December 2017

Bitcoin

Everything You Wish You Knew and More

By Alex Wallace

Forward

On April 26, 2014 I attended a Maker Faire in Lehigh Valley, Pennsylvania. Amidst the robots and 3D printers, one young nerd stood out from the crowd. At his booth he had commercial and home-made lasers, as well Bitcoin mining rigs (everything looked equally likely to burst into flames at any moment.) The Bitcoin mining rigs were working to process transactions in the hopes of receiving Bitcoins in return (more on this later.) The lasers were sitting on the table looking cool as all hell. It's no wonder that the Arctic Spyder 3 laser beat out Bitcoin for a spot on my Christmas list.

While I didn't leave with any Bitcoin or lasers, I left with $60 worth of 3D printer filament. If that $60 went into Bitcoin instead of plastic it would be worth $2018.65 today (December 10, 2017.)

Background

Emergence of Bitcoin and what it meant for the world

Currency has been used throughout history as a means of managing wealth. Currency allows people to keep track of wealth distribution and easily exchange wealth. Fiat money is subject to a host of flaws. In order to establish and retain value, a trusted central issuer (governments) must guarantee that the money is real. The value of the currency is subject to volatility due to the sociopolitical environment of the issuing government. Bitcoin is the first technology to emerge that establishes secure currency[1], automates secure transactions, and maintains a ledger of wealth. By establishing a distributed system in which users are able exchange and manage wealth without a third party, Bitcoin eliminates the inefficiencies, vulnerabilities, and corruption found within traditional financial systems.

In October of 2008 cryptocurrency[2] researcher Satoshi Nakamoto published a white paper titled "Bitcoin: A Peer-to-Peer electronic cash system" [1.] In this paper, Nakamoto details methodology[3] for electronically transferring money without going through a third party. Traditionally, transactions require an intermediary to establish security. In the absence of trust between parties, an accepted middle-man (financial institution) functions as transaction security. Nakamoto's novel solution establishes a method of maintaining a distributed receipt of all transactions processed. By creating an autonomous system capable of verifying, processing, and maintaining a ledger of wealth distribution, Nakamoto disrupted financial institutions. He revolutionized the way society can fundamentally exchange and manage wealth.

Shortly after releasing this paper, software was released allowing for the Bitcoin[4] currency to emerge. Immediately, value was created in three main ways [2]:

1. Untraceable transactions: Due to Bitcoin's complexity and anonymity, law enforcement was unable to utilize the data available in the blockchain to trace transactions[5].

This popularized Bitcoin on the dark web where illicit goods and services could then be exchanged anonymously[6].

2. Low transaction fees[7]: By eliminating a transaction middleman, Bitcoin is able to process secure transactions on its own distributed network.

3. Economic disruption: Many people who found themselves dissatisfied with traditional financial institutions looked to Bitcoin as a solution. Anarchists who saw the power given to governments through their ability to manage the global economy saw Bitcoin as an opportunity to liberate the economy from the hands of the government. Accompanying these views comes the investment potential[8] in large scale disruption of financial institutions. This projected growth of blockchain technology drew a lot of investment money into the system.

As the technology continues to develop, so does its value. This zine explores the current technology supporting cryptocurrencies and its potential implications.

> "A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution"
>
> Satoshi Nakamoto
> Bitcoin Founder and Developer

1. Fiat money retains value because there is an accepted consensus that it is a secure storage of wealth. Much like a trusted government is capable of issuing currency, Bitcoin establishes secure coins which the network verifies as real.
2. Digital currencies operating off of protocols ensuring secure transactions.

3. This methodology he describes is now known as blockchain technology (explained later.)
4. A cryptocurrency operating on blockchain technology.
5. This has since changed. Researchers have been able to map IP addresses to Bitcoin addresses. Bitcoin transactions are no longer completely anonymous [3.]

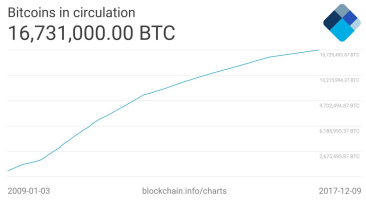
6. In turn, this illicit activity sparked a lot of negative media attention, much of which was inappropriately directed at Bitcoin. Many people accepted this as a reason to discredit Bitcoin. Like my dad.
7. Low transaction fees are not intrinsic to the nature of Bitcoin. Transaction fees have increased (more later.)
8. The day I wrote this Bitcoin reached an all time high of $10,000 (November 28, 2017.)

What is Blockchain?

The current technology supporting Bitcoin and how it continues to develop

Bitcoin transactions operate on a system called the blockchain. The blockchain is a record of transactions managed by a network of computers. Distributing the control of the network across many computers ensures that no individual is capable of controlling the network[9]. Transactions are first broadcast by sending them to every user[10] on the network. Computers then verify transactions by confirming that the person who sent the Bitcoin owns the Bitcoin, and has not already spent them[11]. The valid transactions are then added into a group of transactions called a "block". In order to add transactions to the block, computers must iterate through numbers to crack a code. This computing power is called Proof-of-Work. Proof-of-Work allows the system to confirm that for every user submitting their block of transactions, sufficient processing power went into it. This ensures that attackers cannot easily spam the network with fake transactions. Once a user finds Proof-of-Work for the current block of transactions, the block is broadcast to the network. If the block contains all valid transactions, users will accept the block and begin working to find the next block.

In each block of transactions, the first transaction is the network determined creation of new Bitcoin. The ownership of the Bitcoin is assigned to the user who creates the block. This is how miners were able to profit in the early days of Bitcoin. To thwart future inflation, the system was designed to cap the number of Bitcoins entering circulation at 21 million. As of December 10, 2017, 16.7 million Bitcoin have been distributed.



Bitcoins in circulation vs. time [4.]

9. In order to control the network you would need more processing power than everyone else on the network combined. This is commonly referenced as a 51% attack.
10. Users in this sense are also known as miners. Miners are people who use their computers processing power to process transactions for the blockchain network.
11. A huge breakthrough in Nakamoto's paper was his solution to the previously unsolved double spending problem.

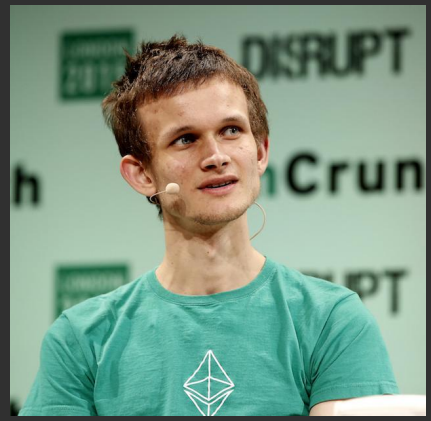
Mining profitability has diminished due to:

- Reduction in the number of Bitcoins being released.
- Transaction volume increasing.
- More miners on the network.

As a result transaction fees have risen in order to compensate miners.

Blockchain has been developed for applications beyond currency.

For example, Ethereum is a blockchain system that allows people to write specific protocols into the blockchain which expands the versatility of the technology. These commands are known as smart contracts.



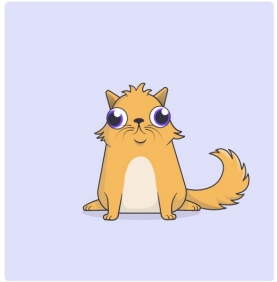
Vitalik Buterin
Ethereum Founder

Buterin provides the simple explanation that smart contracts are like being able to download an app onto a blockchain system [5]. They provide a secure way for terms of an agreement to be carried out once certain criteria are met, without the need for a trusted third party.

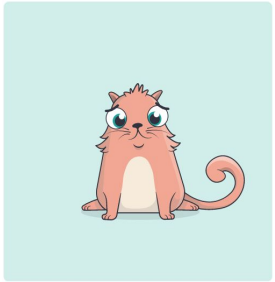
CryptoKitties

One of the first decentralized applications allowing people to interact directly with the Ethereum blockchain

EmeraldGreen [3.75%] BRISK
Kitty 81151 · Gen 13
Brisk



Jeff Teague
Kitty 71984 · Gen 9
Brisk

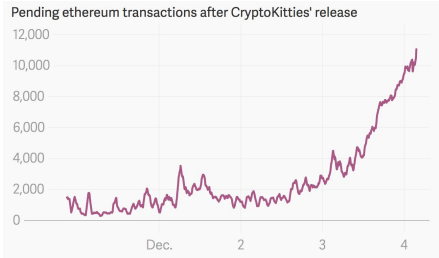


Satoshi
Kitty 64025 · Gen 9
Brisk

My current CryptoKitty investments[12] (December 9, 2017)

One of the first large scale decentralized applications (ĐApp) to be run off of the Ethereum network is a collectables based game called CryptoKitties. Released November 28, 2017, CryptoKitties are virtual cats that have different traits and breeding qualities.

The game operates on the Ethereum blockchain by having smart contracts that manage the sale, ownership, and breeding of the cats. Without getting into the specifics of the game, it is an important part of the blockchain world because it was the first time many people interacted directly with the blockchain. Shortly after the game was released, the Ethereum network became congested because of the volume of transactions. The game exposed weaknesses in the scalability of blockchain based networks.



[6]

As of December 04, CryptoKitties was the busiest address on the Ethereum network accounting for 11.77% of all transactions.

12. Dear future me,
I'm sorry I bought digital cats. I will not do it again.

Sociopolitical Impact

Cryptocurrency has impacted large scale political and social systems

"In many countries in Africa, there are far more cellphones than bank accounts. For Bitcoin, all you need is a phone."

-Manuel Valente
Co-founder of La Maison

Current financial systems exclude a large portion of the global economy. The global reach of Bitcoin technology facilitates easier global trade and standardized currency. Anyone can send Bitcoin to anyone in the world at any time.

In Kosovo, Albvision Ltd installed the country's first Bitcoin ATM [7.] This sparked a statement from the Kosovo Central Bank: "We inform all potential virtual money users that in the Republic of Kosovo there is no institution guaranteeing the reimbursement of money that is lost." In response, Valmir Hazeri, COO of Bitsaphire commented: "The risk is the same; a user can lose money if they do not know how to use it. But this ATM will create possibilities for Bitcoin to have more users. The biggest risk is not knowing how to use it."

Due to the decentralized, unregulated nature of Bitcoin, many governments have looked to regulate and control Bitcoin. China, a huge player in cryptocurrencies, began regulating the crypto market in early 2016 when it banned no-fee trading. Since then it has banned initial coin offerings (ICOs), and all Peer-to-Peer and Over-the-Counter exchanges.

Prior to these bans the volume of Bitcoin traded against Renbinbi[13] was 90% [8]. These bans have not had any significant impact on the proliferation of the currency. Exchanges continue to be available elsewhere throughout the world, and Bitcoin prices have continued to rise. Regulation continues to be integral to the future of Bitcoin. Regulation and government involvement brings legitimacy to a technology widely perceived to be illegitimate.

Economically disadvantaged countries see benefits from adopting Bitcoin or other cryptocurrencies as their currency. Zimbabwe was forced to adopt other currencies after the Zimbabwean failed due to hyperinflation in 2009. The country has adopted Bitcoin, the U.S. dollar, and the South African rand as ways to exchange wealth. As countries continue to suffer from hyperinflation, more and more people who distrust fiat money look to cryptocurrencies as a safe haven [9.]

Some countries have begun to look at developing their own cryptocurrencies. **The ramifications of any government controlled cryptocurrency cannot be overstated.** A government backed cryptocurrency would be appealing to many people looking for a regulated cryptocurrency. If a government were to issue its own cryptocurrency it could have sole control over the blockchain. The decentralization value derived from cryptocurrency is destroyed under a centralized issuer. Distributed security is lost when there is a centralized, attackable head. The issuing government would have sole access to all transaction data in the blockchain. These factors all significantly detract from the value of the currency[14], with very little value added.

China has considered releasing their own currency. Russia has looked into releasing the CryptoRuble, its own cryptocurrency [10.] Russia is subjected to economic sanctions which results in a heavy dependence on the world monetary order. Developing their own currency would liberate them economically. The value of the CryptoRuble would be backed by Russia's power of taxation. Money would begin to flow from the U.S. and Euro economies into the Russian economy. Once the impacts of their currency was realized by the rest of the world, many more countries would likely develop their own cryptocurrencies.

13. China's official currency.

14. It would essentially be a digital national currency, falsely glorified by being able to brand itself with the widely misunderstood terms "blockchain" and "cryptocurrency." Bitcoin, and a government run "cryptocurrency" are fundamentally different and incomparable.

Switzerland is a likely frontrunner because of its central position in the financial space throughout history.

"I think it is false to believe that the winners in the Bitcoin economy are going to be based in America. And the reason is that America has one of the most oppressive financial regulatory schemes of much of the world. A company would be hamstringing itself to set up in the United States.[15]"

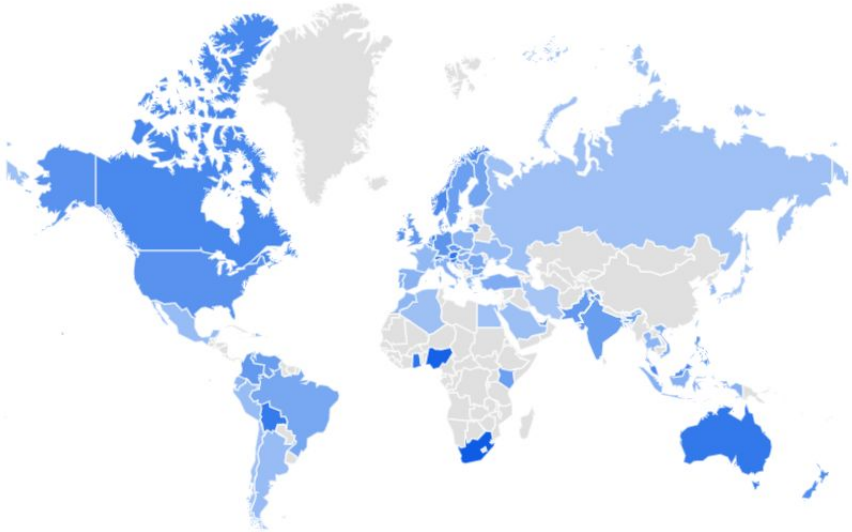
-Erik Voorhees
CEO, Coinapult

15. Some still do because of the increased access to Venture Capital in America.

United States media has obfuscated Bitcoin and cryptocurrencies for much of the American public. The media attention that Bitcoin has gotten in the United States has been everything but positive. Without bothering to learn about the technology, much of the country discredits the technology because of the picture painted in the media. Powerful players such as Warren Buffet and JPMorgan CEO Jamie Dimon, who directly benefit from current economic schemes, vehemently speak out against Bitcoin. Events like the Mt. Gox[16] hack are widely perceived as a result of Bitcoin's technology. Bitcoins did not just disappear, they were stolen. Much like online bank accounts must be secured against hacks, online Bitcoin storage must be secure. On June 13, 2011, Mt. Gox's site was breached and it's database was stolen [11]. Over $460M USD of Bitcoin were stolen through account breaches and trade manipulation. As it was one of the largest exchanges of the time, the fallout came down on Bitcoin's price. Many people saw this as a reason to discredit Bitcoin's security[17].

16. Mt. Gox was a domain name previously owned by founder Jed McCaleb. The guy literally repurposed his old "Magic: the Gathering" card trading website (**M**agic: **T**he **G**athering **O**nline e**X**change) into a hackjob Bitcoin exchange [12].
17. If I went out and repurposed an old website I own into a Bitcoin exchange and it got hacked would anyone be surprised? Would that be the fault of the currency I was holding?

Bitcoin search interest by region, Google Trends



[13] Retrieved December 9, 2017

1	South Africa	100
2	Nigeria	95
3	Slovenia	85
4	Austria	78
5	Ghana	76

In light of this media attention, Americans rarely seek out this information on their own. As of December 9, 2017, the United States is ranked the 17th country by volume of Google searches for the term "Bitcoin." While the United States is currently a leader in the financial world, it appears positioned to miss a global wealth restructuring.

Economics

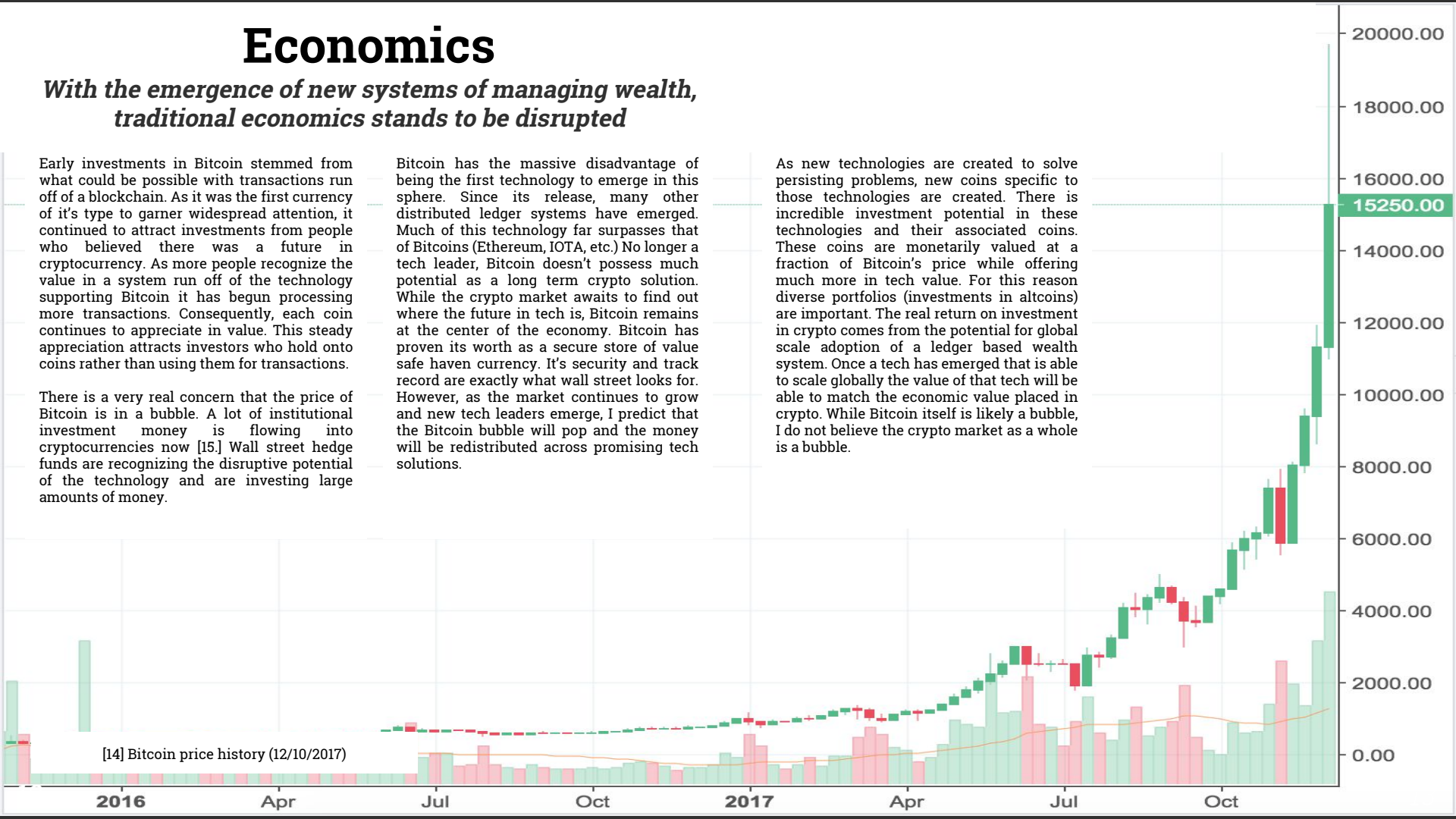
With the emergence of new systems of managing wealth, traditional economics stands to be disrupted

Early investments in Bitcoin stemmed from what could be possible with transactions run off of a blockchain. As it was the first currency of it's type to garner widespread attention, it continued to attract investments from people who believed there was a future in cryptocurrency. As more people recognize the value in a system run off of the technology supporting Bitcoin it has begun processing more transactions. Consequently, each coin continues to appreciate in value. This steady appreciation attracts investors who hold onto coins rather than using them for transactions.

There is a very real concern that the price of Bitcoin is in a bubble. A lot of institutional investment money is flowing into cryptocurrencies now [15.] Wall street hedge funds are recognizing the disruptive potential of the technology and are investing large amounts of money.

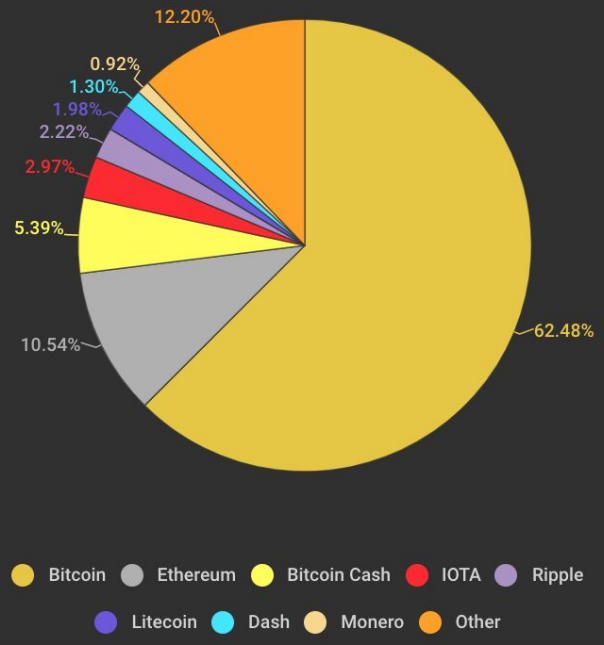
Bitcoin has the massive disadvantage of being the first technology to emerge in this sphere. Since its release, many other distributed ledger systems have emerged. Much of this technology far surpasses that of Bitcoins (Ethereum, IOTA, etc.) No longer a tech leader, Bitcoin doesn't possess much potential as a long term crypto solution. While the crypto market awaits to find out where the future in tech is, Bitcoin remains at the center of the economy. Bitcoin has proven its worth as a secure store of value safe haven currency. It's security and track record are exactly what wall street looks for. However, as the market continues to grow and new tech leaders emerge, I predict that the Bitcoin bubble will pop and the money will be redistributed across promising tech solutions.

As new technologies are created to solve persisting problems, new coins specific to those technologies are created. There is incredible investment potential in these technologies and their associated coins. These coins are monetarily valued at a fraction of Bitcoin's price while offering much more in tech value. For this reason diverse portfolios (investments in altcoins) are important. The real return on investment in crypto comes from the potential for global scale adoption of a ledger based wealth system. Once a tech has emerged that is able to scale globally the value of that tech will be able to match the economic value placed in crypto. While Bitcoin itself is likely a bubble, I do not believe the crypto market as a whole is a bubble.



[14] Bitcoin price history (12/10/2017)

Current Cryptocurrency Market Capitalization $416.6B*



[16] *Retrieved December 6, 2017

How to Buy Cryptocurrencies

The infrastructure supporting cryptocurrency is still developing. As such it is important to research secure methods of trading.

In order to exchange Bitcoin you need to be able to buy, hold, and exchange it. For cryptocurrencies this means secure exchanges, wallets, and payment processors need to be developed. As cryptocurrency is a technology developed in the last ten years, it is unsurprising that the infrastructure supporting it is not yet fully secure. Some popular exchanges, wallets, and payment processes are detailed below. Trade at your own risk.

Offline wallets, or "cold wallets" are more secure as they are stored offline and cannot be breached through the internet. Online wallets or "hot wallets" are less secure because they are online, exposed to hacks. The same is true for online exchanges.

The easiest way to make money in today's crypto space is through investing, rather than mining.

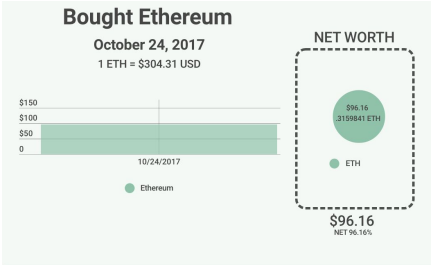
Type	Name	Pros	Cons
Exchange	GDAX	Widely popular	As with any online exchange, security is a concern
Exchange	Binance	Easy to set up	Frequent congestion and security issues
Exchange	Bittrex	*	*
Wallet	Ledgerwallet	Hardware wallet. High security.	High complexity.
Wallet	Jaxx	Software wallet with high security. Highly functional app support.	Steep learning curve. Developers control new integrations.
Payment Processor	myetherwallet	*	*
Exchange, Wallet, and Payment Processor	coinbase	Accessibility.	Online. Low security and transaction speed.

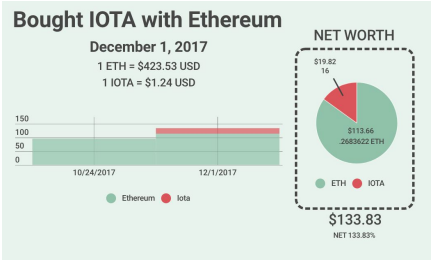
* Bittrex and myetherwallet have been recommended to me by I haven't researched them.

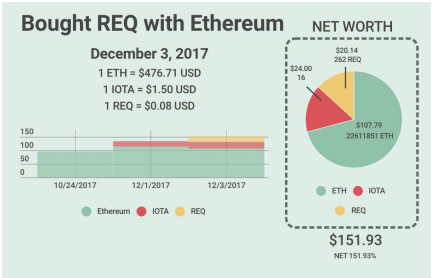
Cryptocurrency Portfolio Example

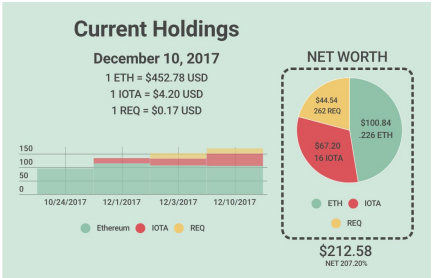
10/24/2017 - 12/10/2017

An example portfolio managed with $100.00 USD







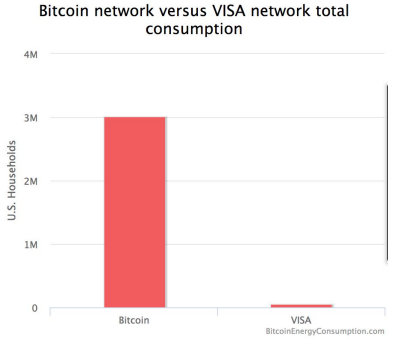


Current Flaws and Emerging Technology

As issues in Bitcoin's underlying technology emerge, new cryptocurrencies develop solutions

There is a lot of energy waste in the Bitcoin and Ethereum blockchains. As a function of Proof-of-Work transaction verification, high network activity equates to high processing requirements. Processing transactions consumes energy at an unsustainable rate. Fortunately this problem has been able to be addressed quickly. The Ethereum development team has developed a Proof-of-Stake verification method which reduces the need to expunge energy [17.] Scheduled to be integrated into their blockchain, the method they are calling Casper increases security and energy efficiency while decreasing the risk of centralization.

As the rate of transactions on the Bitcoin blockchain increases, transaction fees continue to rise. Steam, an online gaming site, stopped accepting Bitcoin. Transaction fees approached $20 a transaction compared to $0.20 in 2016 when they began accepting Bitcoin [18]. Similarly, Ethereum's blockchain experienced issues with scalability under unsustainable transaction volumes following the release of popular ĐApp CryptoKitties. Newly emerging cryptocurrency, IOTA, combats scalability issues by fundamentally redesigning blockchain. As part of each transaction, two other transactions are verified [19.] The result of this is that rather than being burdened by increased traffic, the network becomes more efficient.



[20][18]

18. My dad has been an invaluable resource throughout this project. His constant supply of anti-Bitcoin news inspired much of my research.

Frequently Asked Questions

Confusing topics and terms

Question: **How can a currency be legitimate if the origin of the currency is unknown?**

Answer 1: Fiat money is legitimized through a trusted 3rd party, traditionally governments. It's value is backed by the issuing government's economy and power of taxation. Bitcoin is legitimized by eliminating the 3rd party and establishing distributed trust. Because the ledger of wealth is maintained across a distributed network, there is no need to place trust in a central issuer.
Answer 2: The origin of every Bitcoin is known. When miners work to process transactions they group them into blocks. The first transaction in each block is the creation of a new Bitcoin. This new Bitcoin's ownership is assigned to the miner who successfully added the block to the blockchain. Furthermore, the Blockchain serves as a receipt of every transaction. The history of every Bitcoin can be traced.

Question: **Could the creator scam the system?**

Answer: No. Developers have no special control over any data or transactions on the blockchain. All operating protocols are agreed upon by the network. In order to change these protocols a developer would need to fork[19] the blockchain. In order for these changes to be accepted, the community needs to vote through mining in favor of the new protocols.

Question: **What does it mean to mine Bitcoin?**

Answer: Mining Bitcoin means that you are processing Bitcoin transactions for the network. The Bitcoin network is operated over many computers. Each computer is doing their part in processing transactions and ensuring distributed security. Once a block of transactions is processed, the person who processed the transactions is rewarded with newly created Bitcoin and transaction fees. As there are only 21 million Bitcoins to distribute, new coins are entering the economy at a slower rate as time goes on. Consequently, transaction fees have been playing a larger and larger role in miners compensation.

Q: **If I buy a Bitcoin what have a purchased?**
A: You have purchased a digital currency. Traditional currency uses physical notes or coins to represent wealth. Digital currencies use unique codes to store wealth. Imagine that instead of keeping track of bills, your computer just stored the unique serial number on the bill.

19. A fork is when new protocols are suggested to the network. Nodes, or groups of miners, that upgrade to accept the new protocols will process transactions according to new rules and nodes that do not upgrade will continue processing according to the accepted rules.

Frequently Asked Questions

Confusing topics and terms

Question: **What can I do with my Bitcoin?**

Answer: Everything you can do with traditional currency and more... eventually. As is true with any new technology, the infrastructure supporting Bitcoin is still emerging. In order to use Bitcoin you need to buy it, hold it, and spend it. What this looks like for Bitcoin is exchanges, wallets, and payment processors. Because of the global scale of Bitcoin once the infrastructure is there you will be able to send money instantly to anyone anywhere in the world. For travellers this global ledger of wealth also means that no one will have to exchange currencies anymore.

Q: **What's possible with Bitcoin?**

A: No one really knows yet. Much like when the internet came out, the most impactful uses are yet to be realized.

Question: **Will Bitcoin still exist in 5 years?**

Answer: The short answer (barring unforeseen catastrophe) is yes. The Bitcoin blockchain will likely always exist and the transaction network will remain in place. The long answer is I hope not. Bitcoin emerged as the first legitimate currency of its type. It drew attention to what could be possible with a distributed ledger record of wealth. Since Bitcoin's release, much more promising technology has emerged. For this reason, I hope another coin will replace Bitcoin as the leader in cryptocurrency.

Further Reading

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About This Zine

Who am I and why did I make this?

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I am a senior at the University of Pittsburgh studying Mechanical Engineering with a certificate in Innovation, Product Design, and Entrepreneurship. I've been following cryptocurrencies for around five years. During this time I realized that the vast majority of the population wishes they knew more about Bitcoin. I created this Zine as a final project for my Written and Professional Communication class in the hopes that it could deliver the information people wanted in an accessible way.

After graduation I am pursuing positions at startups in Pittsburgh.

Feel free to contact me about this project or anything you might be working on.

If you want to support this project and more like it, the QR code is an Ethereum address through which you can send me Ethereum.
0xd26f72E2150458d989943CEaE27883A651fad673
Alternatively, my Venmo is John-Wallace-18