do users use Bitcoin for microtransactions today?</th>
<th>In what situation would users buy with Bitcoin and pay through email?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google scholar</td>
<td>22</td>
<td>445</td>
</tr>
<tr>
<td>Science Direct</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>IEEExplore</td>
<td>26</td>
<td>13</td>
</tr>
</tbody>
</table>

Figure 6, Database results for review 1

3.1.4 Manual search
To further increase the validity of our chosen reports it was necessary to go through the results manually. It was possible to remove a large number of hits that the database filter could not spot by reading through all the articles and reports while using the same inclusion criteria’s as before. Finally duplicates were also removed and the papers organized by question.

<table>
<thead>
<tr>
<th></th>
<th>In what situation do users use Bitcoin for microtransactions today?</th>
<th>In what situation would users buy with Bitcoin and pay through email?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual hits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google scholar</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Science Direct</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>IEEExplore</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Total sum</td>
<td>13</td>
<td>31</td>
</tr>
</tbody>
</table>

References

[10], [11], [12], [13], [14], [15], [16], [17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41], [42], [43], [44], [45], [46], [47], [48], [49], [50], [51], [52], [53]

Figure 7, Final list of reports for review 1

3.1.5 Data collecting
In the end I got 44 different papers to focus the studies on. The papers were organized into a database where important information, like how much they mention Bitcoin or email, were noted together with some demographic info like country of origin and which date it was written. Special interest was taken to measure if the paper seemed positive to Bitcoin as a general idea and what method for using Bitcoin that was described most often.
3.2 Study 2: A review of email based Bitcoin services online

3.2.1 Search strategy
As with the first study the first thing to do were to formulate relevant search questions in order to describe the problem. Those questions would be broken down into their keywords to be included in the search. The resulting keywords was then rewritten as search strings suitable for a search engine to handle.

3.2.1.1 Keyword definition
These are the questions formulated earlier.

- What are the major sites that offer bitcoin services today
- What email based services does these sites offer
- What email based bitcoin sites are currently offline
  - What services did they offer
  - How long did they last
  - Why did they fail

The main questions are specific enough for further analyze and the follow-up questions are better answered by a manual review of the sites in question. The focus would therefore be the following two questions.

- What are the major sites that offer Bitcoin services today
- What email based Bitcoin sites are currently offline

The first question can be divided into the following keywords
- Bitcoin
- Service
- Site

And the second into the following keywords
- Bitcoin
- Site
- Email
- Offline
3.2.1.2 Query string definition

Like before, in addition to the keywords derived from the questions some suitable synonyms were chosen to improve the results. The keywords and synonyms were then made into useable search queries.

What are the major sites that offer Bitcoin services today?

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitcoin</td>
<td>Cryptocurrency</td>
</tr>
<tr>
<td>Service</td>
<td>Feature</td>
</tr>
<tr>
<td>Site</td>
<td>Page, Company</td>
</tr>
</tbody>
</table>

Query string

(bitcoin OR cryptocurrency) AND (service OR feature) AND (site OR page OR company)

Figure 8, Search words for review 2 question 1

What email based Bitcoin sites are currently offline?

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bitcoin</td>
<td>Cryptocurrency</td>
</tr>
<tr>
<td>Site</td>
<td>Page, Company</td>
</tr>
<tr>
<td>Email</td>
<td>Mail</td>
</tr>
<tr>
<td>Offline</td>
<td>Closed, Down, Dead</td>
</tr>
</tbody>
</table>

Query string

(bitcoin OR cryptocurrency) AND (page OR company) AND (email OR mail) AND (offline OR closed OR down OR dead)

Figure 9, Search words for review 2 question 2
3.2.2 Study selection and quality assessment

3.2.2.1 Inclusion criteria
The search yielded the address for many large Bitcoin sites which were stored for manual search. I also discovered that a lot of information about new sites are not necessarily announced on their own home page, but instead in newsletters and information pages published by other sites. The search discovered several news sites that focused on Bitcoin which announced lists of important Bitcoin sites. To make sure all important sites are found, sites that were mentioned by others and deemed important were included. Since the purpose of this search were only to find as many Bitcoin sites that used email based services as possible no specific regard was taken whether the site still existed or the nature of their services. All sites found or mentioned would together become a master list of sites regarding Bitcoin. From this list of sites those that followed the following rules were chosen for further study.

- They are known to the public
- They mainly deal with Bitcoins
- They once had an email based Bitcoin service

For the second question we also included the following criteria

- They had an email based Bitcoin service open for more than a month
- They are now closed or defunct.

3.2.2.2 Exclusion criteria
Some sites are too small or were referred to too early to be interesting. We will exclude sites that does any of the following

- Was open for less than a month
- Were shown to be a scam
- Closed before 2013
- Are not among the 100 first most relevant hits.

3.2.2.3 Sources
As source Google.com was used because of its large database and good reputation in general.
3.2.3 Database search
The google search gave millions of hits, most of them linking to the same sites. To make sure that the manual filtering would not be impossibly large the 100 most relevant links was selected. Those sites were then analyzed manually for references to Bitcoin companies and all unique Bitcoin sites were noted.

<table>
<thead>
<tr>
<th>Total database hits</th>
<th>17000000</th>
<th>3870000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selected</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Sites found</td>
<td>69</td>
<td>5</td>
</tr>
</tbody>
</table>

Figure 10, Database results review 2

3.2.4 Manual search
The final search was made manually by reading through the selected sites and take a note of all mentioned sites that offer Bitcoin services. Those sites were afterward examined again in detail to see if they offered any email-based services, and in that case what kind of service it was. The same kind of review were done on the results of the second search, except for that only sites that now are offline were noted.

<table>
<thead>
<tr>
<th>Sites that might have email based Bitcoin services today</th>
<th>What email based Bitcoin sites are currently offline</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>[54], [55], [56], [57], [58], [59], [60], [61], [62], [63], [64]</td>
<td>Mt.Grox, Email-tipbot, Mailacoin</td>
</tr>
</tbody>
</table>

Figure 11, Final list of sites for review 2

3.2.5 Data collecting
From the search we got 11 working sites that have email based Bitcoin services today, and three that once had, but are now defunct. The working sites were categorized in a database after the type of services they offered. The same thing were done with the defunct ones.
4 Results

4.1 Study 1

4.1.1 General impression
The papers were published by many different organizations and held vastly different views about Bitcoin and its applications. One thing that most papers seemed to agree on were that Bitcoin was mostly used in connection with mobile services. Nearly every instance where methods for payments that involved Bitcoins are mentioned talked about it in association with mobiles and as something that were supposed to be accessed from an app on a mobile phone.

4.1.2 Question 1
The first question asked were in which situations people performed microtransactions today. In the texts there were mostly three areas were microtransactions are mentioned the most.

- Mobile payments
- In-game purchases
- Donations

4.1.2.1 Mobile payments
There are no doubt that most of the microtransactions are made with a mobile phone. 75% of the papers that mentioned microtransactions also talked about its use for mobile transactions. A mobile transaction is “any kind of money transaction that is conducted via a mobile network” [17]. Mobiles has lately developed into a tool for accessing most of the services where it once were required for the user to visit a bank office. With the recent development of increasingly more advanced smartphones and apps the requests for simpler ways to transfer money appears to have increased. “Mobile payment platforms developed because of a need of the rural unbanked consumers to transfer money as well as receive money when banks were unwilling to provide these services at affordable prices.” [44]. Modern mobiles give people, the opportunity to pay without the need for cash or a credit card by giving them a direct connection to their bank account or a digital wallet. The transactions are fast and secure and you can do it almost anywhere, regardless if there is a physical broadband connection there or not. This makes it popular for small transactions and in situations where a bank is not readily available as long as there is a connection to the Internet available.

4.1.2.2 In-game-purchases
The second most mentioned source of microtransactions was the situation were purchases are made by the player in a computer or mobile game in order to purchase virtual goods. 62% of the papers mentioned this. Commercial mobile games are often designed around the “Freemium” model, which is “a business model where the product itself is free but extra features or functionality requires an additional fee” [18]. Many games today use this model especially in the market of downloaded games that are bought through an app store. Since this system is often based on simple features bought for small sums of money the need for a good microtransaction system is obvious.

4.1.2.3 Donations
Microtransactions are sometimes used as a way for people to donate money in the form of gifts or tip to organizations or individuals they think deserve a reward. 38% of the papers mentioned this kind of transaction. On the internet, especially in communities centered on discussion forums it is not unknown to reward people who have done something interesting with a dollar or two.
the most well-known are the internet forum Reddit that has built in ways for the readers to reward each other for things of interest. Also, among indie programmers tools to make small donations are sometimes used as a way to fund their games without using advertisements [18] or just to help the player show some general gratitude towards the game creator. These rewards are usually a dollar or less and are handled by the game site or forum itself with help of a third part service.

4.1.3 Question 2
Our second question focused on if email could be considered a useful way to handle Bitcoin transactions. This turned out to be difficult since there were no studies that mentioned emails in a meaningful way in regards of Bitcoin. Most of the studies focused on the mobile market and the money trading business while some discussed if Bitcoins had the right to call itself a currency. The fact that no one seemed to be willing to discuss email based Bitcoin seem to indicate that the question either has not been analyzed properly or that email are regarded unusable for services when it comes to Bitcoin. Our second study will try to answer this by examining the companies that do use email based Bitcoin and see how developed it is.

4.1.4 Other questions
Even though email services were not mentioned in connection to Bitcoin there are a few other important things we can learn about this currency. One of the questions that was asked the most about Bitcoin was whether it should remain an unregulated currency or if new laws were needed to control it. Of 44 papers 10 expressively wanted the Bitcoins to be regulated while nine clearly was against it. Another question that came up frequently were if Bitcoin could be considered safe enough to trust, or if it could be hacked. The general opinion also shifted wildly depending on the focus of the paper where banks and other money institutions were mostly skeptic while the users were generally more accepting. Other opinions about Bitcoin that often appeared were

- Bitcoin is not considered completely safe
- Bitcoin is most often used by the poor
- Many banks and financial people want to regulate Bitcoins
- Bitcoins is seen as the start of something better in the future.
4.2 Study 2

4.2.1 General impression

The number of companies that offers Bitcoin related services on the net are huge. Most of them are either trading companies or virtual wallets. Of the trading companies there are a few that offer email related services, usually in connection to a virtual wallet service of their own design, but most focus solely on services similar to a standard stockbroker or currency trader. The companies that offer a digital wallet, but no trading functions on their site usually has a wider range of services and does more often mention email as a way to transfer bitcoins to others. Since the nature of Bitcoin is such that you can send it to anyone as long as you has their Bitcoin address, which is a text string that anyone can send by email, most companies simply mentioned that aspect, or supposedly took it for granted that the customers knew this. Some had their own email solutions or tools to help users email Bitcoins on their own, usually by mailing a link to their sites where the recipient could sign up and receive the transfer. There were also a few companies that offered email enhancements that allowed the users to automatically send bitcoins with their emails if they wanted. Those services were in a great minority, but deserves a mention.

4.2.2 Question 1

The first thing we tried to find out was “What are the major sites that offer email based Bitcoin services today”. From the search we found 69 Bitcoin companies that could be considered major in their field. All those companies did not have email based services so a manual search was made to.

The services could broadly be divided in three categories

- Sending money
- Invoices
- Tipping

4.2.2.1 Sending money

To help users to handle Bitcoin easily there are programs called e-wallets that keep track of your Bitcoin addresses and transactions. Some companies only offer this service and nothing more while others also has other services like trading and advanced methods for transferring Bitcoins to others. One service that sometimes are offered are the ability to send Bitcoins directly from your e-wallet to any other person with an email, even if the recipient was not using the same e-wallet as the sender or even had an e-wallet at all. From the 11 companies examined, seven were e-wallet companies that offered this service. This may seem like a large percent, but from the 69 companies originally examined 65 turned out to be E-wallets or trading companies. Despite this only seven e-wallet companies combined their ordinary services with email.

4.2.2.2 Invoices

Two of the companies had specialized functions for handling invoices from companies that wanted to offer their customers the ability to pay with Bitcoins. Their services allowed the customers to send their invoices by email with the benefit that the recipient could pay by simply clicking a link. This link would connect them automatically to their Bitcoin wallet and perform the transaction.

4.2.2.3 Tipping

The third services found were a mechanism that allowed the users to give tips to people over the internet. Only one company ChangeTip, were found that did this. This company do not have an email
service of their own, but will offer their users the ability to make a One-Time-Donation. That can be described as a single Bitcoin transaction described by a clickable link that can be sent as text on an chat forum or in an email. The link can also be shown as an image similar to an emoji if the user wants to make the transaction a little more intuitive. This service requires that the receiver also has an account at ChangeTip for him to be able to receive the tip, or that he makes one after he has received the tip. Changetip also offer their users some code that they can add to their sites which will add a clickable button that visitors can press if they want to send a tip.

4.2.3 Question 2
The other question was “what email based Bitcoin sites are currently offline”. It is always difficult to find traces of companies that no longer is around, and our search did only manage to locate five companies, of which three were shown to have been closed down permanently. Two of them were companies specialized in tipping, while the last one were MtGox, the once market leading Bitcoin trading company that filed for bankruptcy after major a hacker attack.

4.2.3.1 Tipping
The two oldest services that were closed down were Mailacoin and EmailTipBot. Mailacoin were a small email service specialized in sending bitcoins to anyone who had a Bitcoin address. It was launched in April 2013 and generated some media attention. According to its founder Matt Edwards Mailacoin was supposed to allow bitcoins to be transferred “as a gift, to help spread the word, and to make sure they would also enjoy some of the long-term growth in Bitcoin value that will (hopefully) take place over the next decade or two”. The service disappeared soon afterwards when the creator moved on to other projects. EmailTipBot was a similar service that was created in 2014. The service was fully automated, but poorly updated and ceased to function when its network license run out in January 2015.

4.2.3.2 MtGox
MtGox was a trading company that originally bought and sold trading cards. In 2010 they changed into a Bitcoin exchange that quickly became popular. In time MtGox begun to dominate the market and eventually handled 70% of all Bitcoin trading [66]. In 2013 technical issues and banking problems forced the company to freeze all withdrawals, sometimes for weeks. Eventually in February 2014 MtGox suspended all trading after an alleged hacker attack where more than 700000 Bitcoins were stolen. Shortly thereafter they filed for bankruptcy.
5 Discussion

Bitcoins is a complex subject that has been discussed in many instances lately. Its relevance goes all the way from large macroeconomic aspects that affects entire countries down to tiny tips of less than dollar. My focus was to analyze Bitcoin in relation to email services. Bitcoin with its unregulated nature and its roots in cryptology may seem like a good candidate for email based service. The results, however, indicates that the interest in such a service might be low.

5.1 Results

From the large amount of studies found that discussed Bitcoin, and from the wide range of institutions that published them, it is clear that Bitcoin has made an impact on the modern economy at large. The topic that has been discussed the most is the technical aspects of Bitcoin as well as its place in the current economy. To address this, we will first discuss the general impressions gained from the studies, before I will go on and try to answer the specific research question that was chosen.

5.1.1 General impression

One might wonder why there are such a lack of information about email based Bitcoin services. One reason might be the way the Bitcoin phenomena itself are described in the articles. From the papers, whenever Bitcoin is discussed it is usually from one or more of five different views. Economy, Technology, Security, Social and Legal, and mostly from the first two views.

All the views have their own way of describing Bitcoins and came to their own conclusions about its usefulness and future.

- Economical
  - Discussion – There is a great deal of discussion going on about how Bitcoin might affect the current economic system and whether it was wise to leave it unregulated as it is now. Some papers also describe the current usage of Bitcoin and its impact on...
the mobile market. Since the debates were mostly about how Bitcoin was used as a currency in contrast to what actual services that used it the subjects soon came to focus on regulations and stores. Even the papers that were supposed to focus solely on how to make payments with Bitcoin seemed to assume that it was going to be used with a mobile. The second study showed that the most common company that handle Bitcoin online today are either wallets or money trading business where thousands of transactions are made every day to automatic services. There are also a multitude of stores that accept Bitcoin as a currency, but they are either customers of an existing e–wallet service or has made their own.

- Conclusion – From the papers it were obvious that Bitcoin is seen as a modern currency that is here to stay and will not disappear soon. Its unregulated nature seem to be troublesome for large companies like banks since it removes the ability for them to control the market. Bitcoin is also seen as a system mostly for mobile customers or for places where the regular bank services are scarce or unreliable. An email based service might not be very useful for a store since it cannot be made as an automatic service, but has to be received and accepted by the recipient. This limitation alone removes most of the stores and money traders since it would be extremely slow to handle all transactions manually instead of using the current automatic applications.

- Technical
  - Discussion – Most of the papers analyzed the Bitcoin protocol, its strengths and weaknesses and how people have tried to improve or break the code. Bitcoins cytological roots has been analyzed from all angles, but no serious flaws were shown in the protocol itself. Other aspects that has been examined are the wider promises of Bitcoin, like total anonymity and its inborn safety. Modern technology has shown that it is possible to trace a bitcoin back to its owner under certain circumstances and also to map people’s habits while using Bitcoin at large. This goes against the public assumption that a spent bitcoin is completely anonymous and untraceable. Certain new services has appeared lately though that tries to increase the anonymity. Since a Bitcoin transaction is represented by its key, which can be presented in the form of text, it seems to be possible to make a transaction using email as a medium. Some e-wallet companies has taken advantage of this and made it possible to send bitcoins to anyone by email, regardless if the recipient has any wallet or not. The limitations that come with the email medium has been countered by some companies by adding a second layer of safety, like passwords or the need for the user to login to their site in order to get the money.
  - Conclusion – Bitcoin is seen as a strong and reliable system in itself, but not as anonymous as people like to think. There are ways to identify users by analyzing customer patterns and some Bitcoins can be traced. Several new services has appeared lately that tries to fix this problem, but it still not solved. There are no technical limitations to making Bitcoin transfers by email, but maybe some practical. To make an email based service work one has to not only handle the technical problems with Bitcoin, but those that come with email as well.

- Safety
Discussion – The security aspect of Bitcoin were discussed widely. The topics were usually about if the protocol in itself where unsecure and how the apps and programs that use the protocol could be made to handle the security. Bitcoin is built around a complex cryptological algorithm that is seemingly impossible to crack, and difficult to fool. Some ways to cheat the system has been found over time, but those security problems has been acknowledged and handled since then. For the system to be completely secure, however, it is required that the programs used to send and receive Bitcoin has an equally high-level of security. This is not always the case as some spectacular Bitcoin thefts has been made by people that have found weaknesses in the sites that handle Bitcoin. Because of this it is important to be careful when you choose how you want to handle the funds. This brings us to one of the larger problems for an email-based service. Email is known to be a target for hackers. A transfer made by email would always be at risk to be stolen by someone hacking the email system since anyone that has the Bitcoin key can retrieve the money. This makes an email based service risky and therefore possibly not as attractive as a fully automated system on a secure server.

Conclusion – For the most people the Bitcoin protocol would be as secure as promised, but it is not immune to theft and fraud. The main problem lies in the programs and sites that handle the money. Several large Bitcoin thefts has been made and most of them from companies with low security when it comes to passwords and addresses. When it comes to the largest Bitcoin theft of all, MtGox things like fraud was also a possibility. An email service would have to find a solution to this if it wants to handle larger sums of bitcoins. As always it is a matter of trust, and with Email you can never be sure who gets to read it in the end.

Social

Discussion – Digital currencies has changed the lives of many people. Especially in the poorer parts of the world. One of the most well-known examples is the recent development of the banking situation In Kenya. For a long time the banks of Kenya has focused on the larger cities and neglected the rural areas. As a result it has become complicated for most Kenyans to do banking errands unless they live in a major town. To solve this situation mobile services has been introduced as an alternative to ordinary banks. The most popular service is a virtual currency called M-Pesa which allows the users to transfer virtual money to each other by mobile phone, without the involvement of any bank. This service comes with a price though and require a lot of identity checks before the transfer goes through. As of lately Bitcoin has been introduced as an alternative because of its ease of use, relative security and low transfer fees. M-Pesa has become an important part of the Kenyan society, and shown how virtual cash can help a society. Among the services that used Bitcoins there were several that catered to the more social aspects if the net. The email services that were offered did include tipping services and the ability to use special emoji in messages and chats. Analyzing those companies might show more insight in how a successful Email service with Bitcoins might be built. None of the actual companies has been running for a long time though so it might be hard to draw any specific conclusions.
o Conclusion – For people in parts of the world where banks are less available and money can lose value fast virtual money has been a useful alternative for those who need secure transfer. Bitcoin, with its built in security and ease of use could fulfill the same role if needed as long as people learn to use it. It is still a young currency though so it might take time to learn the full aspect of how it affects the society at large.

• Legal

o Discussion – Several papers discusses whether Bitcoin could be considered money at all, or if it was legal to buy and sell with it. The future of Bitcoin were also mentioned, especially when it comes to its unregulated status. Some want Bitcoin to be as regulated as ordinary Fiat money, while others prefer its current unregulated status. In some places the possible threat of Bitcoin has already forced the governments to act. In Thailand, after Bitcoin became the target for heavy speculation and a rapid increase in value, it was declared in 2013 that Bitcoin lacked any legality as a currency and it was banned from being used in trades in the country. Recently in the USA the state of New York has also demanded that Bitcoin traders must apply for a special BitLicense to be allowed to do business there. Regulations like this might diminish the freedom that Bitcoin offers, but might also be useful when it comes to avoid fraud and stop illegal activity. In the early days of Bitcoin the supposed fact that the currency was impossible to trace made it an interesting target for illegal activities. On places like Silk Road Bitcoin were used to buy and sell illegal materials and weapon on the Internet. After the site got raided and was forced to shut down that activity seems to have decreased somewhat. There are nothing illegal with a Bitcoin service by itself though, only the way it might be used. An email based Bitcoin service could be considered more legal since its lower security and the fact that an Internet Service Provider can be forced show emails sent by a suspect to the police as part of an investigation. For that reason sending Bitcoins over email would be of less interest for illegal operations that wish to hide their transactions and therefore more positive in the eyes of the public.

o Conclusion – Bitcoin are thought of by banks as a valuable goods, but not a standard currency. The general consensus is that it is legal to pay with at the most places even if regulations and bans has begun to appear. People from governments and banks sometimes see Bitcoin as an emerging threat, although one that still is too small to be worried about. It could be easier to manage by imposing regulations, but also lose some of its popularity. Much illegal activity has also been possible because of Bitcoin’s reputation as untraceable. After this was proven wrong, the situation seems to have been improved somewhat.
5.1.2 Study 1
Despite doing a thorough search of all available papers and articles the result was poor. Most of the papers mentioned microtransactions from various aspects, but most of it from an economical or technical perspective.

5.1.2.1 Research question 1
- What is the most common way for a user to use microtransactions today?

The most common method described were digital transfers made in connection with a mobile app or used through an automatic online service. Such transfers could be made to a store or to purchase a service. This type of behavior can be assumed to increase since the number of companies that accept Bitcoin is increasing rapidly. Microtransactions and in game purchases were often mentioned. Among hobby programmers and in online RPG games it is a common practice to offer bonuses in return for a minor donation. From the game makers perspective this is a useful technique to gain some extra players and money. If a player buys some local virtual currency in a game, then he has not only gained an advantage which would incite him to keep playing, he has also invested some money in the game which would change his opinion of the game from just some free entertainment so something he has invested in and will show loyalty towards. There are many examples of games where players has been so involved in this system that they have spent a minor fortune in small sums in order to keep playing and be on the top.

The most common online services described in the papers were either involved in transfer of money or offered services for economic speculation, or both. Today there are many sites that focus solely in trading virtual currencies against each other or changing them for fiat money. Virtual currency speculation are today a huge business with a turnover in millions of dollars. There were no email services mentioned at all, which is worrying, but might suggest that it just have not made such as large impact in the Bitcoin community at large. One of the main focuses on Bitcoin is its security. To have a bitcoin should be as secure as keeping it in a bank. An email, however, is far from secure and is closer to keeping your letters at home in a drawer rather than in a bank vault. There might be large issues of trust that needs to be solved before people would see it as something that is secure enough to be allowed to handle money.
5.1.2.2 Research question 2

- How could a microtransaction of Bitcoins be handled through email, especially with respect to:
  - The technical structure of Bitcoin
  - Safety and security issues
  - The most common usage patterns for micro transactions

A Bitcoin at its core is a notice in the online ledger that is called the Blockchain. To transfer money from one person to another is as easy as telling the Blockchain that you intend to do the transfer and it is valid. The different transactions are recognized to the system by the user’s private keys, which are secret, in combination with the recipient’s public key, which anyone can see. If you know the public key you can do the transfer if you have your private key available. Since the keys can be sent as a string of characters an email based system would be possible. All that is required is that the email knows or has access to your public Bitcoin key and sends it to the recipient when you need something transferred to you. This transfer is also harmless and secure since no one can do anything with this address except from sending you more money. The problem lies in the client itself. If someone gets access to your private Bitcoin key he can easily transfer all the bitcoins in your wallet to wherever he wants. An email client or service that has access to this key could, and most probably will, be the target for attacks by viruses and hackers who want to get to the key. To avoid this the email client needs to be very secure to make sure no one can access it, something that most email clients today cannot fulfill. Another problem appears when you consider who would possibly use a service like this. Most virtual microtransactions today are either payments in stores, economical speculation or in game purchases. Neither of these are suitable for a system that is not automatic, and there are already automatic solutions in use that appears to be just as effective as an email based system could be.
5.1.3 Study 2
When we analyzed the Bitcoin companies directly we got some intriguing result since several prominent Bitcoin companies offered some minor email-based Bitcoin services. It is interesting that emailed based Bitcoin services seem to be a forgotten topic in the literature while it clearly is a thing in the world at large.

5.1.3.1 Research question 1
- What are the major sites that offer Bitcoin services today
- What email based services does these sites offer

We found 67 major sites that have Bitcoin services today. From them there were 11 which had email based services. The sites were chosen not from their financial strength since that is something that changes quickly in the evolving Bitcoin landscape, but from how popular they appear to be based on much they were discussed in media.

A description of the major sites that offer email based Bitcoin services and when they launched are as follow :

- Blockchain
  - A combined statistics and wallet service from Luxembourg that launched in 2011. It allows its users to transfer Bitcoin by creating links that can be attached to emails or chats. A recipient can click the link and will automatically get the received Bitcoins transferred into his account.

- Changetip
  - A tipping service from the USA, launched in 2013. They give their users the ability to send or receive minor sums to random people as a reward or to show their appreciation. They accept many types of currencies including Bitcoin. One of their services is the ability to create a One-Time Tip Link which can be sent over email. The recipient will then receive the coins by clicking the link.

- Circle
  - A wallet service from the USA that launched in 2013. It has functions for receiving and sending bitcoins by email through their site. You request money from a recipient by using their email address as identifier. The recipient will be notified about this transfer through email, together with a link for accepting or denying the payment. The money is then transferred automatically into the users account

- Coinapult
  - A wallet service from Panama that launched in 2013. They give their users the ability to send Bitcoins to an email address of their choice. The recipient will receive a link in an email that will transfer the funds to his account when he clicks it.

- Coinbase
  - A wallet service from the USA that was founded 2012. It offers the possibility to request and receive Bitcoins over Email. If you send bitcoins to an address that is not registered with the site it will transfer the money to a newly created account and email the recipient the information it will need to take possession of it.

- Coinkite
A wallet service launched at 2013 in Canada. It allows the user to send vouchers for bitcoins to recipients by email or SMS. Those vouchers can then be redeemed to the Bitcoin account of your choice.

- GoCoin
  - A company launched in 2013 in Singapore that handle payments for companies that wants the ability to make invoices that are payable in bitcoins. One of their products is a Click-To-Bill function that sends an email to a recipient with a link that will start their E-Wallet and prompt them to pay the invoice.

- GreenAdress
  - A Wallet service from Malta that launched in 2014. The users can use their services send bitcoins to someone’s email address, and secure it with a password. The recipient will get a link to the site where the recipient can type the password and receive the funds.

- Kolab now
  - A web based email provider from Switzerland that launched in 2013. Their services include functions to transfer file transfers and manage invoices. A recipient have the opportunity to pay a bill over mail with Bitcoins if they want.

- Unocoin
  - A combined trade and wallet service from India that launched 2013. It allows their users to send bitcoins to a recipient by email. The receiver will get a link back to the site where he can claim his bitcoins

- Xapo
  - A wallet service from Switzerland that launched in 2014. Their services include the ability for the users to send bitcoins to a recipient by their email-address.

5.1.3.2 Research question 2

- What email based bitcoin sites are currently offline
- What services did they offer
- How long did they last
- Why did they fail

There were 3 sites that had closed down lately that could be shown to have had email based services. They were Mailacoin, EmailTipBot and MtGox.

- Mailacoin were a service where a user could send bitcoins to anyone as long as they had a Bitcoin address. It went online in May 2013. The site gained a lot of attention at first, but were also criticized because it lacks security. Over time the site was not developed further and was apparently abandoned. In June 2015 the lease on the domain name expired and has not been renewed.
- EmailTipBot was a simple automatic online tipping service that was launched in 2014. It was controlled by sending it email messages. You could transfer money to it from your wallet, and a recipient could then claim them by emailing a request to the bot with their Bitcoin address. The owner of the site was very enthusiastic at the beginning and promised it would be expanded to include other cryptocurrencies as well. Over time nothing happened and in the end the site ended up in a permanent hiatus.
5.2 Method

The systematic literature study method is a very effective method for getting a feel for everything that is known concerning a specific subject. For it to work well, on other hand, it requires that there is plenty of information about the subject to choose from. When it comes to Bitcoin it gets a bit complicated. Bitcoin is a relatively new phenomenon, and one that is developed every day. New companies come and go; some people find new ways to use Bitcoin in their daily life while other loose interest just as fast. There are thousands of articles and papers written about this, but very few of them actually have anything new to say, or what they say get invalid very soon as after a few months many new promising Bitcoin services that are discussed has failed and become forgotten.

To find general information about Bitcoin was a relative simple task. There were many papers that talked about the subject in various ways. The more specific task of finding studies that discussed Bitcoin in combination with email was much harder. Even though there are thousands of papers about Bitcoin in general, there were close to none that even mentioned the possibility of email services that included Bitcoin. To compensate for this the study would include a large number of papers in order to get a general feel for the subject, and then include a second study were instead Bitcoin companies were analyzed. This method would supposedly give a general feel about how the Bitcoin situation looked today.

The search was made through three online databases. Google Scholar, IEEExplore and Science Direct. It soon begun apparent that the majority of hits came from Google scholar alone which therefor begun to dominate the results. After having analyzed the results manually, it turned out that every result that was a university thesis came solely from Google Scholar while the other two, IEE and Science Direct, only gave journals and conference papers for the study. Finding relevant query words turned out to be a problem. At first it was hard to determine which words that are relevant among all the possible choices. Some obvious words to use were found by analyzing the questions, but after closer inspection the result was poorer than expected.

I decided to go with the original search anyway since they seemed to represent a great deal of the current research and discussions. Analyzing this material would show where the general interest of Bitcoin seem to be today which might help get a feel about where it is heading in the future. It did not say much about its connection to email, which is a problem.

To balance this the second study was focused solely on email based services and ignored all other aspects of Bitcoin. After major Bitcoin companies that was found had been analyzed and examined for email services, it could be concluded what seemed to be the most popular ways to use email for Bitcoin services. Since Google was selected to perform the study, which is a very general search engine, instead of a more specialized one, some of the result that was found did only connect briefly with the subject. By analyzing the most promising results and then include every site that was mentioned a list could be produced that showed what appears to be the Bitcoin sites most sites were talking about. Those sites were decided to good enough for further analyzes. Another thing that might be a problem was the decision to limit the research to only include recent articles and articles written in English. At first every article was included, no matter the date, it soon became obvious though that any article written before the Bitcoin boom 2013 was speculative at best and would give very little relevant material for the study. When the search was restricted to only include the latest articles it brought more interesting results. Since Bitcoin is a currency that is
developing fast a lot of new articles were written while this study was made. I also decided to not include those or the study it would soon be unmanageable. This means, however, that the results of the first study are valid mostly for the time of early 2015 since it does not regard the latest developments. The second study tries to correct this somewhat by including both old and dead companies as well as the most recent in the search. The language aspect came with its own set of problems. Since Bitcoin always has been very popular in China the language barrier left out large groups of articles that were talking about Bitcoin in Chinese or other languages. The restriction was necessary since there was not possible to have the articles translated, but it has resulted in that the focus on the research comes from western word mostly.

China is today one of the largest users and developers of Bitcoin services so another study which included Chinese reports and articles might give much information about where Bitcoin is heading nowadays. There were also no reports from Africa included even though there are many places in that area that has had an interesting development regarding Bitcoin lately. Once again the language barrier did stop us from taking advantage of this.

5.3 Ethics
One thing to remember when it comes to new technologies is fact that just because a discovery could be developed into something bigger, does it mean that it always should. If something is developed long enough and gets big enough it will affect the society at large, and bring changes for the better or for worse. All major discoveries so far has come with their own pitfalls as well as benefits, both which should be considered before its usefulness can be evaluated. Bitcoin is no exception and some of these problems has already revealed itself. The following questions do I find to be of particular concern.
5.3.1 Bitcoin and taxes
Bitcoin is not a regulated currency. It operates free from banks and outside nations and laws. For a user this freedom might feel tempting, but for a government it could be a nightmare. For a tax system to work properly the government needs a great amount of knowledge about the flow of capital from the people and the companies in the country. If a transaction is untraceable it would be anonymous and therefor very hard to tax. The control government banks has over the local economy is also a great tool to boost the economy during a depression and cool the market during a boom. If a great deal of a country’s business are made with tools that lies outside of the governments control, like Bitcoin, then the possibility to control that part of the economy would be lost. In worst case that could cripple the country’s ability to function normally. At the moment Bitcoin is far too small to make any larger impression on countrywide economy, but in the greater perspective it might be necessary with more regulations unless we want the way society works and the ways the government can influence the economy to change in unpredictable ways.

5.3.2 Bitcoin and criminals
In November 2015 a hacker targeted the network of the Swedish bank Swedbank and tried to extort a large sum of money. He also demanded that the ransom money should be paid in Bitcoin. That was probably a wise choice for him since if the ransom had been paid it would not be possible to trace it back to him afterwards. For the rest pf us it shows how criminals could use this currency as a tool for crime.

Cryptocurrencies like all valuable goods has always been coveted by criminals, Bitcoin even more than most because of its general usefulness and its untraceability. A currency that will be anonymous as soon as it leaves you hand would be a perfect tool for money laundry. Illegal goods like narcotics and other ill-gotten gains could be traded without the need to worry about leaving financial traces. Terrorists could get donations from donors that would remain anonymous to everyone. All of these are valid concerns that is addressed daily.

The criminal aspect of Bitcoin are well known, but there are also many counteractions taken. The hidden trading site Silk Road, which used bitcoins as a way to avoid being discovered, was infiltrated and taken down by police recently. Methods to trace specific bitcoin and mark them for later detection does already exist and other countermeasures for tracking bitcoins is researched for all the time. Bitcoin is not illegal by itself, but it opens new ways for people to do illegal activities. How this problem is to be solved will most likely be great challenge for the police in the future.

5.3.3 Bitcoin and accessibility
Bitcoin is a child of the internet. It can be used wherever you can access an internet server, as long as you have the tools and the software. Unfortunately this is not the case everywhere. Approximately half the world population owns a smartphone today, the rest, for reasons of availability, economy or maybe personal choice, does not. A currency that can be used exclusively online will doubtless exclude large groups of people from accessing it, as well as any products that uses it. Today this is a minor problem. The number of people that owns a smartphone are growing every day and most of those people does not even know about Bitcoin. In the future this might change and if an important function in society gets too dependent on Bitcoin, it will come to a point where it might be hard to manage without it. A good example of this is when mobile phones became popular in the 1990s. Before that, as a public service, phone boots were common around the cities. People could use them to make their usually phone calls, and also to call for help in case of an emergency. With the mobile
revolution the need for phone boots became less obvious and after a few years payphones were almost gone from the public. This made the situation difficult for those who did not have a mobile phone. Without a mobile you would have to find someone else who had one, or hope that there is an open store what a phone they can let you use, if you spot an emergency. This way an important function of society became dependent on who had whose who had a particular technology, but left out the rest. To avoid this it is important to remember that even if a new technology is supposedly better and more effective, there could always be alternatives for those who cannot use it.

5.3.4 Bitcoin and the environment
Cryptocurrencies differ from fiat in that they have no physical representation. The validity of a bitcoin is measured, not by the metal it is made from, but by the computer power used to generate it. This might seem like an ideal situation for the environment since the need for mines and other environmental hazards would be smaller. In reality Bitcoin is far from environmental. When you make a Bitcoin you need to solve a complex mathematical calculation that require a lot of computer power. The difficulty of making the calculations to create a bitcoin is not of any purpose except to making sure that new bitcoins are not minted too fast. Without its extra layer of complication artificially added to control the process, the calculation would be trivial for a modern computer. Every calculation made by the computers requires electricity which must be produced somewhere. When the electricity is made to fulfill a seemingly artificial need it could be considered a waste of resources that could be used for other means. Since most electricity today is made by nonrenewable means it seem extra wasteful and unnecessary. By developing for Bitcoin you make sure that more coins are needed and more energy wasted and more computer resources needed. There are already stories about students that has tied up universal supercomputers with Bitcoin calculations, taking valuable computer time from more important research. This is an area of Bitcoin that should be studied better and addressed soon. There are suggestions for alternative cryptocurrencies that would use calculations with secondary uses like research or analyses which might make the waste seem smaller, but so far no ideal solution has been suggested.
6 Conclusion

From what has been found there seem to be little interest in another email based Bitcoin service. Some of the biggest actors on the Bitcoin scene has already launched email-based services like this as a complement to their regular services, and the smaller companies has problems finding a suitable niche for their product. The environment for Bitcoin today seem to be mostly based on mobile payments. The main reason might be that Bitcoin is mainly used as a tool either for shopping, tipping or investment. All three are situations that operate best if the customer uses automatic programs or built in services. The only exception are in developing countries like the Philippines, Cyprus and Kenya where Bitcoin is sometimes used as a safer alternative to their own currency, but even there virtual currencies are usually accessed through specialized mobile apps like M-Pesa. The difference between accessing the currency through an automatic mobile app and through email is that when you receive an email it requires for someone to be there and receive the message manually. This makes it unsuitable for a company that might get thousands of transactions every day. Security is another issue. Sending bitcoins over email are in many ways similar to someone who send money with a birthday card by regular mail. Just like with a postcard the security for email based Bitcoins are not better than the system that delivers it, which might make people consider it a risk. For an email based Bitcoin service to take off it would have to compete with the big companies in the sector or find a unique way to market its service. An example of this is Changetip, a company that among other services offer pictures similar to emoji that can be used in chats or emails if the user want to tip the receiver. The images have a Bitcoin value added by the sender and can be cashed into Bitcoins when they have been received. Time will tell if their idea will work though since their company, like most that handle Bitcoins, are still very young. Bitcoins are still new and developing phenomena and might mature into a more email friendly system given time. Today though it is still too early to say for sure.
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