The Future of Democracy: Blockchain Voting

Ryan Osgood
Mentor: Ming Chow
COMP116: Information Security
December 14, 2016

Abstract

Blockchain voting could have many tangible benefits and could be the catalyst needed to propel voting to the 21st century. This paper will first analyze the problems with current voting techniques and showcase the vulnerabilities of a current voting machine. Then, the engineering of the blockchain and its benefits will be discussed and current work being done on blockchain voting, as well as progress and challenges of widespread adoption.

1 Introduction

According to the Oxford English Dictionary, a democracy is a "system of government by the whole population or all the eligible members of a state, typically through *elected* representatives."[1] By definition, for a democracy to be functioning, people need to be elected — which is done by voting. Voting is the foundation of any successful democracy and must therefore be accessible and secure for all eligible citizens. Today's most common paper-based voting systems are accessible and cheap but have two major problems, according to Follow My Vote's CTO and founder Nathan Hourt: they are not scalable (which leads to major problems such as accuracy) and are "reliant on the procedural security of officials conducting their jobs

---

"Definition of Democracy in English." Oxford Dictionaries. Accessed December 14, 2016. https://en.oxforddictionaries.com/definition/democracy.

correctly and honestly".[2] Additionally, when those paper-based voting systems are paired or assisted by electronic voting machines, multiple security vulnerabilities can easily lead to election rigging and fraud from the government itself or third parties. The blockchain might offer a massively scalable solution to current and outdated voting methods by providing secure and fraud-proof digital voting.

2 To The Community: Why Does Blockchain Voting Matter?

On December 9th 2016, The New York Times released an article stating that American intelligence agencies had concluded with "high confidence" that Russia acted covertly in the latter stages of the 2016 presidential campaign to harm Hillary Clinton's chances and promote Donald J. Trump.[3] This current issue as well as Trump's claims that the 2016 presidential campaign was rigged and voter intimidation problems throughout the nation on November 7th have made voting security in the United States a major issue.

One of the major problems with voting security in the United States stems from the electronic voting machines (EVMs) used to vote or assist in voting in many states. In 2015, the Brennan Center for Justice at NYU School of Law published a famous study named *America's Voting Machines at Risk*. The study found that, in 2016, 43 out of 50 states used EVMs that were at least ten years old. The study found that this old voting equipment is not only more prone to failures and crashes but is also notoriously easy to hack and tamper with. A perfect example of

---

[2] Koven, Jackie B. "Block The Vote: Could Blockchain Technology Cybersecure Elections?" Forbes. Accessed December 14, 2016. http://www.forbes.com/sites/realspin/2016/08/30/block-the-vote-could-blockchain-technology-cybersecure-elections/.

[3] Sanger, David E., and Scott Shane. "Obama Orders Intelligence Report on Russian Election Hacking." The New York Times. 2016. Accessed December 14, 2016. http://www.nytimes.com/2016/12/09/us/obama-russia-election-hack.html.

the need for a blockchain based voting system and the wider EVM problem can be found in the Virginia WINVote voting machines that were decommissioned in 2015.[4]

2.1 WINVote Security Vulnerabilities

The now decommissioned Virginia WINVote machine was a perfect example of the problems with a lot of electronic voting machines in the United States. Despite its fragrant security vulnerabilities, the machine was extensively used in 24% of Virginia precincts up until 2015 when it was decommissioned.[5] Although the WINVote is an extreme example and many of the security issues found were specific to the WINVote, some problems were similar to many found on voting machines throughout the United States, "all of which demonstrates just how flawed the federal testing and certification process is for approving voting machines."[6]

The following is a brief summary of a security assessment conducted on the WINVote machine by the Virginia Information Technologies Agency (VITA) that eventually led to its decommission. Jeremy Epstein, a security expert specializing in e-voting, summarized the ridiculous and shocking findings by saying: "the vulnerabilities were so severe, and so trivial to exploit, that anyone with even a modicum of training could have succeeded […] within a half

---

[4] Zetter, Kim. "Virginia Finally Drops America's 'Worst Voting Machines'." Wired. Accessed December 14, 2016. https://www.wired.com/2015/08/virginia-finally-drops-americas-worst-voting-machines/.

[5] Norden, Lawrence, and Cristopher Famighetti. "America's Voting Machines at Risk | Brennan Center for Justice." America's Voting Machines at Risk | Brennan Center for Justice. Accessed December 14, 2016. https://www.brennancenter.org/publication/americas-voting-machines-risk.

[6] Zetter, Kim. "Virginia Finally Drops America's 'Worst Voting Machines'." Wired. Accessed December 14, 2016. https://www.wired.com/2015/08/virginia-finally-drops-americas-worst-voting-machines/.

mile with a rudimentary antenna built using a Pringles can."[7] The full report can be found at the following link:

http://www.elections.virginia.gov/WebDocs/VotingEquipReport/WINVote-final.pdf

The most shocking findings from the report include:

- The wireless connection uses WEP (very insecure) and the unchangeable password was "abcd", additionally even if the devices could be put offline, the networks cards remain online and can still send and receive traffic with no way to turn them off.
- The machine ran a version of Windows XP that had not been patched since 2004 and had open ports with running services: 135/tcp, 139/tcp, 445/tcp, 3389/tcp, 6000/tcp and 16001/tcp
- The admin password was hardwired as "admin"
- Running a very weak Microsoft Access database with no tampering detection and uses a very weak encryption key, which was "shoup" (the name of the voting machine provider).
- Physical USB ports like USB are not protected.

All those vulnerabilities could be used to easily tamper with a government election with very minimal technical knowledge:[8]

1. Use a network sniffer like Ettercap to sniff and capture network packets, from the voting station's parking lot for instance
2. Use the .pcap file to figure out the WEP password, using a simple tool like John the Ripper. The password was shown to be "abcd"; this entire process took VITA two minutes.
3. Connect to the voting machine using Wi-Fi; if asked for an admin password, use "admin".
4. Figure out the hardwired password for the Microsoft Access database using John the Ripper,\; the password was "shoup" and was found in a few seconds.
5. Add, delete or modify any of the votes or tallies using Microsoft Access software.
6. Upload modified copy of database back to the voting machines.

---

[7] Epstein, Jeremy. "Decertifying the Worst Voting Machine in the US." Freedom to Tinker. Accessed December 14, 2016. https://freedom-to-tinker.com/2015/04/15/decertifying-the-worst-voting-machine-in-the-us/.

[8] Epstein, Jeremy. "Decertifying the Worst Voting Machine in the US." Freedom to Tinker. Accessed December 14, 2016. https://freedom-to-tinker.com/2015/04/15/decertifying-the-worst-voting-machine-in-the-us/.

Such a flawed mechanism of voting is an example of the problematic and flawed ways people vote all around the world, and in this case, in the United States. For the first time, however, blockchain technology might be able to provide a solution—and evolve e-voting into a plausible and safe version of what were previously unsuccessful attempts.

3 The Engineering Behind Blockchain Voting

As the hype surrounding bitcoin is slowly waning, the industry is becoming more and more interested in its underlying technology: the blockchain. Now, proponents claim blockchain technology to be one of the most important new technologies of our time, about to take society by storm, and bitcoin served as the most thorough and complete proof of concept. In fact, Marc Andreessen, founder of VC firm Andreessen Horowitz and one of the most influential members of Silicon Valley, claimed in a New York Times article that the invention of the blockchain is as important and influential as the creation of the Internet itself.[9] Blockchain voting cannot be understood without understanding how the blockchain works.

What is the blockchain? At its core, the blockchain is a distributed database that maintains a secure and ever-growing ledger of records (usually transactions) known as blocks. What does that mean? A useful way to understand the blockchain is the spreadsheet analogy: "picture a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that this network is designed to regularly update this spreadsheet and you have a basic

[9] Andreessen, Marc. "Why Bitcoin Matters." The New York Times. 2014. Accessed December 14, 2016. http://dealbook.nytimes.com/2014/01/21/why-bitcoin-matters/.

understanding of the blockchain."[10] This database (the blockchain) is managed by a network of nodes that all have their own copy of the blockchain. The nodes are simply computers connected to the network that have agreed to process the validity of transactions on the blockchain based on a set of rules the network has agreed to. Once a node validates a transaction, it adds it to a chronological groups known as a block that is then added to the blockchain. Valid transactions are therefore grouped together and added to the database in a block, one after the other, hence the name blockchain. When the first block of the chain is added, it is marked with a hash function. As the second block is added, it is also marked with a hash function that contains part of the first block's hash function. Therefore, when a node submits a new block for addition to the chain, if the node has changed any of the database transactions included within the previous blocks, the hash function of that block would also need to be changed. When that altered block is added to the blockchain, all other nodes will realize its hash function is incorrect (so a change must have been made on previous blocks) and the update will be rejected. This fundamental aspect of blockchain is what makes the technology tamper-proof and secure.[11] The transactions stored in the database can be cryptocurrency transactions like bitcoin, or, in the scope of this paper, votes. The technical implementation of a blockchain infrastructure is summarized in the following infographic:

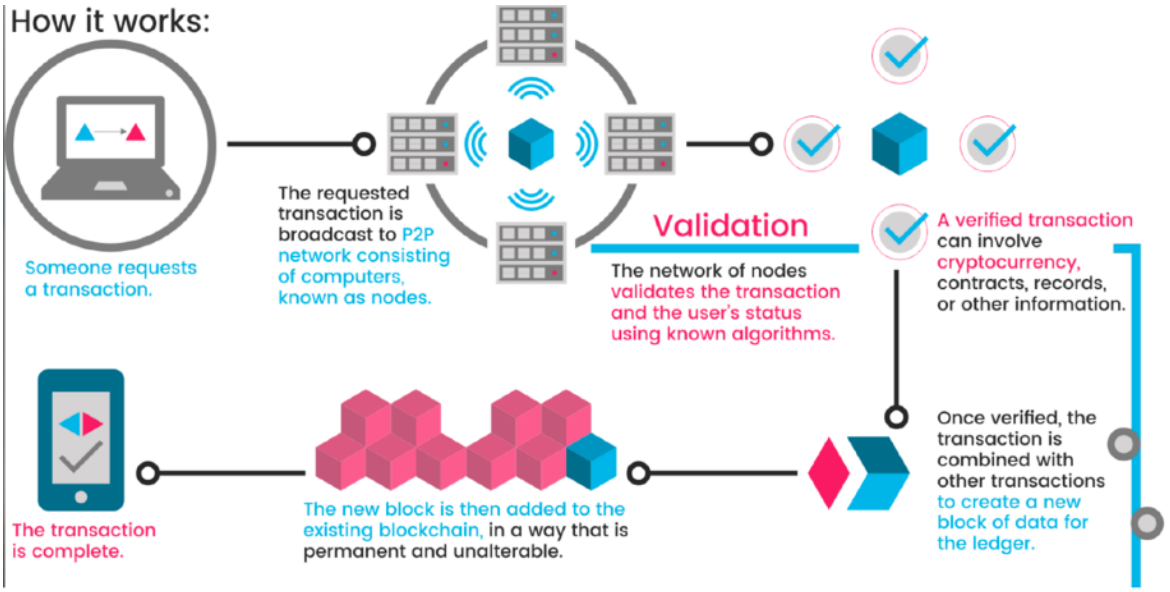
Figure 1: How the Blockchain works:[12]

---

[10] "What Is Blockchain Technology? A Step-by-Step Guide For Beginners." Blockgeeks. 1969. Accessed December 14, 2016. http://blockgeeks.com/guides/what-is-blockchain-technology-a-step-by-step-guide-than-anyone-can-understand/.

[11] "Blockchain Technology in Online Voting - Follow My Vote." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/online-voting-technology/blockchain-technology/.

[12] "What Is Blockchain Technology? A Step-by-Step Guide For Beginners." Blockgeeks. 1969. Accessed December 14, 2016. http://blockgeeks.com/guides/what-is-blockchain-technology-a-step-by-step-guide-than-anyone-can-understand/.



By storing blocks of information that are identical throughout the network, the blockchain does not have a single point of failure and cannot be controlled by a single entity; two points that are important when using the blockchain for voting.[13] Two additional important properties result from any node being able to download the blockchain and verify new data using a block's hash value. The first one is transparency; data on the network is public and can be accessed and checked by anyone making it transparent. Additionally, it would take huge amounts of computing power to alter any unit of information on the blockchain making it almost incorruptible.[14] Blockchain technology allows for transparent and incorruptible data that cannot have a single point of failure or be controlled by a single entity, making it potentially an ideal platform for digital voting.

---

[13] "What Is Blockchain Technology? A Step-by-Step Guide For Beginners." Blockgeeks. 1969. Accessed December 14, 2016. http://blockgeeks.com/guides/what-is-blockchain-technology-a-step-by-step-guide-than-anyone-can-understand/.

[14] Ibid.

4 Current Applications and Proposal

Despite being a new technology, a few organizations and startups have already started experimenting with blockchain voting. This section will discuss different implementations for blockchain voting systems that have been proposed and use those to come to a conclusion about the best, most realistic implementation method.

4.1 Votebook

In September 2016, Kaspersky Labs, industry leaders on computer security, and The Economist newspaper organized a case-study competition where MBA teams from the US and the UK had to implement voting systems using the blockchain. The Votebook team, consisting of NYU Masters students came in first place and offered one of the most thorough and effective case study on how a blockchain voting system might look like.[15] Votebook made eight design considerations when creating their system:

1. Individuals may check that their vote was counted (but cannot see their neighbor's vote)
2. The system should not enable coerce voting
3. The system should either produce or hide interim results, as desired
4. The system must allow for voter abstinence
5. The system must be audible
6. Not every voter has access to the internet
7. Only citizens can vote
8. The most practical system requires the least amount of behavioral change for voters

Votebook decided that remote voting was not possible due to too many threats: authentication of the user is daunting and easily compromised remotely, voter's personal

[15] Kaspersky, Eugene. "Cyber Security Case Study Competition- Kaspersky." The Economist. 2016. Accessed December 14, 2016. http://www.economist.com/whichmba/mba-case-studies/cyber-security-case-study-competition-2016.

computer could be compromised, voter intimidation is more likely remotely, and auditing more difficult remotely.[16] Most alarmingly, a "minimally resourced adversary could launch a Denial of Service attack on an entire neighborhood". [17] Votebook implemented a system of voting that heavily resembles the current system, using voting booths and voting stations with paper results that back the voting blockchain. According to the team, this is the best approach as most voting cybersecurity experts favor a paper-based audit trail in the physical world.[18]

Votebook's implementation is based on the blockchain with one major difference. Instead of having the blockchain be public and any node be able to connect and verify transactions, nodes must have permission (by granting encryption keys) from a central authority (a government) to make changes to the ledger. In this case, the nodes would be voting machines that have received permission to be nodes, creating a "permissioned blockchain".[19] Votebook's system consists of voting machines resembling traditional voting machines that act as nodes on a blockchain. Once polls open, voting machines would collect votes and organize them into a "block", ready for verification on the network. The block would be broadcasted on the network and every other node will check the validity of the block's components by using their public key that corresponds to the proposing node's ID to decrypt the hash and check for a match.[20] As per blockchain protocol, the receiving nodes will then verify that the hash of the previous block in

---

[16] Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

[17] lbid.

[18] lbid.

[19] Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

[20] lbid.

the database is correct, making sure no tampering has occurred. If these conditions are satisfied, the receiving nodes will append the existing database with the new node. Additionally, a second blockchain ledger would be used to keep track of voters. In Votebook's system, the voter's experience is almost identical to the current voting experience on EVMs in the USA but is much more secure and reliable for digital voting due to their blockchain approach.

4.2 Follow My Vote

In Virginia, the state that decommissioned the WINVote machine in 2015, the startup Follow My Vote is also trying to implement a blockchain solution to voting. As a very early stage startup with no case studies available, Follow My Vote has less information available than Votebook. Nevertheless, Follow My Vote's implementation of the blockchain is radically different. Whereas, like all blockchain implementations, Follow My Vote allows for auditing, security and tamper-proof tallying of votes, the major difference lies with how people vote using their platform.

In Follow My Vote's approach, the voter has to install the "voting booth" on a computer, tablet or smartphone.[21] The voter then needs to verify its identity by submitting legal documents (like a passport) to an Identity Identifier that would have been already approved by the organization holding the election.[22] Once its identity verified, the voter could request an online ballot and submit their vote to the blockchain. Follow My Vote's system also allows for voters to vote early or even have the ability to change their mind and vote for another candidate as long as

---

"Blockchain Voting: The End To End Process." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/blockchain-voting-the-end-to-end-process/.

[22] Ibid.

its before a cutoff on election day. Once the polls closed, voters' most recent vote would be the only one counted. Finally, voters would be able to follow their vote from the ballot box to make sure their vote counted.[23]

In 2016, Follow My Vote tried to run a parallel presidential election to demonstrate the effectiveness of its system.[24] However, the team failed to meet the election day deadline for development and failed on its mission. As of November 5th 2016, the Follow My Vote project is still active but out of funds.[25] Follow My Code's approach of not using real voting booths or a paper-trail is brave and optimistic but is clearly flawed. As Votecode's team pointed out, there are too many security flaws associated with the method: authentication of the user is quite hard, remote voters can easily be intimidated, and voter's personal computer could be compromised.[26] Those factors alone make this an unrealistic choice for an effective governmental voting system although it could still be used for private elections with less at stake.

4.3 VoteWatcher

VoteWatcher is perhaps the most mature and tested blockchain voting implementation to this date. VoteWatcher is a branch of Blockchain Technologies Corporation (BTC), a large blockchain company that provides blockchain services, a blockchain ATM, and acts as a

---

[23] "Blockchain Voting: The End To End Process." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/blockchain-voting-the-end-to-end-process/.

[24] "Parallel Presidential Election 2016 - Follow My Vote." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/parallel-presidential-election-2016/.

[25] lbid.

[26] Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

blockchain startup incubator. [27] VoteWatcher is a blockchain voting system not just for governmental elections but for all types of voting necessary.[28]According to its website, VoteWatcher has already been used at eleven different voting events and has already counted up 5,000 votes in the process.

Just like Votebook, VoteWatcher's voters experience a very similar voting process to the one currently in use. After registering using current methods, voters are given a paper ballot at the voting station. This paper ballot will contain three QR codes — one for the blockchain address, one for the ballot ID, and one for the election ID.[29] Once the ballot is scanned, the appropriate vote is sent to the proper candidate's unique address (like a bitcoin wallet) on a local (offline) blockchain, the machine would also keep images of every paper ballot.[30] Once the election is complete, all data from the current machine (local blockchain, ballot images, and metadata) would be zipped and stored on a DVD before the machine would be taken online to connect to the other machines on the network and start adding votes to the online final blockchain.[31]This is done so that no outside interference from hackers on the network is possible as the machine stores all important information offline before being connected. Finally, anyone

---

[27] "Blockchain Technologies Corp. | Cutting Edge Blockchain App Development." Blockchain Technologies Corp. Accessed December 14, 2016. http://blockchaintechcorp.com/.

[28] "VoteWatcher - The World's Most Transparent Voting Machine." Vote Watcher. Accessed December 14, 2016. http://votewatcher.com/.

[29] Hertig, Alyssa. "The First Bitcoin Voting Machine Is On Its Way." Motherboard. Accessed December 14, 2016. http://motherboard.vice.com/read/the-first-bitcoin-voting-machine-is-on-its-way.

[30] "Creating The Next Generation Voting Machine." Medium. 2016. Accessed December 14, 2016. https://medium.com/@blocktechcorp/creating-the-next-generation-voting-machine-6c566a3a3a84.

[31] Ibid.

would be able to check exactly how many votes each candidate acquired in real time using a "blockchain explorer", a tool that can check information on different parts of the ledger.[32]

According to BTC, its machine will be stored in a chassis and impervious to "electromagnetic funny business".[33] Furthermore, the specifics of how to configure the blockchain would depend on the client that needs elections. Right now, BTC uses bitcoin to run elections where a voting token represents an amount of bitcoins. They also have created their own blockchain called VoteUnit that operates like bitcoin but without any transaction fees.[34] VoteWatcher markets heavily its use of a paper ballot system for elections.[35] Their use of the blockchain is purely a tamper-proof and public auditing system, where everything is backed by paper ballots.[36] As stated on their blog, the reason for this is the same that Votebook understood: internet voting is the future we are heading towards but there is still no possibility of well securing a voting system when voters use their own devices.[37]

4.4 Proposal

Based on the three implementations discussed, an effective, secure and realistic blockchain voting solution for state elections can be proposed. Dr. Jeremy Clark, a

---

[32] Hertig, Alyssa. "The First Bitcoin Voting Machine Is On Its Way." Motherboard. Accessed December 14, 2016. http://motherboard.vice.com/read/the-first-bitcoin-voting-machine-is-on-its-way.

[33] Ibid.

[34] Ibid.

[35] "VoteWatcher - The World's Most Transparent Voting Machine." Vote Watcher. Accessed December 14, 2016. http://votewatcher.com/.

[36] "Blockchain Voting Is Coming, But It Won't Be Online (Yet)." Medium. 2016. Accessed December 14, 2016. https://medium.com/@blocktechcorp/blockchain-voting-is-coming-but-it-wont-be-online-yet-d3e29e8834ab.

[37] Ibid.

cryptographic voting systems specialist at Concordia University stated, “A [sic] voting system that uses a blockchain as a public ledger but requires voters to show up and vote in person is an excellent option for elections today, but reaching beyond that is too risky.”[38] Following this logic, the proposed system would use paper ballots for voting, with an auditing and counting system that uses the blockchain. The proposal has the following characteristics:

- Voters would register using current methods.
- Voters would go to a voting station and vote on an offline and physically secure machine, minimizing the threat of network and physical attacks.
- The voters would vote on paper ballots used by VoteWatcher that have three QR codes.
- The ballot would be scanned by the machine with votes stored on a local blockchain, the scanned images would also be digitally stored as well as the physical paper copies.
- Voters would receive a receipt of their vote with their vote address so that they can later check that their vote was properly counted once the voting period is over.
- Once the voting period is over, the machines would store all digital information (scanned ballot copies, the offline blockchain, and metadata) on a DVD or flash-drive before putting the machine online. The DVD or flash drive would be securely stored as well as the physical ballots, in case auditing is necessary.
- Once online the machine would become a node in a “permissioned blockchain” as proposed by Votebook.
- The machines would each add their individual counts to the blockchain, grouped by blocks. Just like Votebook, this would be done using a time-based protocol where machines would add their data to the blockchain one after the other as the other machines validate it. [39]
- As the blockchain would be public, all interested parties (voters, governments, third-party agencies) could verify the votes for accuracy and validity once the election is over.
- The blockchain code would be open source so that anyone has access to it.

This system borrows from both VoteWatcher and Votebook’s implementations to create a very secure voting method by leveraging old school paper-based voting and the blockchain’s

---

[38] "Blockchain Voting Is Coming, But It Won't Be Online (Yet)." Medium. 2016. Accessed December 14, 2016. https://medium.com/@blocktechcorp/blockchain-voting-is-coming-but-it-wont-be-online-yet-d3e29e8834ab.

[39] Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

benefits. Using this methods, security threats are minimized while allowing for a transparent, incorruptible voting system that is tamper-proof and offers audit and recount features both in digital blockchain form and paper form. One important note is that no system is perfectly secure. This proposal might be a step in the right direction and mitigate a lot of threats, especially compared to the machines currently or recently in use (like the WINVote) but a lot of potential threats are still present. The physical machines could be compromised, and different social engineering techniques would still be a threat (such as voter impersonation) as well as possible technical vulnerabilities, especially if the blockchain code is open-sourced.

5 Blockchain Voting Adoption

Despite being a better, more secure technology, the main problem with blockchain voting has to do with political adoption both in the United States and abroad. There are a few obstacles to adoption. First of all, the technology is still relatively new and unknown to the general public. Second of all, political gridlock and red tape is always a problem and even if the technology is approved, bipartisan issues as well as the massive scale of governmental elections might mean adoption of blockchain voting could take years. Additionally, in the United States, voting is not under federal jurisdiction but is governed at the individual state level and "states are sensitive to federal encroachment", which means country-wide adoption will be near impossible.[40] Another problem is that blockchain voting requires a powerful and reliant internet infrastructure and access to expensive and energy-hungry voting machines, requirement not guaranteed in a lot of

[40] Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

regions around the world. Finally, some states might simply not want fair and tamper-proof elections as their government might control or gain advantage from their current voting systems. Given those hurdles, blockchain voting systems will most likely first be adopted in tech-savvy and democratic countries that have an efficient central government that dictates country-wide voting procedures (unlike the United States).

The first use of blockchain voting technology happened in Denmark when the Danish Liberal Alliance used a blockchain voting system to conduct an internal vote in April 2014 during its annual meeting.[41] Furthermore, BTC used the VoteWatcher system on at least two separate occasions to count votes at the Libertarian Party Conventions in the United States. The first time was in April 2016 at the Party Convention in San Antonio, Texas.[42] The second time happened at the Libertarian Convention in New York City in May 2016. Additionally, Rand Paul, the Libertarian presidential candidate in the 2016 elections has spoken favorably about the blockchain and bitcoin in the past.[43] In February of 2016, Ukraine and the United States signed a memorandum to develop an Ethereum-based voting system (Ethereum is a blockchain platform).[44] Russia also announced in April 2016 that it had developed and successfully tested a

---

[41] Bogdan, Diana. "Democratic and Efficient: Is Blockchain Voting Our Future?" CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/reviews/5497-democratic-and-efficient-is-blockchain-voting-the-future.

[42] lbid.

[43] Bello Perez, Yessi. "7 Politicians in Support of Bitcoin and Blockchain Tech." CoinDesk. 2015. Accessed December 14, 2016. http://www.coindesk.com/7-politicians-in-support-of-bitcoin-and-blockchain-tech/.

[44] Platonova, Elena. "Ukraine to Introduce Ethereum-based E-voting." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/4794-ukraine-to-introduce-etherium-based-e-voting.

blockchain-based proxy voting system.[45] Finally, the tiny Australian Flux party has advocated for the use of blockchain voting in Australian elections.[46]

The benefits of blockchain voting are so plentiful that blockchain voting will inevitably become more and more common throughout the world. To accelerate that process, political parties in different countries must continue to push for wider adoption of the technology and make it clear that this is not in the interest of any one party but of the democratic government as a whole. Additionally, general wider adoption of blockchain technology in various industries will make the technology more well-known and increase the chances of such system being used throughout the world. Finally and most importantly, governments must be willing to improve the democratic process in their respective countries and put the people's will first as a democracy is only as strong as the ability of its people's voice to be heard.

6 Conclusion

Blockchain voting is not perfect but can be implemented in a way that greatly improves on current system of voting around the world.

The blockchain offers many potentially world-changing opportunities and has been one of the most hyped technologies of the last few years. However, the spotlight is often on applications its applications in the developed world. That spotlight is much less often on developing countries that could potentially benefit an incredible amount from blockchain

---

[45] Rudina, Maria. "Russia's National Settlement Depository Succeeds in Blockchain Test." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/5414-natsionalnyj-raschetnyj-depozitarij-uspeshno-protestiroval-blokchejn-2.

[46] Lavinskaya, Anna. "New Australian Party Seeks to Upgrade Democracy with Blockchain." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/4842-australian-new-political-party-uses-blockchain-to-transform-democracy.

technology, and specifically blockchain voting.Bitcoin and other cryptocurrency are often said to have to the potential to help people out of poverty in developing countries as transferring of funds is free, bitcoin is relatively stable, and anyone in the world can use it to make or receive payments.[47] Additionally, the blockchain is a trust-less system that proves the ownership of assets without being corrupt, something incredibly valuable and useful in the developing world.[48] In their book *Why Nations Fail*, Acemoglu and Robinson argue that the main driver of economic development is whether or not the country's political system is "inclusive", where an inclusive country has its people's best interest in mind whereas an "exclusive" country only has the interests of the country's elite. Fair and tamper-free elections that can be monitored by third parties (such as international watchdog organizations) are perhaps the main way a country can be "inclusive", and can be done using a blockchain system. Refining and adopting blockchain voting systems is of utmost importance because as long as the rulers of developing countries are willing to implement a blockchain system and the those countries have minimal infrastructure in place, blockchain voting could be a huge driver for economic development throughout the world and lift countries and their people out of poverty.

---

[47] Nath, Trevir. "Can Blockchain and Bitcoin Help the World's Poorest." Investopedia. 2016. Accessed December 14, 2016. http://www.investopedia.com/articles/investing/042116/can-blockchain-and-bitcoin-help-worlds-poorest.asp.

[48] lbid.

Bibliography

Andreessen, Marc. "Why Bitcoin Matters." The New York Times. 2014. Accessed December 14, 2016. http://dealbook.nytimes.com/2014/01/21/why-bitcoin-matters/.

Bello Perez, Yessi. "7 Politicians in Support of Bitcoin and Blockchain Tech." CoinDesk. 2015. Accessed December 14, 2016. http://www.coindesk.com/7-politicians-in-support-of-bitcoin-and-blockchain-tech/.

"Blockchain Technologies Corp. | Cutting Edge Blockchain App Development." Blockchain Technologies Corp. Accessed December 14, 2016. http://blockchaintechcorp.com/.

"Blockchain Technology in Online Voting - Follow My Vote." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/online-voting-technology/blockchain-technology/.

"Blockchain Voting Is Coming, But It Won't Be Online (Yet)." Medium. 2016. Accessed December 14, 2016. https://medium.com/@blocktechcorp/blockchain-voting-is-coming-but-it-wont-be-online-yet-d3e29e8834ab.

"Blockchain Voting: The End To End Process." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/blockchain-voting-the-end-to-end-process/.

Bogdan, Diana. "Democratic and Efficient: Is Blockchain Voting Our Future?" CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/reviews/5497-democratic-and-efficient-is-blockchain-voting-the-future.

"Creating The Next Generation Voting Machine." Medium. 2016. Accessed December 14, 2016. https://medium.com/@blocktechcorp/creating-the-next-generation-voting-machine-6c566a3a3a84.

"Definition of Democracy in English." Oxford Dictionaries. Accessed December 14, 2016. https://en.oxforddictionaries.com/definition/democracy.

Epstein, Jeremy. "Decertifying the Worst Voting Machine in the US." Freedom to Tinker. Accessed December 14, 2016. https://freedom-to-tinker.com/2015/04/15/decertifying-the-worst-voting-machine-in-the-us/.

Hertig, Alyssa. "The First Bitcoin Voting Machine Is On Its Way." Motherboard. Accessed December 14, 2016. http://motherboard.vice.com/read/the-first-bitcoin-voting-machine-is-on-its-way.

Kaspersky, Eugene. "Cyber Security Case Study Competition- Kaspersky." The Economist. 2016. Accessed December 14, 2016. http://www.economist.com/whichmba/mba-case-studies/cyber-security-case-study-competition-2016.

Kirby, Kevin, Anthony Masi, and Fernando Maymi. Votebook: A Proposal for a Blockchain-based Electronic Voting System. The Economist. Accessed December 14, 2016. http://www.economist.com/sites/default/files/nyu.pdf.

Koven, Jackie B. "Block The Vote: Could Blockchain Technology Cybersecure Elections?" Forbes. Accessed December 14, 2016. http://www.forbes.com/sites/realspin/2016/08/30/block-the-vote-could-blockchain-technology-cybersecure-elections/.

Lavinskaya, Anna. "New Australian Party Seeks to Upgrade Democracy with Blockchain." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/4842-australian-new-political-party-uses-blockchain-to-transform-democracy.

Nath, Trevir. "Can Blockchain and Bitcoin Help the World's Poorest." Investopedia. 2016. Accessed December 14, 2016. http://www.investopedia.com/articles/investing/042116/can-blockchain-and-bitcoin-help-worlds-poorest.asp.

Norden, Lawrence, and Cristopher Famighetti. "America's Voting Machines at Risk | Brennan Center for Justice." America's Voting Machines at Risk | Brennan Center for Justice. Accessed December 14, 2016. https://www.brennancenter.org/publication/americas-voting-machines-risk.

"Parallel Presidential Election 2016 - Follow My Vote." Follow My Vote. Accessed December 14, 2016. https://followmyvote.com/parallel-presidential-election-2016/.

Platonova, Elena. "Ukraine to Introduce Ethereum-based E-voting." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/4794-ukraine-to-introduce-etherium-based-e-voting.

Rudina, Maria. "Russia's National Settlement Depository Succeeds in Blockchain Test." CoinFox. News on Bitcoin and Other Virtual and Cryptocurrencies. Accessed December 14, 2016. http://www.coinfox.info/news/5414-natsionalnyj-raschetnyj-depozitarij-uspeshno-protestiroval-blokchejn-2.

Sanger, David E., and Scott Shane. "Obama Orders Intelligence Report on Russian Election Hacking." The New York Times. 2016. Accessed December 14, 2016. http://www.nytimes.com/2016/12/09/us/obama-russia-election-hack.html.

"VoteWatcher - The World's Most Transparent Voting Machine." Vote Watcher. Accessed December 14, 2016. http://votewatcher.com/.

"What Is Blockchain Technology? A Step-by-Step Guide For Beginners." Blockgeeks. 1969. Accessed December 14, 2016. http://blockgeeks.com/guides/what-is-blockchain-technology-a-step-by-step-guide-than-anyone-can-understand/.

Zetter, Kim. "Virginia Finally Drops America's 'Worst Voting Machines'." Wired. Accessed December 14, 2016. https://www.wired.com/2015/08/virginia-finally-drops-americas-worst-voting-machines/.