Visualizing the economic development of cryptocurrencies

Thesis

Author: Mike van Rossum
Student No. 500620057

Supervisor: Bart-Jan Steerenberg

August 2014
“Vires in Numeris”
Preface

"A mysterious new technology emerges, seemingly out of nowhere, but actually the result of two decades of intense research and development by nearly anonymous researchers.

Political idealists project visions of liberation and revolution onto it; establishment elites heap contempt and scorn on it.

On the other hand, technologists – nerds – are transfixed by it. They see within it enormous potential and spend their nights and weekends tinkering with it.

Eventually mainstream products, companies and industries emerge to commercialize it; its effects become profound; and later, many people wonder why its powerful promise wasn’t more obvious from the start.

What technology am I talking about? Personal computers in 1975, the Internet in 1993, and – I believe – Bitcoin in 2014."

- Marc Andreessen, creator of Netscape, the world’s first web browser
Abstract

Communication and Multimedia Design

Visualizing the economic development of cryptocurrencies

by Mike van Rossum

Cryptocurrencies are a new way of thinking about financial systems and currencies. These decentralized technical phenomena work in a completely different way compared to traditional financial systems. This thesis discusses the difficulties traders and journalists face while trying to understand the economical state of these systems.

The research question is:

**How can interactive media visualize quantitative information about the economic development of cryptocurrencies over time to traders and journalists?**

We answered this question using the following sub questions:

- What resources do traders currently have and what knowledge do these resources provide?
- Which questions do journalists currently have while trying to cover a story around the cryptocurrency financial market?
- What properties are important for understanding the economical state of a cryptocurrency?
- From what angle does a trader or journalist needs to look at these properties to understand the economical state?
- What ways of visualizing quantitative information are broadly used in the broader financial services sector?
- What ways do we need to design different visualizations for the cryptocurrency markets because of differences in the markets and the audiences?
• What technical alternatives can we choose regarding the aggregation platform, infrastructure and front-end?

• What open-source tools can we use to realize this platform with minimal efforts?

• How can we limit the server costs while trying to create the real platform on a global scale?

• Did our solution provide insights to traders and journalists regarding the economical state?

Research was conducted on both traders and journalists (in the form of interviews, desk research and prototype testing) to determine what information both groups are looking for. Existing research was looked at to see what kind of currency metrics played a role in economic state and price formation. Based on this research a list of metrics was defined that can be used to better understand the currencies. Important perspectives on these metrics were also established.

Additionally, a web based visualization platform was proposed that shows how these metrics developed over time. It offers a number of different ways to view and compare those metrics between different currencies. We designed the interface of the platform and built an early prototype that was tested by traders, journalists and cryptocurrency users.

At the final stages of the research we validated that:

• the economical properties and perspectives gave insight to the economical state of the currencies.

• the target audience was able to navigate the interface and read all visualizations.

• our prototype offers new insights previously unreachable for our target audience.

A lot of people inside the cryptocurrency community (including people of the target audience) were very interested in the prototype. 296 people have left their email address and want to stay updated when the full proposed solution is available.
## Contents

5.1.1 Mining distribution ........................................ 19  
5.1.2 Market volume distribution ................................. 21  

6 Designing the prototype ........................................ 25  
6.1 A too narrow view of the markets ............................... 25  
6.2 Visually communicating complex statistics ...................... 25  
6.3 A simpler platform ........................................... 26  
6.4 Time based metric visualizations ............................... 26  
6.5 The role of exchanges ......................................... 27  
6.6 Exchange types ............................................... 27  
6.7 Cryptocurrency mining statistics ............................... 28  

7 Visual solutions .................................................. 29  
7.1 Current state elements ........................................ 29  
7.2 Time based visualization ...................................... 31  
7.2.1 Time based controls ....................................... 31  
7.2.2 Comparison or distribution ................................ 32  
7.2.3 Individual metrics ......................................... 35  
7.3 Top lists ....................................................... 36  

8 The user interface ................................................ 38  
8.1 Limitations in the prototype .................................. 38  
8.2 The views ...................................................... 39  
8.3 Example views ................................................ 39  

9 Technical implementation ........................................ 42  
9.1 Technical implementation of the prototype .................... 42  
9.1.1 Deciding on the front end framework ....................... 42  
9.1.2 Application design of the prototype ....................... 44  
9.1.3 Model logic ............................................... 45  
9.2 Technical suggestions for the back end ....................... 46  
9.2.1 Back end application design ............................... 46  
9.2.2 Database layer ........................................... 46  
9.2.3 Fetching layer ............................................ 47  
9.2.4 Computation layer ....................................... 47  
9.2.5 API layer ................................................ 47  

10 The prototype .................................................... 48  

11 Validating the prototype ........................................ 49  
11.1 Test plan ..................................................... 49  
11.1.1 Use case 1: Finding a crypto investment vehicle ........... 50  
11.1.2 Use case 2: Reporting an exchange shutdown ............. 50  
11.2 Feedback from the cryptocurrency community ................. 51  

12 Conclusion ....................................................... 52  
12.1 Interest in the full platform .................................. 52  
12.2 Discussion .................................................... 53
# Contents

12.2.1 Exploring forming markets ........................................... 53  
12.2.2 A more segmented target audience ............................... 53

A Interviews with journalists ................................................. 56
B Interviews with Traders ..................................................... 58
C Qualitative feedback during the design phase ....................... 60
D Test results .......................................................................... 68
E Web traffic analysis ............................................................. 72
F Survey results ........................................................................ 74
Bibliography ........................................................................... 80
Chapter 1

The cryptocurrency ecosystem

1.1 An introduction to Bitcoin

When an entity who went with the name Satoshi Nakamoto proposed a peer-to-peer trustless currency called Bitcoin in 2008 it was first met with scepticism [1]. Bitcoin wasn’t the first experiment of a cryptographical based currency [2]. But because it combined multiple ideas into a single project it still gained traction. Bitcoin does not rely on trust of any single entity and users can transact in a relatively anonymous nature [3].

Bitcoin was launched in the midst of the financial crisis of 2008, a time where a lot of people were looking at alternative ways to transact in a global economy. During this time Bitcoin grew from an idea and some simple open source software into the multi billion dollar economy that it is today.

It is hard to predict where Bitcoin will go in the future as the dynamics of this open currency are so different from anything we’ve seen before. Economists and academics have different opinions based on the economic properties of the currency. For example Brian Hanley takes a negative stance, arguing that the ignorance of banking fundamentals will lead to it’s demise [4]. Though others embrace the differences, saying that it’s up to the market whether Bitcoin will succeed or not [5]. Though as the market grows, the number of academics taking Bitcoin seriously grows along with it [6].

Because Bitcoin doesn’t rely on trust of any single entity there is no one in charge. Bitcoin is merely a framework that uses math and cryptography to enforce fixed rules to all participants. If a party does not follow the rules the rest of the network would simply ignore the cheating player. At the heart of the system is a transaction ledger called the blockchain, it is fully public and open. The ledger is hosted on a peer-to-peer
network, similar as the file sharing protocol Bittorrent. Public key cryptography ensures that only the owner of an account (called an address) can sign a transaction that moves funds to another account. Lastly a process called mining ensures that new transactions end up in the Blockchain. The mathematical term is called Proof-of-work and it follows a free market model that provides incentive for spending computing power in order to verify transactions cryptographically and hereby collecting fees and rewards [7]. It is designed in such a way that the verification takes a constant amount of time, regardless of the amount of computing power spent [8].

Due to this nature the ecosystem looks a lot different from traditional financial systems. In fiat monetary systems an institution determine interest rates periodically based on demands in market and the state of the economy. However all of Bitcoin’s supply is predetermined by an algorithm; the future supply of bitcoin is already known today [9].

In the land of Bitcoin, anyone with a computer is able to verify transactions and gets rewarded for doing so. Licenses are not required since cryptographic proof is used to ensure that the work is legit. Since the rewards for mining is set for all the miners combined, it is a free market where metrics like electricity costs determine mining profits [10]. An advantage of such a system is that trust relies on the open-source and verifiable system, instead of individual participants who might fraud the system.

1.2 Overview of the ecosystem

Before discussing different metrics that can be used to weigh cryptocurrencies it is important to have a view of the whole ecosystem.

1.2.1 Mining Market

Even though Bitcoin is a new kind of currency system only a few years old, people from all over the world have jumped in on a number of different opportunities. While the value of a bitcoin is rising the amount of money that can be made through mining grows along with it. Every ten minutes a miner gets rewarded. At time of writing this reward is 25 bitcoin in addition to transaction fees. With the current price of one bitcoin around $600[11] this results in all miners combined earning over $2,000,000 every day. However the reward is distributed in a lotto type system where you pay tickets with hashing power. Because the chance of winning the reward gets smaller for miners with little hashing power, pools are created that split rewards over all participants [12].
Mining companies are rising and hardware manufacturers are designing chips specifically designed to mine bitcoin. A year ago it was reported that the Bitcoin network had more computing power than eight times the 500 fastest supercomputers combined [13]. Though at the time of writing moment the network is over a 1000 times faster than it was back then [14]. Figure 1.1 shows the current mining power.

As of April 2014, around $1 billion has been spent on hardware to build the mining infrastructure [15].

1.2.2 Wallet providers

The way Bitcoin handles accounts in the blockchain is technical and non forgiving [16]. A number of so called wallet providers are creating easy web interfaces and apps for consumers, similar to online banking systems. Figure 1.2 shows the interface of Coinbase.

A few of the biggest wallet providers like Coinbase share user growth numbers periodically [17]. Raw account number information can also be retrieved from the blockchain. Though since Bitcoin is pseudonymous and most software and human users have hundreds of bitcoin addresses it is hard to extract real usage information from these numbers. These metrics from wallet services can thus be used to track user growth.
1.2.3 Online merchants

When comparing Bitcoin to traditional payment methods there is a lot of potential for the new currency. The credit card system is expensive, puts the customer at risk of fraud and does not have a way to protect the consumer’s privacy and identity [18]. International payments are another difficult problem for online consumers. Because of these reasons the number of online merchants accepting the new currency is growing every day.

Bitpay is online payment solution for merchants wanting to accept Bitcoin. Through Bitpay merchants can accept Bitcoin without having to store or deal with them, Bitpay will handle the conversion into fiat currencies the merchant already works with. At the time of writing Bitpay provides this service to over 30,000 merchants [19].

Similar to wallet providers, these metrics can be used to track the currency usage of a cryptocurrency.

1.2.4 Altcoins and Trading

Bitcoin is fully open source, this means that everybody is free to copy it and name it something else. These alternative cryptocurrencies are called altcoins. There are currently over 300 of such currencies [20]. While the inner workings are almost always the same as those of Bitcoin, the price is not. The price of Bitcoin and altcoins is driven by supply and demand.

The value these altcoins add to the cryptocurrency ecosystem is wildly debated [21]. Some altcoins do offer features not covered by Bitcoin. Like Primecoin that uses the proof-of-work to simultaneously calculate big prime numbers, which are interesting in many different fields of science. Or Darkcoin that promises a better privacy model against the pseudonymous model that Bitcoin has.

Cryptocurrencies can be traded on online exchanges. Bitstamp, one of the bigger Bitcoin exchanges, only facilitates trades between Bitcoin and the US Dollar. While Cryptsy, an altcoin exchange, lists a large number of altcoins that can be traded against Bitcoin and Litecoin in over 200 markets [22]. Because the trading of cryptocurrencies is currently unregulated the markets behaves differently, with for example Pump and dump schemes happening around the clock [23].
Figure 1.2: The user interface of Coinbase
Chapter 2

The informational gap

This is a completely new ecosystem that has to be approached differently compared to traditional financial systems. This thesis focuses on different aspects and metrics of the economy that can be used to gain an understanding in economic development. It than proposes a data visualization platform that shows this economic development.

To create such an informational platform that provides insights in economic developments it is important to look at the state of the market, how the target groups currently try to understand and predict market behaviour and research that has been done towards price formation.

2.1 Research on price development

Since there are no underlying fundamentals all prices are driven by supply and demand in a purely speculative financial market. But since the future supply is known to everyone in advance (see chapter 1.1, all price fluctuations are caused by a shift in demand.

It is hard to know what the main drivers behind Bitcoin’s price are. However multiple scientific studies have been done to identify metrics that correlate with or drive the price. This is possible due to the digital nature of Bitcoin and most social behaviour of its users.

In 2012 Buchholz et al did a statistical study towards the demand and price volatility. They compared Bitcoin’s supply to the transaction volume, the trading volume, average transaction amount. But also looked at external metrics like Google trends [9].

Garcia et al studied the behaviour of Bitcoin investors through social media and search queries around sudden price movements like bubbles and crashes [24]. They found
positive feedback loops in the social media use and user base. Kristoufek did a similar research in 2013 where he studied the relationship between search queries on Google and Wikipedia and the development of the Bitcoin price [25]. He found that even though search queries strongly correlated with the price, there was no clear leader as to which drove the other. Kristoufek found that most price developments were driven by speculation and trend chasing. In 2014 Kristoufek extended his research on price development to look at Bitcoin’s drivers such as the transaction volume, the trading volume, mining the hash rate and influence from the Chinese market. And how they correlated with the price in the past few years. He then used a visualization called wavelet coherence analysis to plot the correlation over different time frequency spaces per driver. He saw that Bitcoin’s transactions were driving the appreciation of the currency, and with that the price. Though this link became weaker in time [26].

Looking at this research we see that people have been the studying price formation and development for some time now. Though most research has been limited to Bitcoin and did not cover altcoins. Iwamura et al looked at the economical properties of cryptocrurrencies following the ideas of Austrian scholar Friedrich A. Hayek in the context of digital currencies. They came up with a list of characteristics of an ideal qualified cryptocurrency [27]. Bornholdt and Sneppen proposed a model to look at different altcoins using attention, capitalization, trade volume and mining [28].

This research towards social media statistics showed that for certain periods of time in specific contexts these statistics might correlate with economic development and price formation. However this appears to be to sporadic to include in the platform: when the statistics are of no importance they only act as red herrings.

Kristoufek’s research towards properties of the currency proved to be very valuable. As the correlation between those and price formations remained much more constant.

### 2.2 A decentralized technical innovation

The decentralized nature of Bitcoin combined with the new technical properties make it hard for journalists to accurately cover what is happening in the ecosystem. We’ve seen this behaviour at past innovations. Before the internet was widely adopted media tried to explain what this new thing might be, though most reporting failed in even mentioning the impact this medium might have had. One classical example happened during NBC’s show Today [29].
"It was really handy during the earthquake. That’s how a lot of people were communicating, telling loved ones and families they were okay. Because all the phone lines were down."

We are seeing the exact same thing happening today on Bitcoin as can be seen in the Wall Street Journal [30].

In 2011 the Bitcoin price reached a new height of $27 in a short period of time. A price crash followed and the technology magazine Wired announced the death of digital currency [31]. Though Bitcoin is a lot bigger now with the price around $600 at the time of writing [11].

When Leah McGrath of Newsweek published an article claiming to have found the anonymous creator of Bitcoin she came under heavy fire from the Bitcoin community for making too many assumptions and doing bad research. She claimed the man she found confessed on being the creator, though he denied those facts ever since [32].

Most financial journalists are covering the properties of Bitcoin using traditional frameworks to compare and understand Bitcoin [@mm], but this becomes very hard to do properly when you don’t understand the fundamental value that Bitcoin might have to offer [33]. Market behaviour is based on this risky potential with huge upsides, not on the current properties and usage [34].

2.3 Changes in market behaviour

When trying to value Bitcoin and altcoins multiple metrics could be taken into account, the raw currency data like transaction volume, mining network and market data but also currency community and development statistics. This thesis uses some of these metrics in an informational platform focused on providing high level information on these cryptocurrencies. The platform is designed for traders and reporters who want to get an overview of the whole ecosystem at a glance.

There exist some platforms trying to address specific metrics in a limited scope. Most Bitcoin charting websites have advanced market graphs, including market depth charts and candle charts. However most are specifically designed for the Bitcoin system. While this may have been fine some time ago when Bitcoin was the only cryptocurrency tradable for fiat currency, this is not the case anymore. Kraken for example, a classic Bitcoin to fiat exchange, now also provides markets for trading Ripple, Dogecoin and Litecoin with the US Dollar [35].
The most common metric to compare different cryptocurrencies is the market capitalization [20]. However due to the way a cryptocurrency is distributed the available supply is not always straightforward. The Ripple currency for example is for 20% distributed to miners (the users) and 80% is given to the company behind the currency who then redistributes it [@ripple] (this again relies on trust of a third party company). The market capitalization is calculated by the price of a single unit times the available supply. Though what the true available supply is is not clear. Each cryptocurrency has a different distribution [36], though they are not taken into account when comparing the currencies.

2.4 Research scope

This research tries to define the economic state of a cryptocurrency using a number of properties. And from what perspective those properties need to be approached in order to understand the economic state. It proposes a visualization platform that shows the properties in these perspectives specifically for traders and journalists.

2.4.1 Research question

The research question is:

How can interactive media visualize quantitative information about the economic development of cryptocurrencies over time to traders and journalists?

2.4.2 Sub questions

The sub questions are:

- What resources do traders currently have and what knowledge do these resources provide?
- Which questions do journalists currently have while trying to cover a story around the cryptocurrency financial market?
- What properties are important for understanding the economical state of a cryptocurrency?
- From what angle does a trader or journalist needs to look at these properties to understand the economical state?
• What ways of visualizing quantitative information are broadly used in the broader financial services sector?

• What ways do we need to design different visualizations for the cryptocurrency markets because of differences in the markets and the audiences?

• What technical alternatives can we choose regarding the aggregation platform, infrastructure and front-end?

• What open-source tools can we use to realize this platform with minimal efforts?

• How can we limit the server costs while trying to create the real platform on a global scale?

• Did our solution provide insights to traders and journalists regarding the economical state?
Chapter 3

What information are those studying cryptocurrencies looking for?

This thesis is focused on two specific target groups: Journalists and traders. Journalists refer to people creating financial or technical news coverage and traders are day traders interested or active in the cryptocurrency markets.

These two target groups (sometimes indirectly) have a influence on price development and economic activity. When traders position themselves in a market, they are stimulating economic activity and directly influencing price. This phenomenon is called market impact. Markets are tightly coupled with other markets and other exchanges. So before they decide in what market they are active they have to have an understanding of the big picture.

Journalists responsible for covering cryptocurrencies have a big impact on the general consensus about those currencies. As seen in chapter 2.2, journalists are currently having a hard time in doing so. By only focusing on a few key metrics in a limited way, they can easily understand the economic state.

By only focusing on macroeconomics we are not creating a trading platform, or a platform that lets users inspect precise price movements in specific markets. But more a platform that gives a quick overview of the whole state of the economy.
3.1 What are journalists looking for?

Interviews were performed with a number of journalists that have written publications in the Bitcoin space in the past, see attachment 1. It showed that journalists perform desk research on the Bitcoin economy before publishing a story. In this research they are trying to gain insights in the current size of the market through multiple time frames. The sizes are compared against historical time frames (for example the Bitcoin price is higher than it was before). Currently the main topics for journalists are market distribution (in the exchange landscape), international market distribution (what countries are leading the Bitcoin market?), Bitcoin price trends (including bubbles and crashes) and market response on news (something happened, though the price did not change).

Current market research tools might be able to aid in this research, though are not optimized for this purpose at all. This results in strange news publications.

3.1.1 Mt. Gox bankruptcy

Just before the exchange Mt. Gox went bankrupt it was not possible to withdraw money from the website, though it was still possible to trade on the markets they offered. This meant that there still was a US Dollar price for a bitcoin on Mt. Gox, though it was unrelated to the real price of Bitcoin and more a reflection on what currency users were most confident in regarding a possible future withdrawal.

A new market was created where Mt. Gox users could trade their "GOXBTC" (Bitcoin on Mt. Gox) against normal bitcoin based on the perceived risk of in the future being able to withdraw GOXBTC from Mt. Gox [@bitcoinbuilder]. But at the same time a lot of media were reporting a Bitcoin crash based on the price at Mt. Gox [@business insider, @nasdaq, @standaard].

3.1.2 Lack of research tools

As shown in chapter 2.1 and earlier in this chapter, journalists are having difficulty covering the Bitcoin and altcoin space. All online resources covering the current state of the market are purely on providing traders specific tools to make better investment decisions (see chapter 5). While a depth chart of the order book is very valuable when determining what position to take in a market, its complex nuances \(^{1}\) do not help towards

---

\(^{1}\)These charts shows current offers in a market on a single exchange. When looking at such a chart one also has to be aware of other exchanges and other markets, because they are tightly connected. All standing offers can also be pulled at any time for market manipulation purposes [37]
What information are those studying cryptocurrencies looking for?

gaining a global overview of the whole space. Chapter 5 has a detailed discussion of
existing tools. This is especially a problem for all mainstream technology media that
cover cryptocurrencies. Bitcoin media coverage can currently be found in technology
media, financial media and rarely in mainstream media.

3.1.3 Information needed by journalists

This thesis aims to design a platform that offers the information these reporters are
looking for. Without the bloat that comes with a full trading or statistics platform.
Focusing on the current real-time state as well as past market states when big events
happened in the ecosystem.

According to our interviews, the most important factors journalists are looking for are:

- Development of the cryptocurrency usage over time.
- Cryptocurrency market activity.
- Market exchange distribution.
- Market volume distribution.
- Country comparison.
- Comparison of different cryptocurrencies, on market activity and currency usage.

3.2 What are traders looking for?

Interviews were also performed with traders, details can be found in attachment 2. These
people look at the market from different perspectives before deciding to invest or take
certain positions, they go great lengths to analyze the environment. Before looking at
tools that help in understanding specific market behaviour and trends traders try to
get an overview in the macroeconomics of the cryptocurrency landscape. This overview
consists of a mental image of the big exchanges and monetary flows on their markets.

An interface that shows these macro statistics and how they develop over time, without
the noise of micro market structures can help traders gain a more broad insight. This
can especially serve as a starting point for traders new to cryptocurrencies, as a lot of
forex trades are taking an interest in the Bitcoin space [38]. But it is also of use for
traders who want to be up to date with the latest macro economical developments.

According to our research, the most important factors traders are looking for are:
What information are those studying cryptocurrencies looking for?

- Market exchange distribution.
- Development of the cryptocurrency usage over time.
- Currency price development and volatility.
- Cryptocurrency market activity.
- Comparison of different cryptocurrencies, on market activity.

3.3 Metrics in the platform

Based on conversations with the target group in chapter 3.1 and 3.2 and the scientific research in chapter 2.3 we have set up a list of most important metrics that had an impact on the price formation of Bitcoin in the past and is most relevant to the target audience. By offering statistics about those metrics the target group can see in the current state of the multiple cryptocurrencies. This also makes it possible to compare the currencies and gain an understanding in their relation.

- Currency data
  - Price
  - Trading volume across exchanges
  - Price volatility
  - Transaction volume
  - Amount of transactions
  - Distribution hashing power

- Exchange data
  - Trade volume
  - Amount of trades
  - Active markets

3.3.1 Perspective on metrics

When looking at the metrics described in chapter 3.3 it is important to think about what the target group wants to know about a metric. If we take the textit{exchange data trade volume} metric we are looking at the sizes of the exchanges in the economy as
What information are those studying cryptocurrencies looking for?

measured by trading volume. Both target groups are not that interested in the current state of this metric (for example a list with exchanges and their total trading volume). They want to see how this number evolved into its current state. They also want to see how that state developed relative to the state of exchanges.

An historical example is the news coverage around the bankruptcy of Mt. Gox (which is discussed in chapter 3.1.1). A lot happened in the final weeks of its existence and journalists had a hard time figuring out what was happening on the different exchanges and with the currency itself. This was caused by reporters not having the proper tools to figure out the global state of the economy.

Based on the understanding both target groups are looking for we came up with the following perspectives on all metrics in chapter 3.3:

- How did the metric develop over time?
- What is the distribution of the metric (how many mining pools, exchanges, currencies are there and how do they compare)?
- What is the size of the metric in a specific point in time, with most focus on the now (eg. real time, current state)?

3.4 Edge cases in metrics

Because not all metrics can be fairly measured we need to define unclear metrics and how the platform will deal with them.

3.4.1 Mining hashrate distribution

While most cryptocurrencies use a similar Proof of work system as Bitcoin, they do not all use the same hashing algorithm. Hashing power is calculated based on the amount of hashes the network is able to calculate. However not all hashing algorithms are the same and the hardware required for different algorithms is so dynamic and non comparable. Therefore it is not fair to compare the hashrate of different currencies. It is possible to evaluate how the hashrate of a single currency develops over time.

Most cryptocurrencies use either SHA256 (such as Bitcoin) or Scrypt (such as Litecoin and Dogecoin). But new altcoins are coming out with completely different mining algorithms. Most notable examples are altcoins that implement Proof of Stake[39] and Ethereum [40].
We could possibly compare mining reward distribution (and thus pool distribution), because these are more normalized regardless of the implemented hashing algorithm. However that is beyond the scope of this thesis and not covered in the metrics in chapter 3.3.

3.4.2 Value measurement

When measuring trading volume of cryptocurrencies there needs to be a unit of value to which all different currencies can compare. For example we need a way to compare a market volume of 100 LTC in LTC/DOGE to a market volume of 200 BTC in BTC/DRK. This is possible since all currencies can be traded against Bitcoin. Crypto-coincharts.info compares markets based on total volume measured in Bitcoin. However it is preferable to have one unit of value we can use for all metrics.

The Bitcoin price is arguably one of the single most important metrics the platform has to offer (and it cannot be measured it against itself: one bitcoin is always one bitcoin). Because metric has very volatile tendencies it is hard to look at the value in Bitcoin measured over a time frame. In the example of the market volume of LTC/DOGE, when we see 100 Bitcoin for a specific time frame, is that measured in Bitcoin at that specific time frame? What if the price for either BTC/LTC or BTC/DOGE changed between now and that time frame? What if the Bitcoin price changed between now and that time frame? This problem persists in other metrics as well, such as a currency’s price.

If we look at other fiat currencies, we see that the US dollar is used as a benchmark against all other major currencies [41]. If we extend the dollar as a value benchmark for all cryptocurrencies, we eliminate the questions as to how the value is calculated. Another advantage is that a large part of the target audience is new to digital currencies, valuing currencies based on the dollar can help them gain a quicker understanding of the numbers they are dealing with.
Chapter 4

How can visualized quantitative cryptocurrency information help traders and journalists?

While we can’t provide traders with knowledge of future price directions, we can provide metrics that have correlated with or even driven Bitcoin’s price in the past (as we’ve seen in chapter 2.1). Because of the similarities Bitcoin shares with most altcoins, we can assume these metrics are not meaningless for altcoins. As the market for altcoins is growing [28], we can expect new research on the whole ecosystem.

This thesis will visualize market activity combined with current currency statistics to give a clear picture of the current state of the currencies and where the market thinks the currencies will be in the future.

In our research (see chapter 3), it became clear that both target groups used both published news articles and existing charting tools to try and gain an understanding in the informational gap. The quantified market data (like price and volume) used for these articles also came from charting tools. The majority of our target audience has worked with charting tools to study quantifiable metrics about cryptocurrencies before.

Working with numbers is hard, and it’s not in human nature to work with raw numbers. By visualizing the quantified data we can offer something that is understandable at a glance [42]:

"The problem is further compounded by the data’s continually changing nature, which can result from new information being added or older information continuously being refined. This deluge of data necessitates new software-based tools, and its complexity
How can visualized quantitative cryptocurrency information help traders and journalists?

requires extra consideration. Whenever we analyze data, our goal is to highlight its features in order of their importance, reveal patterns, and simultaneously show features that exist across multiple dimensions.”

By limiting the platform to displaying quantified information we can automate displaying the ever changing data. We also stay in an unbiased state no matter what the current economy looks like.
Chapter 5

Existing data visualization platforms for cryptocurrencies

Multiple tools already that show market data on multiple different economic properties. Most are either focused on raw currencies data, so called Blockchain explorers. Or they are focused on real time price developments for specific markets on specific exchanges, these are regarded as trading tools.

Hereby those tools are not able close the informational gap explained in chapter 2. There are some very limited tools that try to highlight the informational gap, but they are not able to provide satisfying answers for our specific target groups (found in chapter 3.1 and 3.2).

5.1 Metrics already visualized

Some platforms are already trying to fill the informational gap and have already created visualizations for them. However to address the problems for the target audience it is important to show all the metrics as described in chapter 3.3. The state of the economy is a combination of those metrics. There have been situations in the past where the importance of a single metric is of big importance.

5.1.1 Mining distribution

One practical example is the mining pool distribution. Under normal circumstances what mining pools are big is only of importance to miners. Transactions are processed
Existing data visualization platforms for cryptocurrencies

regardless of the amount of miners and an increase in mining activity has no effect on the amount of bitcoins entering the market nor does it effect anything else.

However, it is argued that the value of Bitcoin is made up by the trust users have in the system [43]. And that this trust is partly caused by the decentralized nature as opposed to a centralized currency like fiat. Eyal et al showed that the network consensus, which is based on the mining power being distributed, can be undermined if a single party controls a significant amount of hashing power. Thereby opening a number of attack vectors and endangering the trust in the network [44]. If a single party has a large portion of the mining power of a single currency, it is no longer decentralized and trust is shifted to that party.

In June 2014 the single mining pool GHash.io gained a large portion of all hashing rate in the network. This was public knowledge because the blockchain is open and everybody can inspect what miners mine how many transaction blocks. Blockchain.info provides a pie chart of the distribution of the mining power based on mined transaction blocks.

Figure 5.1 shows the distribution for different mining pools. It is widely considered dangerous when a pool has over 50% of the mining power [45], this opens up the possibility for a number of attacks on the network [44].

The Bitcoin community was watching as GHash.io approached the 51% number [46][47] until it did on June 14th [48][49]. The community was monitoring the hashing power by hourly checking the visualization by blockchain.info. This is not an efficient way at all. Bitcoiners were interested in the development over time to be able to determine risk. Even though the online community was recorded during the panic, it still is not possible to see how big the GHash.io threat was on that chart (how long did they have over a certain amount of mining power? For how long were they a major player in the space? How fast did the threat grow?). Therefor we see that while the pie chart is good for the current state of the market, it doesn’t offer anything beyond that scope. Which in this case didn’t provide answers the community was looking for.

This use case showed a clear information flow. The chart was inspected by the community. The community discussed concern and from here the story was picked up by media. It started with cryptocurrency media [50] and bubbled outwards to broader technology media companies [51]. Finally financial media reported on the story [52].

We can conclude that the even when the existing charts are of big importance when separated from other metrics, they can still be improved to offer a more clear picture.
When looking the same metric for different cryptocurrencies we see that the pie chart pattern is currently the only used way to visualize hashrate distributions for other currencies. See figure 5.2 and 5.3.

5.1.2 Market volume distribution

We notice similar trends when we look online for market distribution. BitcoinAverage.com is a site that offers a Bitcoin price based on the weighted average of all the top bitcoin to fiat markets.

They offer a table that again shows the current state of the market, see figure 5.4.

They do offer the raw underlying data in CSV format. This might be great for traders or researchers how want to work with the raw data. However most of our target groups are looking for a a general oversight at a glance.

The table only serves in that purpose for the exact current state based on the last 24 hours (differences or nuances in this time period cannot be shown at all).

Cryptocoincharts.info, one of the few websites that also cover other cryptocurrencies besides Bitcoin, has a bubble chart of the market volumes per different coin as depicted in ??.
Existing data visualization platforms for cryptocurrencies

Figure 5.1: Bitcoin’s mining distribution visualized
Figure 5.2: Litecoin’s mining distribution visualized

Figure 5.3: Dogecoin’s mining distribution visualized
Existing data visualization platforms for cryptocurrencies

Figure 5.4: Bitcoin’s price average by Bitcoinaverage.com
Chapter 6

Designing the prototype

During the design phase we were in close contact with the Bitcoin (and cryptocurrency) community as well the target audience. Through experimenting with different data visualizations and immediately gathering feedback we were able to see what visual communication appeared most successful. Using this constant feedback gathering process we went through multiple iterations and shifted directions. Details of the feedback gathering process can be found in attachment 3.

6.1 A too narrow view of the markets

In the first versions the prototype was heavily focused on trading volumes, as this is an important metric that is under lighted existing in current tools (see chapter 5). However multiple traders pointed out that relying to much on this metric would distort the image of the economic state the prototype is trying to give. It was also pointed out that it’s not possible to fairly measure different exchanges this way because of the different fee models exchanges use. The exchange Okcoin uses a zero fee model where trading is free. Because of this the volume on Okcoin is not comparable to most other exchanges where trading costs a fee.

6.2 Visually communicating complex statistics

When showing early versions of the prototype it became clear that even though cryptocurrency traders have in-depth knowledge of the math behind all metrics in the platform, there was still a lot of confusion on how to interpret the visual graphs. The
platform had jargon which acted helped in understanding the graph. However the jargon only confused the other target group, (non financial) journalists.

After testing multiple prototypes with the community and directly with the target audience it became clear that is infeasible to create one product that serves the full target audience as well as provide in-depth statistics.

6.3 A simpler platform

For this reason in the final versions the prototype shifted towards a small number of metrics with a small numbers of visual ways to interpret them. Most journalists where looking for some key statistics to put the space into perspective. Traders also already have some tools when they are in need of specific data. A platform with a small number of key metrics and clear visualizations gives the most insight to the target audience.

6.4 Time based metric visualizations

When displaying a metric on a time based chart there are multiple ways of showing different time intervals on different scales. We tested a line chart with a user selectable time range for the price metric of a currency. Multiple traders played with the time range to see how the metric behaved over time. But most journalists did not know what time intervals to select for a proper view of the metric.

To solve this issue we implemented the charts with controls for multiple fixed time intervals, the time period for these intervals is also fixed to the current time. After some testing the following time periods proved to be most easy to understand and provide the best view of the metric:

- The last 24 hours
- The last 7 days
- The last 30 days
- The last 12 months

Not all time periods are as useful in all metrics. For example, the hash distribution of Bitcoin has a lot of noise in the smallest period of 24 hours. But having different
time periods for different metrics proved to be confusing. Hash distributions for curren-
cies with a smaller block conformation like Litecoin don’t have this problem at a daily
timescale. Because of this reason, all time based visualizations in the prototype use
these periods.

We’ve seen that in almost all cases the preferred time scale is 30 days. The default time
scale will this be 30 days. The other time periods can be selected by the user.

6.5 The role of exchanges

The ultimate goal of the platform is to provide insight in the economical state of the
currencies, while only touching the different parts of the ecosystem as metrics. Though
the exchanges play a major role in the economical state. Besides its role as market and
thus price formation it’s also the place traders need to be familiar with. The exchange
landscape has also generated a big portion of the news because of the amount of money
involved and the clash with the regulators. Finally the exchanges are also places that
anchor the abstract and fully digital world to real people and familiar fiat currencies like
the dollar and the euro.

For this reason exchanges still play a big role in the prototype.

6.6 Exchange types

As explained in chapter 1.2.4, there are two types of exchanges. Exchanges that support
trading cryptocurrencies to fiat currencies and exchanges that only support cryptocurrencies.
The difference is big because of the required licensing and regulation the first
type needs to apply by. With pure cryptocurrency exchanges we also see that all cur-
currencies are valued against Bitcoin. When the Bitcoin price moves (against the dollar for
example) all other cryptocurrencies move along, without anything happening in these
markets.

The first prototype differentiated between the two types in the interface. It also had
comparisons to see the sizes relative to each other. However all journalists we interviewed
that did not have knowledge of the cryptocurrency exchange landscape had a hard time
understanding the difference. On top of that it complicated the interface a lot.

Because the difference is only important for traders interested in certain markets the
prototype now does not differentiate between the two anymore.
6.7 Cryptocurrency mining statistics

As discussed in chapter 1.2.1, the mining part of the ecosystem is one of the network fundamentals. Without miners no transactions would ever be validated and cryptocurrencies would not be possible in their current form. There are multiple important statistics on mining. They have to do with the currency generation and currency health. But the story is technical and only a few metrics are important for gaining an understanding of the development.

In earlier versions we had three different charts:

- A line chart showing the Bitcoin difficulty
- A line chart showing the total hashing power of the network
- A stacked graph that shows the distribution of mined blocks among the mining pools

The first chart was excessive as it did not hold any useful information for both target groups. It is only important for miners.

Interviews with journalists showed that both the second and third chart did not answer relevant questions the journalists were facing. They were interested in the distribution among pools. But they wanted to know the hashrates of these pools instead of the mined blocks.

Therefore the first and second chart were removed, the third one now compares the estimated hashrate of the mining pools.
Chapter 7

Visual solutions

This chapter will discuss different visual solutions for the metrics described in chapter 3. These solutions were the results of the design phase described in chapter 6. All solutions are implemented in the working prototype.

7.1 Current state elements

The platform shows a small number of metrics for currencies and exchanges. As described in chapter 6.3, it is important to show how these metrics developed over time. In the platform this development is regarded as the most detailed view of the metric. When giving an overview of multiple metrics, the platform uses current state elements for two reasons:

- The current state element act as a link to the detailed view of the metric. Hereby creating a deeply nested view for the detailed developments of a single metric.

- The current state element gives the most recent state of the metric. It offers the metric at a glance. This is for when a journalist or trader is aware of how the metric developed in the past and is only interested in the present state.

Figure 7.1 shows an implementation.

- The block has a title stating the metric.

- It has the current state. In this case it shows that the current price for the currency this metric belongs to is $583.
• It has an arrow indicating the whether this current state is above or below the state from 30 days ago. As discussed in chapter 6.3, 30 days is the default time scale.

• It has a minimal chart showing the development of the metric over the last 30 days.

The user can hover over the arrow to read a detailed description, see figure 7.2. The user can also hover over the chart to read a detailed description, see figure 7.3.

When the user hovers over the block the opacity of the block is animated to 80% to communicate it is a click able element, see figure 7.4.

**Color usage**

When listing multiple metrics they all have a different color to clearly differentiate the different statistics, see figure 7.5.
7.2 Time based visualization

A time based visualization is used for the detailed view of a metric as well as for the top lists described in chapter 7.3.

7.2.1 Time based controls

Chapter 6.3 discussed the time scales our users are interested in. When presenting the detailed view of a metric the user needs to be able to change the timescale. These controls allow the user to do this, while also showing what timescale is currently active. The implementation is shown in figure 7.6.

The controls are labeled as:

- 1D for a single day of data (24 hours)
- 1W for a single week of data (7 days)
7.2 Time based controls

• 1M for a single month of data (30 days)
• 1Y for a single year of data (12 months)

When the a detailed page loads the 1M button is active. This is because the 30 days is the default time scale as discussed in chapter 6.3.

After clicking the 1D button the view will change to reflect the new timescale and the controls will update to the image below, see figure 7.7.

7.2.2 Comparison or distribution

As discussed in chapter 3.4, the distribution of metrics is important in understanding the metric. For trade volume, mining distribution and currency comparison we not only need to show the metric developing over time. But also how it is distributed. The ideal case would be to visualize the metric for different parts over the same historical time frame. For example when looking at trade volume per exchange, the ideal chart would not only show how a single exchange volume evolved over time. But also how that development compared to the development in trade volume of other exchanges. This way different patterns and information can be extracted from the same chart:

• Exchange X grew in trading volume compared to all other exchanges.
• Exchange Y grew at the same rate as all other exchanges.
• All exchanges grew, except for exchange Z.
• Whenever we see a lot of volume in exchange X, we see a drop in volume at exchange Y.
• What does the total volume of all exchanges look like?
• At point X, what was the exact distribution of exchanges?

The stacked graph chart is able to visualize these metrics in such a way, see figure 7.8.

"The main idea behind a stacked graph follows Tufte’s macro/micro principle: the twin goals are to show many individual time series, while also conveying their sum. Since the
Figure 7.8: A stacked graph chart

*heights of the individual layers add up to the height of the overall graph, it is possible to satisfy both goals at once."

El Byron *et al* [54]

The stacked graph will be used to offer the following comparisons:

- Exchange volume distribution
- Currency market capitalization comparison
- Currency mining distribution
An implementation is shown in figure 7.8.

The left side holds the stacked area chart. On the right a legend shows which color represents what market and what their total share was over the full time period (in both the value and in percentages compared to the others for that time period).

**Interactivity**

To be able to provide more exact information on specific time intervals it is possible to hover over those time slots, see figure 7.9.

Finally it is possible to show the connection between the legend and the area as well as look more detailed at one specific area. A user can do this by hovering over a legend item, see figure 7.10.
7.2.3 Individual metrics

Most metrics are not compared or do not have a distribution. In these cases we use an area chart to visualize its development over time in the detailed view, see figure 7.11.

The chart is designed with simplicity and readability in mind.

Interactivity

A user can hover over the chart to get detailed information about a specific point in time, see figure 7.12.

The area chart will be used for:

- Currency price (in dollars)
- Currency volatility (in percentage)
7.3 Top lists

To compare the biggest exchanges and currencies in the landscape we use the top list element. It lists the eight biggest currencies and exchanges, see figure 7.13.

The left side holds a table with the top eight exchanges. The metrics for each exchange are present in the table.

- Currency transaction volume (in dollars)
- Currency transaction amount (in transactions)
- Exchange trade volume (in dollars)
- Exchange trade amount (in trades)
The right side holds a donut chart that shows a comparison of trading volume across the exchanges. The table on the right also serves as a legend for the donut chart. The names of the exchanges inside the table are links to views about that specific exchange.

**Interactivity**

When a user hovers over the table, the row gets highlighted as well as the arc of the donut chart corresponding with the hovered exchange. Finally the donut chart displays the name of the hovered exchange. See figure 7.14.

The list is used for:

- Top eight currencies
- Top eight exchanges
- 1M for a single month of data (30 days)
- 1Y for a single year of data (12 months)
Chapter 8

The user interface

We propose a platform that solves the informational gap. We created a web based prototype that implements the proposal.

8.1 Limitations in the prototype

The prototype is limited in a two ways that differentiate it from the actual platform.

Mobile interface

Our research pointed out that most users are interested in the development while they are on a laptop or desktop with a lot of screen estate. For this reason we limited the prototype to devices with a screen width of 992 pixels or bigger. This shortened the development cycles during the design phase (described in chapter 6). When fully developing the real platform we propose to create interfaces for all screen sizes.

A side effect of this decision is that almost all interactivity is based around mouse hovering, something that is not possible on most mobile devices that are based around gestures. The prototype is tested and fully functional on an iPad (in landscape orientation), however not all hover interactivity effects can be triggered.

Dummy data

The main goal of this reason was to study the informational gap and to design a solution that helps the target audience. This was accomplished with generated dummy data (details of the generation can be found in chapters 9).
The user interface

Figure 8.1: Sitemap of the platform

8.2 The views

The prototype is a small website based around the visual elements described in chapter 7. The Home, Lab and API views explain some context and show similar data visualization projects.

The currencies and exchanges pages feature top lists and how the ranking metric (trading volume for exchanges and market cap for currencies) developed over time.

8.3 Example views

- Figure 8.2 shows the top part of the exchanges page.
- Figure 8.3 shows a currency page (for Bitcoin)
- Figure 8.4 shows a currency detail page (for Bitcoin’s transaction volume)
The user interface

Figure 8.2: The exchanges page

Figure 8.3: A currency page
Figure 8.4: A currency detail page
Chapter 9

Technical implementation

As shown in chapter 8, the prototype goes well beyond a minimal prototype for testing whether the informational gap has been solved or not. It is a an almost complete implementation of the suggested platform. The prototype can directly be used as a front end for the full platform (while noting some limitations described in chapter 8.1).

9.1 Technical implementation of the prototype

This chapter describes the prototype, what techniques are used and the technical choices made.

9.1.1 Deciding on the front end framework

There are multiple front end frameworks available. When we chose the framework we looked at a couple of factors:

- Front end community
- Extensions that simplify creating a data visualization platform
- Speed and file size

Composition versus inheritance

Composition versus inheritance is a widely debated topic amongst programmers [55]. In a front end framework context this is not about the abstract creation of classes (a concept that does not exist in Javascript), but about the creation of views or view elements.
Libraries like Backbonejs favor a inheritance model where you build objects that inherit from other objects or base objects provided by the library. Because those projects only offer methods you use throughout your application they are called libraries instead of frameworks.

Polymorphing in these libraries is considered bad practise, while this is something the prototype desperately needs. For example to inject either a comparison table described in chapter 7.2.2 or an area table as described in chapter 7.2.3 into the detail view, based on the specific metric. It would require either complex views or complex templating to achieve this without polymorphing. Something that comes natural to frameworks that favor composition.

Composing also simplifies the reuse of modules a lot. AngularJS implements a module system called directives that achieves the same thing as web components in the HTML5 draft. This way all views can be built up by adding a few modules and passing them the right data.

**File size**

AngularJS is also the favorite choice when it comes to file size. While the framework is not that small on itself, it does not require the big library jQuery. Because most DOM manipulation happen inside graphs (which jQuery cannot generate), we don’t have any need for this library anyway.

**Link to data visualizations**

The are a lot of resources for writing dynamic visualizations using AngularJS together with d3 [56]. The best practise is to wrap them in angular directives. This in turn fits really well into the composition required by our prototype.

**Angular templates versus precompiled templates**

One of the disadvantages of using AngularJS is that you are forced to use their templating system. This compared to libraries like backbone that only help with the business logic. While this does not have to be a problem, large projects with a lot of views cannot precompile those views to speed up the initialization [57]. However the prototype did never reach the size where this became noticeable. And if the real platform does, AngularJS has a couple of ways of dealing with this (like lazy loading) [58].

**Frameworks used**

Because of these reasons, the prototype is written in AngularJS. On top of that the following frameworks were used:
• Jade - for writing all markup

• Angular-ui-router - for state management

• Twitter Bootstrap - as a markup library

• Angular-ui-bootstrap - for connecting bootstrap with AngularJS

• Angular-google-analytics - for connecting the application to Google Analytics.

• d3 - for creating dynamic visualizations

• Moment.js - for date parsing and printing

9.1.2 Application design of the prototype

When writing an application in AngularJS, the view layer becomes the place where you create your interface based on a composition of directives. The prototype knows two directive name spaces. These hold all directives in the prototype.

• WZB.elements - all interface elements
  – heroBlock - the current metric state, see chapter 7.1
  – totalTop - the top list, see chapter 7.3
  – daterangeSelector - the time based controls, see chapter 7.2.1

• WZB.d3.charts - all dynamic visualizations
  – lineChart - the area chart, see chapter 7.2.3
  – volumeComparison - the comparison chart, see chapter 7.2.2
  – thumbLine - the line chart in the current metric state, see chapter 7.1

Each directive has its own application logic required for spawning the directive (unless it uses other directives for a specific purpose). The thumbLine directive holds all the d3 code required to draw a dynamic area chart inside the hero block.

All views are composed of those directives. For example the exchange detail view (in Jade):

```
script(type='text/ng-template', id='/market-detail.html')
    ul.pager.col-md-8
        li.previous
```
The views are directed by the state manager as provided by angular-ui-router. States are defined like so:

```javascript
app.state('home', {
    title: 'Home',
    url: '/','
    templateUrl: '/home.html'
})
```

These states also hold all logic related to fetching data from an external source and transforming it so all directives can consume the data easily.

### 9.1.3 Model logic

Even though the prototype uses dummy data, the data is still fetched externally (from a number of JSON files representing REST API calls). As far as the prototype is concerned, it is working with real data coming from a back end API.

It expects the following paths to return JSON data:

- `/json/currencies.json`: limited exchange data used to draw the currencies page as well as the individual currency pages.
- `/json/currency_currency_detail.json`: all data to draw a currency’s detailed view of a metric (for all supported timescales).
- `/json/markets.json`: limited exchange data used to draw the exchanges page as well as the individual exchange pages.
- `/json/market_exchange_detail.json`: all data to draw an exchange’s detailed view of a metric (for all supported timescales).

JSON files with dummy data for all possible calls are included in the prototype.
9.2 Technical suggestions for the back end

The prototype does not have a back end. Here we do list some general suggestions towards implementing a back end. Note that these suggestions do not take external factors into account like expertise of the developers and the production environment.

9.2.1 Back end application design

Generally speaking, the back end will consist of four parts:

1. A database layer, responsible for persisting all data.
2. A fetching layer, responsible for connecting to all cryptocurrency exchanges and blockchain providers to aggregate all required data.
3. A computation layer, responsible for calculating the metrics based on raw data from the database layer and storing them resulting them in an easy to access memory store.
4. An API layer, responsible for delivering the calculated statistics to the front end.

There are multiple ways for these different layers to communicate. We recommend a messaging library like zeroMQ or redis pub/sub because it opens up a lot of possibilities:

- Clean API design and separation of concerns.
- Possibility of growing past a single server into a cluster.
- Performance measure.

9.2.2 Database layer

Since all data (computed and raw) is fully structured, most NoSQL solutions do not make a lot of sense. As the ability to mutate data on the fly is not of any importance. Whether transactions are necessary is a discussion we will leave for the implementing developing team. Whatever the result, we feel that PostgreSQL is the best solution as:

- It supports sharding.
- Is well maintained.
- Runs on a large variety of platforms.
- Has consistent performance for both reads and writes.
9.2.3 Fetching layer

This layer has to deal with huge amounts of raw data and a lot of I/O. Nodejs and Golang are languages that shine in these situations. Though Nodejs might not be an option as Javascript can only deal with floating point numbers. A non precise way of dealing with numbers [59]. Golang doesn’t have this problem but is severely lacking in modules [60]. For this reason python might also be a good option, as it is favored by academics across the globe who work with math [61].

We recommend either Golang or Python, depending on the familiarity by the developers implementing the platform.

9.2.4 Computation layer

This layer needs to process and compute huge amounts of data as cheaply as possible. A compiled language like Golang or C would perform best here. Both languages have a lot of possibilities to store the resulting statistics into a memory store like Redis or Memcache.

9.2.5 API layer

There are two types of solutions possible here. Generate static JSON files on a set interval, which can be served over a CDN or a normal web server. Or create a normal API which retrieves data from the memory store and serve it to requesting clients. Which is favorable depends on the amount of traffic and production environment of the platform. In either case, we recommend using Nodejs to achieve this.
Chapter 10

The prototype

The prototype can be accessed on the following hyperlink:

http://thesis-prototype.wizb.it

This is the fixed version that came out of the design phase (chapter 6). It uses visual elements as described in chapter 7 and the interface described in chapter 8.

When gathering feedback a beta platform was used with a different hyperlink. But because we can’t guarantee that this beta platform will stay in its current state we created this URL specifically for the thesis.

Additionally, all website files can be downloaded on the following hyperlink:

http://thesis-prototype.wizb.it/prototype.zip

This zip file also includes the build script used to generate the website (build.js) and the functions needed to generate the dummy data (serv.js).
Chapter 11

Validating the prototype

In chapter 2 and 3 we described an informational need for macroeconomics of the cryptocurrency ecosystem for traders and journalists. In chapter 5 we saw that existing tools were unable to provide in that need. In chapter 4, 6 and 7 we proposed a new platform that should provide in this need and in this chapter we verify whether this is the case.

11.1 Test plan

Final tests will be performed with both target groups in order to determine whether the prototype is able to solve the informational gap. Even though we examined a slight difference in need for both target groups (see chapter 3.1 and chapter 3.2), there is enough overlap to create a unified test that covers the needs of both groups.

The tests will take place together with the target groups. Journalists and traders will get access to the web based prototype via a laptop. They are asked to use to the platform to find out certain information. This way we verify a few different points:

- The prototype is functioning up to a level where the target group can use it.
- The audience understands the interface.
- The audience is able to interact and navigate the interface to uncover needed information.
- The audience is able to read the visualizations that are in the platform.
All questions the users are asked to perform are based on informational needs that exist in the target groups. These needs were established using interviews, desk research and scientific research (see chapter 2 and 3). The questions are divided into two use cases, one for each target group.

In both use cases we ask the users to think aloud when going through the use cases. We explain that we are testing the platform and study their behaviour using it in order to verify the prototype (and not the user).

For use case 2 we added the non existing exchange CoinTrader to the prototype, specifically for test purposes. The test results are documented in Appendix D.

11.1.1 Use case 1: Finding a crypto investment vehicle

Imagine you are a trader and you want to invest in one of the least risky cryptocurrencies. Use the following points to determine your market position (existing of a single long position in one currency):

1. What cryptocurrencies have a big market cap?
2. What cryptocurrencies are being used the most (based on transaction volume)?
3. What cryptocurrencies are being traded the most (based on trading volume)?
4. What cryptocurrency have a healthy mining ecosystem?

11.1.2 Use case 2: Reporting an exchange shutdown

Imagine that you are a journalist watching the cryptocurrency space. One day the (fictional) pure cryptocurrency exchange CoinTrader goes down and it appears they ran off with everyone’s money. You have to cover the story. Besides the facts around the disappearance you also need to have information about the role of the exchange in the whole space. Answer the following questions using the prototype to gather information:

1. How much money (in USD) went through the exchange on a daily basis?
2. How big was CoinTrader (based on trading volume) compared to all other exchanges?
3. What cryptocurrency was impacted the most (based on trading volume of that cryptocurrency)?
4. Did anything significant happen to that currency after the news came out?

5. Did anything special happen in the markets once the information came out?

11.2 Feedback from the cryptocurrency community

We requested feedback from the cryptocurrency community (consisting of traders, journalists and other enthusiasts). This way we were able to gather feedback through online comments (see Appendix C), a survey (see Appendix D) and web traffic analysis (see Appendix E).

We requested feedback through the following online community platforms.

- The BitcoinMarkets subreddit: http://www.reddit.com/r/BitcoinMarkets/comments/2dfwro/developing_a_new_visualization_platform_for/
- The Bitcoin subreddit: http://www.reddit.com/r/Bitcoin/comments/2dfpr3/developing_a_new_visualization_platform_for/
Chapter 12

Conclusion

In chapter 2.4 we defined the research question as:

How can interactive media visualize quantitative information about the economic development of cryptocurrencies over time to traders and journalists?

Chapter 2 and 3 established what economical properties of cryptocurrencies are needed to understand the economical development. Chapter 3 also defined from what perspectives those properties need to be viewed so that traders and journalists can work most efficiently with them. Chapter 4, 6, 7 and 8 proposed a platform that visualizes those key properties in a web based platform.

We implemented our solution in a prototype as described in chapter 8 and 9 and used the two methods described in chapter 11 to validate that:

- the economical properties and perspectives gave insight to the economical state of the currencies (See Appendix A, B, C and F).
- the target audience was able to navigate the interface and read all visualizations (See Appendix D).
- our prototype offers new insights previously unreachable for our target audience (See Appendix A, B, C and F).

12.1 Interest in the full platform

All people we talked to were very positive on the prototype and want the real platform to be actually build. During the design phase (see chapter 6) and the final test phases
we gathered email addresses from the target audience and the broader cryptocurrency community. 296 people left there email addresses and are interested in the real platform (see figure 12.1).

12.2 Discussion

While our tests show that the target audience is very satisfied with our proposed solution and the prototype thus far. The design phase showed some areas of the research that can be explored further.

12.2.1 Exploring forming markets

The cryptocurrency landscape is extremely young and fluid. When we started this research, Mt. Gox was the biggest and most solid exchange out there. During the final phases of the research Mt. Gox was remembered by some as a tragic event that happened a long time ago.

If we look at the altcoin space we also see a lot of developments that did not exist when we started this research. It will be interesting to see what effects new projects like Maidsafe and Ethereum will have on the ecosystem, they have a chance to change the way we look at these currencies.

Our research is solely based on approaching these projects as currencies, the currently biggest use case by far. However how this will develop over time has yet to be determined. But even from a economical perspective: markets are changing rapidly as more traders enter the field, the economical properties we found might not stay relevant for long.

As a result of this, a huge amount of new research is being published on a weekly basis, while old research is dating very quickly. Correlations that were statistically significant in the past become unpredictable in a matter of months.

12.2.2 A more segmented target audience

During our research we talked to a number of traders. We were surprised by the extreme differences between some. Most notably between day traders and analysts. Even in cases where they shared a history of commodities they both had traded in. They had extremely different views of what caused markets to move and what metrics were truly important.
In future research on traders on the cryptocurrency space, we suggest to segment the traders into multiple groups instead of generalizing them.
Figure 12.1: Gathered email addresses of people interested in our solution
Appendix A

Interviews with journalists

Tim Swanson

Tim have written multiple publications in the past, focussing on both Bitcoin and the Chinese economy. He wrote a book on the latter[62]. His writings have appeared in some cryptocurrency specific news blogs as well as on the big financial blog Business Insider [63].

Tim is interested in the growth of the Bitcoin currency. He is mainly looking for transaction data in the blockchain (off markets), like transaction volume, transaction amount and type of transactions.

He notes that there are already a lot of good tools for market activity focused on the price, but that serves a different target group. He also said that one of the most interesting metrics would be identifying for what purposes a currency is being used, however the complexity that comes with the blockchain analysis required to create these metrics is beyond the scope of this thesis.

[Redacted]

[Redacted] is a news reporter for [redacted]. She researches Bitcoin and covers it on the technology section of [redacted]. She is aware of the altcoin markets, but due the small size compared to Bitcoin has not done any extended research or news coverage yet.

In the past she have written a number of articles on the following topics: Merchant adoption in the Netherlands (focussing on physical merchants as opposed to online merchants), the fall of Mt. Gox, the Chinese Bitcoin rush, the closure of Silk Road, the Cyprus Bubble and Bitcoin as an innovation. Even though most articles were not about the economic properties of the currency, they were mentioned in every article.
Though she is planning on writing an article introducing the altcoin currencies. First focussing on fundamental differences between Bitcoin and a few big altcoins, but also looking at market activities of altcoins.

[Redacted] is extremely interested in a platform that shows comparisons between currency usage and market activity between different coins. She was initially thinking about limiting comparisons to market capitalizations as there are multiple tools that provide that insight, but if she would have access to more metrics in an accessible form she would consider leveraging those.

She stressed that whenever an big event in the space happens, she has limited time to write the article. Whereas for normal news coverage she has more time for research.
Appendix B

Interviews with Traders

[Redacted]

[Redacted] is a portfolio manager at [redacted]. He did research on the role Bitcoin can play for bigger traditional investors. For his research he combined publicly available information on both the currency (to see how it’s being used right now) and market information. Even he found extremely exciting price developments, the big volatility and regulatory uncertainty caused him to stay cautious for a while [x]. Though he is still keeping an eye out on how these metrics develop over time as he expects the market to grow and liquidity to increase. [Redacted] said that with his background in statistics and economics he normally calculates these metrics himself, though he is very interested in a platform that provides those numbers in real time. The altcoin markets are in a to early stage for big traditional investors, though once they get bigger the historical numbers are important.

[Redacted]

[Redacted] is a daytrader. He is trading currencies for over 4 years now on FOREX markets, though he became interested in cryptocurrencies a little over a year ago. [Redacted] is now investing a small part of his portfolio into these digital currencies. He has a blog where he shares his thoughts on market developments [x].

As most of his investments are short term, he is mostly interested in the market activity. He is spending a lot of time figuring out currencies that appear to be interesting by watching the developments, communities and market data. He thinks that a platform that provides a clear view of the whole ecosystem would help him in better understanding developments and picking potential currencies to invest in.

After [redacted] has a good understanding of macro patterns in the market he uses advanced trading tools to dive into specific market microstructures. He uses the online
platform bitcoinwisdom.com to see the candle chart of past trade history, the price formation and the market depth to see current offerings that might determine future price directions.

[Redacted] specifically noted that he needs have clarity on all markets having a direct effect on the specific market he likes to trade in. If he is interested in BTC/DOGE on the exchange Cryptsy he needs to know how big that market is on other exchanges (such as Kraken, Bittrex and Mintpal) as they are heavily correlated because of arbitrage. But also surrounding markets that can be triangulated like LTC/DOGE and BTC/LTC play a role, though this all depends on the different market sizes.
Appendix C

Qualitative feedback during the design phase

---

Trying to provide insight in market volumes

I'm currently doing research at my university about the financial markets of cryptocurrencies. As part of that research I am building a web platform that provides insights (charts, etc) in the sizes of all crypto related markets and how they develop over time.

I aim to build something that can quickly answer questions (I see all the time):

- Is china leading a trend?
- How much money goes into Dogecoin / darkcoin / etc?
- What is the biggest exchange?

So I do not intend to build a trading platform that can be used for trading itself. I've made a small mockup of such an interface:

http://wiz.b.it/beta/volumes/0/

- Could you let me know what you think of such a platform?
- Am I comparing the right metrics?
- How big is the distinction between fiat related (USD/BTC for example) and pure crypto markets (BTC/LTC for example)?
- What knowledge would you like such a platform to provide?

Thanks guys, with your help I can build something awesome for the community.

---

P.S. I am the guy behind the Realtime Bitcoin Globe and I've written an open source tradebot called Gekko about a year ago.
Qualitative feedback during the design phase

You do not need to be Chinese, or even in China, to trade on a Chinese exchange. In fact, this is true for every exchange. The only people with any clue as to where money is coming from and going to are the exchanges themselves, and they probably won’t ever publish this data unless forced to.

I am not trying to get a 100% perfect view of exactly where the money is coming from. However, if you are trading on an Chinese exchange that only lets you withdraw in CNY and has a mostly Chinese interface, I think it’s safe to say you are participating in the Chinese market. In your scenario: where would you draw the line for the “Chinese”? Everyone inside country borders, or anyone with a Chinese nationality? I don’t think there is one simple answer for this.

Think of it as a platform like a leak that can be used to gain a better understanding of market behaviour (traders) or what is happening in bitcoinland (outsiders, news reporters, etc).

The problem with Chinese markets is that they use a 0 fee structure for their exchanges, and this allows HFT trading and all kinds of bots to inflate the volume higher than you would expect to see on other exchanges that have even small or nominal fees. At this point, this gives them a higher sway in the market than I would otherwise like to give them - though their chart patterns are very pretty because there isn’t much spread.

Good point, though even if you can trade without fees you are still exposing your funds to risks. But I do agree with you that it might not be a fair comparison. Also I think that bigger players on exchanges like Bitstamp also don’t pay the fees according to the fee structures and it’s really hard to get some concrete facts / numbers on this.

Not sure how to deal with these differences (besides putting a note in some text somewhere) yet.
Qualitative feedback during the design phase

[-] coincoaster 2 points 2 months ago

How much money goes into Dogecoin / dashcoin / etc? What is the biggest exchange?

How exactly are you planning to measure this?

permalink save report give gold reply

[+] askmike [8] 1 point 2 months ago

The idea is that my platform aggregates the exchanges data (via their APIs), similar to bitcoincharts.com. Though I want to focus more on specific volume related information so that I can provide those answers quickly in a chart.

EDIT: By how much money goes into X I am talking about the traded volume sizes on all big exchanges.

permalink save parent edit delete reply

[-] coincoaster 1 point 2 months ago

Volume is really bad indicator for that. I would not go in that direction.

permalink save parent report give gold reply

[+] askmike [8] 1 point 2 months ago

I agree that you shouldn’t rely on just volume, though combing this indicator with other metrics might create a clear picture of the whole markets.

But as a practical example I am currently curious to see the impact of DPK, besides just looking at the price, marketcap (this one is pretty bad ime, but widely used) or marketdepth.

I think that a lot of news reports that cover these topics are not even based on these metrics at all.

permalink save parent edit delete reply

.offset.1 DEVELOPING A NEW VISUALIZATION PLATFORM FOR CRYPTOCURRENCIES: I NEED YOUR FEEDBACK!

Submitted 4 days ago by askmike

(I posted this in the daily thread yesterday. It had some upvotes but I didn’t reach the amount of people I was hoping for)

As part of my thesis on visualizing the development of cryptocurrencies I need your feedback on the prototype of the webbased datavisualization platform I am building.

The platform

http://beta.wzb.it/

The site has statistics and charts that show the landscape on a macro scale. It is intended as a starting point for understanding the size of the cryptocurrency landscape. Therefore I focused on simple charts with understandable metrics.

It is focused on currencies and exchanges. Here are some examples:

- Currencies page (the 8 top currencies)
- Currency page (the 6 most important metrics for a single currency)
- Currency page (how a certain metric is developing over time)
- Exchange page (the 3 most important metrics for a single exchange)

Feedback

It would be mega awesome if you could fill this short survey or just comment any feedback you might have!

all 17 comments

sorted by: hot ▼ disable inbox replies (?)
Qualitative feedback during the design phase

One of the most important, if not the most important metric for a currency in general (not just cryptocurrencies) is market depth, or liquidity: how many dollars/euros worth of the currency can I buy/sell while only moving the price x%?

I would argue this is the most important metric for any currency, because that is what separates money/currency from all other goods: liquidity. Historical liquidity would be especially interesting.

---

[-] runks 1 point 3 days ago

- **Currency page** (the 6 most important metrics for a single currency)

One of the most important, if not the most important metric for a currency in general (not just cryptocurrencies) is market depth, or liquidity: how many dollars/euros worth of the currency can I buy/sell while only moving the price x%?

I would argue this is the most important metric for any currency, because that is what separates money/currency from all other goods: liquidity. Historical liquidity would be especially interesting.

permalink save report give gold reply

[-] askmike [8] 2 points 3 days ago

You are making a very good point.

I liked the fact that for most metrics I could quickly display it as a single number (with a detailed graph behind it), but I think this would be hard for market depth right? Also it's hard to visualize market depth development over time, you would basically have to stick with certain points in time right?

permalink save parent edit delete reply

[-] runks 1 point 3 days ago

If you want a single number you can calculate slippage, in percent, when selling/buying eg, $1M USD worth of cryptocurrency. Slippage is basically how much you move the price with a trade.

This figure can be calculated regularly, and you can plot it over time.

permalink save parent report give gold reply

[-] askmike [5] 2 points 3 days ago

Yes I could do this, I could even do it both ways (buying $1M worth of coin and selling $1M worth of coin).

I was under the impression that slippage means the difference in money between the price you ordered for and the price you got (because you had to walk the book): meaning it is a cost that comes with trading (just like fees) for traders. I don't know it in this context yet.
Qualitative feedback during the design phase

Yes, you would need one unified order book. Though it’s hard to do since the total order book would likely be crossed due to prices being a little different on each venue (though you could probably calculate an estimate slippage through it).

I think I really need a metric to show market depth. But the current design is focused on the state of the economy at a glance. This information is useful for everyone trying to grasp the economy/market size and how this develops. For that reason I don’t even differentiate between kinds of exchange (pure crypto or fiat-crypto).

Market depth is a complex topic: you can calculate one for a market (say BTC:USD) on 1 exchange (say Bitstamp), or combine the same market on all exchanges. But you can’t really convert this to the “market depth” of a currency. So it’s hard to extract knowledge out of this since it’s really market specific.

The other problems with market depth is that it can provide a false image of liquidity: walls are pulled all the time to try and manipulate the markets. It is very hard to try and split the orders into real orders and ones that are going to be pulled long before the price would ever reach them.

I do already have the metric “volatility”, which of course is not the same. But on a historical perspective the market depth would have showed you how easy it was to move the price, the volatility shows how fast it did move.

Market depth is an extremely valuable market metric and someone needs to create something for it. I am just not sure how this would fit into my prototype at the moment.

Should there be x- and y-axis in the charts (total market cap, daily transaction volume, daily transactions)? Units/labels etc...

Ah good point, I changed the time intervals recently and didn’t add the new labels yet.
Qualitative feedback during the design phase

[-] iamAlso_u_gravity 1 point 4 days ago

This should also be posted in the general discussion area on https://bitcointalk.org for extra visibility.

If you don't yet have an account there, you'll be restricted to the 'newbie' board. If that's the case, I'd be happy to post it for you but I don't have the energy to help you with it today. Perhaps someone else reading this thread could get that done today. If that fails, let me know in the day if you want to get that done pending any changes to it you like to make.

(adding some gold for visibility)

permalink save report give gold reply

[-] askMike [S] 2 points 4 days ago

That's mega awesome, thanks!

I used to be more active at btctalk. I just posted it under my old account.

I can't wait to get the platform up with real data :)

permalink save parent edit delete reply

[-] iamAlso_u_gravity 1 point 4 days ago

You're no newb. Great avatar too.

You're very welcome, btw.

permalink save parent report give gold reply

[-] askMike [S] 2 points 3 days ago

Haah, I've been around for a while :D

Thanks a bunch, let's hope more people find the idea/prototype as awesome as you do!

permalink save parent edit delete reply

[-] Taylorvongrela 2 points 4 days ago

I was going to say that your color choices on the graphs were poorly chosen because they only range from yellow to dark orange, which is really difficult for the eye to discern. Then I noticed that you could actually hover over the the list of the data points and it highlights the pertinent section of the charts, so the colors are less important. I like that chart functionality, but without it the colors would be tough to discern.

permalink save report give gold reply

[-] askMike [S] 1 point 4 days ago

Thanks for your feedback! Someone else also said something similar. This means that I will look at updating the color scheme for that chart (I am using different colors for other pages though). It should always be clearly readable.

permalink save parent edit delete reply

[-] Taylorvongrela 1 point 4 days ago

Yeah, the other pages colors were perfectly fine.

permalink save parent report give gold reply

[-] winterterm 1 point 4 days ago

Maybe you can make log scale on the bottom graph on the currencies page or something, so you can see more what's going on with the other top 7 currencies besides bitcoin just dominating everyone.

permalink save report give gold reply

[-] askMike [S] 2 points 3 days ago

Good point, will try to make this work!

I first tried removing Bitcoin, but you end up with a chart where Litecoin just dominates everything.

permalink save parent edit delete reply
Qualitative feedback during the design phase

[-] askmike 13 points 4 days ago

I hope I'm not spamming this subreddit too much with my requests for feedback.

I'm a student that loves to create cool datavisualizations. A while ago I created a realtime bitcoin 3d globe. But now I need your help for my thesis. I created a platform with charts about the crypto landscape. Like this chart that shows mining pool distribution over time.

I could use all feedback! Read all details here.

[permalink save edit delete reply]

[-] zeimersztoetro 1 point 3 days ago

Hi Mike! I love your globe! Is there any chance you'd be willing to share some source code for that or release it under a GNU General Public License? I'd love toinker with it.

[permalink save parent report give gold reply]

[-] askmike 2 points 3 days ago

Yes I will in the future (hopefully few weeks).

For now, it's based on https://github.com/datasets/webgl-globe

[permalink save parent edit delete reply]

[-] flat_sux 6 points 4 days ago

I love your 3d globe! One quibble: "Next block expected in one minute... Next block expected anytime now." That's not how it works. For random processes, it doesn't matter how much time has passed since the last block was found; the expected time till the next block is always the same!

This is a result of the fact that the expected probability of finding a block in the next x seconds is always the same, whether you just found one 2 seconds ago, or the last one was found 2 hours ago. In other words, random processes have no memory of how long it's been since the last event.

So basically, you take the average time between blocks 10 minutes, and divide by 2 (because you're averaging over your location within a typical 10 minute block interval, and this position ranges from 10 minutes to 0 minutes). So the expected time till the next block is found is always that: roughly 5 minutes, give or take depending on whether hash rate has gone up or down since last difficulty adjustment.

*Edited because I second guessed myself and then added more explanation.
Qualitative feedback during the design phase

No, expected is always 10 minutes unless the difficulty is going up, not 5 minutes. 10 minutes is the average, but it can be anywhere from 0-60+ (there is no upper limit) minutes.

bphase is right. Mathematically it will always be 10 minutes. I will remove this in the future. The reason it is there because the network still expects blocks in 10 minutes (and thus so does my project):

The process of creating blocks involves randomness which should make the 10 minute average. Though from a network point of view we are still expecting a new block in (around) 10 minutes, the network does not care about the block creation process being random or not.

No, bphase is wrong. See my reply above.

There's another way to think about it. Currently, you say the expected time is 10 minutes as soon as the last block happened, but then you constantly adjust that down until 0 minutes/"should happen any time now". But we know that's wrong because the process is random. To fix it, you need to kind of average your current guesses (6 minutes), not take the maximum of them (10 minutes).

There was a discussion on this point when I published the globe. The conclusion (by people better at math than I am) was that mathematically 10 minutes is correct, assuming the difficulty is mapped correctly to the hashrate. But for that:

The difficulty has not caught up with the constant new hardware yet in the past, this changes the reality of blocks, not the expectation of the network (which will always push the difficulty towards 10 min blocks, even if it failed last time).

Nope, it's 5 minutes. Think of it this way: Imagine the blocks occurred exactly every 10 minutes as soon as the clock hit xx:xx:00, but also imagine you don't know what time it is, and equivalently, how long it's been since the last block. What's your expected time till the next block happens? If you say 10 minutes, that means you think the last block just happened! In fact the time since the last block could range anywhere from 0 minutes to 10 minutes, with equal probability. So the time to the next block will be the same. The
Appendix D

Test results

Person 1

Name: -

Role in cryptocurrency: Day Trader

Years of cryptocurrencies: 1

USE CASE 1:

1. Bitcoin
2. Dogecoin, Litecoin
3. Bitcoin, NXT
4. Litecoin, Dogecoin

USE CASE 2:

1. $12M
2. 5%
3. Dogecoin
4. the price collapsed
5. the price collapsed
Person 2

Name: Satoshi Nakamoto

Role in cryptocurrency: Day Trader

Years of cryptocurrencies: 3

USE CASE 1:

1. BTC
2. BTC
3. BTC
4. Dogecoin

USE CASE 2:

1. 12 million
2. 5%
3. Dogecoin
4. volume through the roof
5. the price fell to 1 dollar

Person 3

Name: Peter N

Role in cryptocurrency: Hobby Trader

Years of cryptocurrencies: 0

USE CASE 1:

1. bitcoin
2. bitcoin
3. bitcoin
4. dogecoin
USE CASE 2:

1. $12 miljoen
2. 5%
3. dogecoin
4. de prijs zakte door de helft
5. de prijs zakte door de helft

Person 4

Name: Tim

Role in cryptocurrency: tech blogger

Years of cryptocurrencies: 1

USE CASE 1:

1. BTC
2. BTC
3. BTC
4. DOGE

USE CASE 2:

1. $12million
2. 5 %
3. DOGE
4. bubble bursted
5. the meme died

Person 5

Name: Naomi A–
Role in cryptocurrency: **financial reporter**

*Years of cryptocurrencies:* 2

**USE CASE 1:**

1. Bitcoin
2. Bitcoin
3. Bitcoin
4. Dogecoin

**USE CASE 2:**

1. 12 million dollar
2. 5%
3. Dogecoin
4. The price fell quickly to around $1
5. The price fell quickly to around $1
Appendix E

Web traffic analysis
Appendix F

Survey results

13 responses

Summary See complete responses

What is your role in crypto?

- trader: 5 (42%)
- enthusiast: 6 (50%)
- blogger: 1 (8%)
- reporter: 0 (0%)
- someone keeping an eye on the space: 5 (42%)
- Other: 3 (25%)

People may select more than one checkbox, so percentages may add up to more than 100%.

Do you own Bitcoins?

- yes: 10 (77%)
- no: 0 (0%)

See complete responses for more details.
**Survey results**

- **Are you interested in altcoins?**
  - yes: 6 (46%)
  - no: 1 (8%)
  - I'm keeping an eye out for interesting ones: 3 (23%)

- **Are you only interested in the bigger currencies?**
  - yes: 4 (31%)
  - no: 6 (46%)
  - Other: 3 (23%)

- **Do you own altcoins?**
  - yes: 6 (46%)
  - no: 4 (31%)
Survey results

Are you looking for macro scale statistics?
- yes: 10 (77%)
- no: 0 (0%)

Are you interested in the different exchanges?
- yes: 9 (69%)
- no: 1 (8%)

Are you only interested in the bigger exchanges?
- yes: 6 (46%)
- no: 3 (23%)
- Other: 4 (31%)
Survey results

Do you think the currency metrics of the platform provide a good picture of the currency's state?

- Yes [8] (62%)
- No [1] (8%)
- Other [4] (31%)

Are there any currency metrics you feel are clearly missing?
- “It would be nice to see a chart of the alcoins on their own. Comparing them to BTC makes them nearly invisible on the pie etc. charts. Also, total hash rate (as actual number) is missing, unless I just didn’t see it.”
- “Comparison dollar generation vs. BTC generation, dollar inflation vs. BTC inflation.” Not at this moment.

Do you think the exchange metrics of the platform provide a good picture of the market's state?

- Yes [6] (46%)
- No [2] (15%)
- Other [5] (38%)

Are there any exchange metrics you feel are clearly missing?
- “Ika kenda isajit!接受 Amount of shorts. Volume as an actual number, as well, your ribbon graphs provide a great visual, but perhaps on the tooltip you could have the total volume numbers written, just as you do for exchange market %s. Swap rates.” Not at this moment.
Survey results

Do you think the top 8 for both currencies and exchanges limit the view on the whole landscape?

- Yes: 5 (38%)
- No: 3 (23%)
- Other: 5 (38%)

Do you think the minimal charts provide a too narrow image of the visualized metric?

- Yes: 2 (15%)
- No: 6 (46%)
- Other: 5 (38%)

What do you think of the comparison graph?

- I like it: 7 (54%)
- I like the information but not the visual appearance: 1 (8%)
- I don't understand it at all: 1 (8%)
- I can't clearly read the data: 6 (46%)
- Other: 4 (31%)
Survey results

Are there any things you like to say about the platform?

[1] I like the more minimalist approach to providing big picture data, but would like to see just a little more information included. Or perhaps a drill down option.

[2] The most interesting graphs are hard to find on the site web.

On what devices do you like to see these kinds of charts?

- desktop (web): 6 (50%)
- laptop (web): 4 (33%)
- tablet (app): 4 (33%)
- smartphone (app): 2 (17%)
- everywhere (web): 3 (25%)
- Other: 2 (17%)

People may select more than one checkbox, so percentages may add up to more than 100%.

If the platform had live data, would you recommend it to a friend?

- yes: 6 (46%)
- no: 1 (8%)
- maybe: 2 (15%)
- Other: 4 (31%)

[1] [2] [4]
Bibliography


80


[61] H. Koepke. 10 reasons python rocks for research (and a few reasons it doesn’t), Jan 2010. URL http://www.stat.washington.edu/~hoytak/blog/whypython.html.
